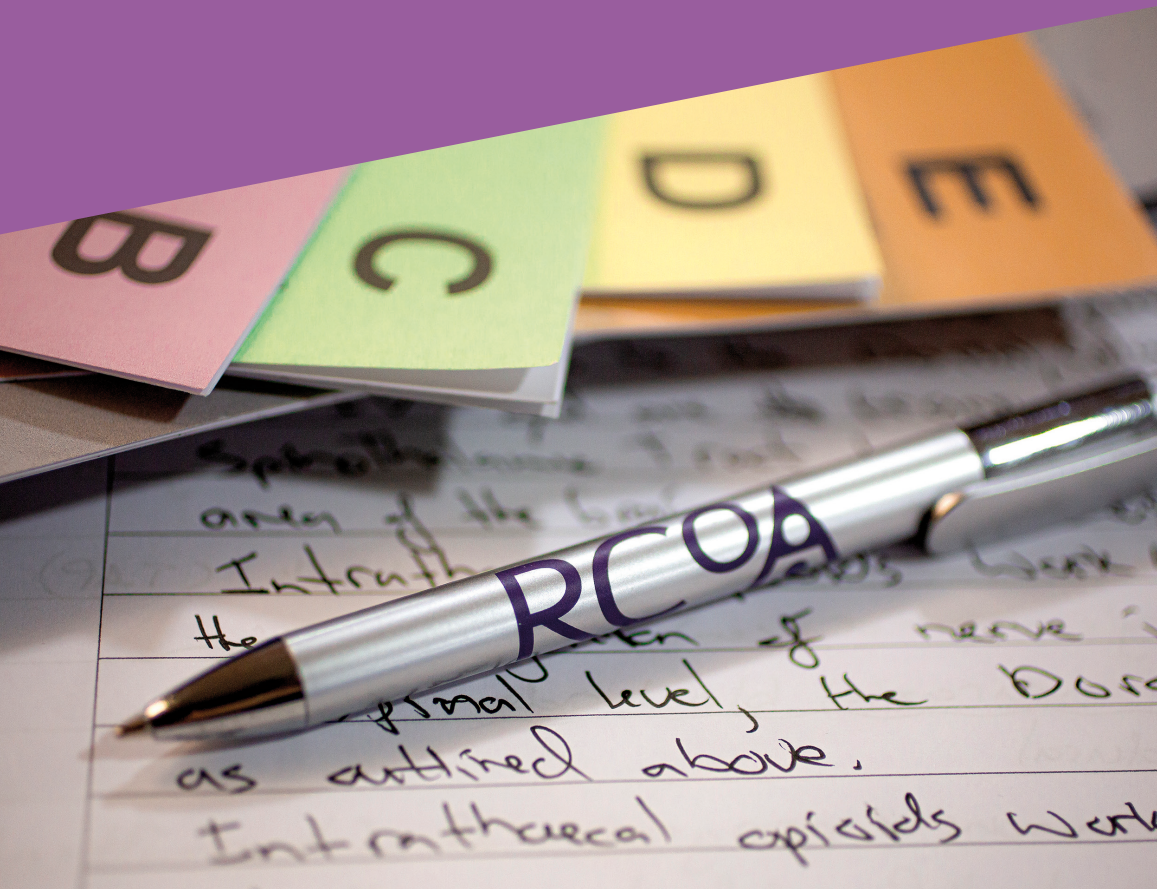
Royal College of Anaesthetists

Guide to the FRCA examination **The Final**

Fourth Edition
January 2020



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Contents

Introduction

Dr Fiona Donald, Vice President,
former Chair, Final FRCA examinations

The previous edition of this guide was published in 2011, and since then the Final FRCA examination has undergone significant changes, which means that an updated version is now well overdue. We hope that this new edition will help candidates and their trainers appreciate the breadth and depth of the knowledge required for this examination. We also anticipate that it will aid them in assessing the expected standard of answers and thereby help with exam preparation.

Examiners are commonly asked why the content and structure of the exam needs to change. The answer is that it is partly due to a process of evolution reflecting changes in practice and in the way training is delivered, and partly a response to the demands of our regulator. The GMC very reasonably requires the College to produce a fair, reliable and suitably robust examination that reflects best contemporary assessment practice. For this and other reasons, we conduct a formal review of our exam processes every few years and institute changes based on current evidence.

As in previous editions, the guide is in three parts. In Section 1, the current examiner leads of each of the relevant subgroups describe their component of the Final examination, including details of the marking system and standard setting. They also outline changes in the format of the questions. There is also a summary of the process for candidates who request guidance from the College due to difficulties in passing the examinations, and information about the system for training, audit,

and assessment of examiners. In Section 2 there are examples of questions taken from the current question banks and, finally, in Section 3 are the answers and some explanation.

As mentioned above, the College examinations are continually evolving, and for this reason the questions included in a book such as this can easily become outdated. To mitigate this problem, we will often put additional example questions and answers on the examinations section of the RCoA website. We also hope to make this book available as an 'e-book or online document' in the future so that updates will be easier and consequently timelier.

Candidates and trainers will be well aware that a new outcome-based curriculum for training in anaesthesia is currently in preparation, and will be introduced in August 2021. Despite this change, the syllabus for the FRCA examinations will not alter greatly. Any changes to the exam brought about by the change to the curriculum, or as part of an independent review of the examinations, will be publicised via the RCoA website and other means of communication well before they are implemented.

I would like to take this opportunity, on behalf of the Council of the Royal College of Anaesthetists, to thank all those examiners and members of the College exams department, who have contributed so much to the examinations and to this guide. Their tireless efforts have ensured that the FRCA examinations maintain the highest standards for the benefit of our patients and the respect in which our specialty is held by the whole medical community.

Section 1: **Examination structure and guidance**

Constructed response questions

Dr Kevin O'Hare, Chair, Final FRCA examinations, Lead CRQ subgroup
Dr Gary Lear, Deputy Chair, Final FRCA examinations, Lead CRQ subgroup
Dr Arun Krishnamurthy, Lead, CRQ subgroup

The aim of the constructed response question (CRQ) paper is to test not only knowledge and understanding, but also higher thinking including application of that knowledge, judgement, and the ability to evaluate and prioritise. It complements the MCQ and oral examinations, which test other knowledge-based competences of presenting candidates.

The format of the written paper has changed since the previous edition of this exam guide was published. Following on from the 2015 examinations review recommendations, the old-style short-answer questions (SAQs) have been replaced by CRQs. In September 2019, a hybrid paper consisting of six CRQs and six SAQs were used, and from March 2020 this component of the examination will consist entirely of 12 CRQs.

CRQs have more subsections than SAQs and may include data and artefacts for interpretation. Candidates will answer the questions in a booklet as before, but each individual subsection will have space for its own answer. The number of marks awarded for each subsection is shown in brackets after the question. Some subsections may ask candidates to prioritise their answers. For example, candidates may be asked to list four specific actions they would take in the management of a particular intraoperative problem. In this case, the space in the answer section will allow for four answers to be given (ie, 1, 2, 3, 4), and only the first distinct answer per line will be awarded marks. (ie, one discrete answer for subsection 1, etc). Any additional answers on that same line will not be considered. Individual questions will continue to be marked out of 20, and the paper as a whole will have a total mark of 240. The examination is blueprinted to the Stage 2 (intermediate) curriculum, and each question will be mapped to the Primary and Final FRCA syllabus. The CRQ paper will continue to assess the mandatory areas of training. These may be included as part of a question – for example pain management may be included as part of a question on the perioperative care of a case, rather than as a stand-alone question.

Individual questions will continue to be marked out of 20, and the paper as a whole will have a total mark of 240. The examination is blueprinted to the Stage 2 (intermediate) curriculum, and each question will be mapped to the Primary and Final FRCA syllabus. The CRQ paper will continue to assess the mandatory

areas of training. These may be included as part of a question – for example pain management may be included as part of a question on the perioperative care of a case, rather than as a stand-alone question.

Included in this guide are a small number of sample CRQs. Please note that these are from a trial exam which took place in early 2018 and as such were very early versions of a CRQ and were intended to allow this modality to be refined and evolve. They are not entirely indicative of the CRQs we use currently but in general they follow the same format. The reason for their inclusion is that currently we do not have a sufficient bank of developed CRQs to allow for some of those to be included in this guide. Hopefully in the near future we will release more up to date CRQs on the RCoA website.

Setting the paper

Putting together the CRQ paper is time-consuming and requires much thought and discussion. A diverse range of questions sampling the whole of the curriculum is included. The questions allow time for analytical thought, and the paper must determine and maintain the College's standards.

Examiners are asked to submit questions several months in advance, and the CRQ subgroup select the final 12 questions bearing in mind the aim of each question and the balance of the paper as a whole. To ensure the purpose of the question is as clear as possible, each question is reviewed and refined several times.

In addition to specific knowledge-based competences listed in the exams' syllabus, examination material may also be developed from guidance or recommendations published by healthcare organisations such as the RCoA, The Association of Anaesthetists (the Association or AAGBI prior to 2019), NCEPOD, NICE, SIGN, NPSA, CEMACH, etc. The public expect their doctors to keep up to date with important developments, and such material may be examined under the collective umbrella of 'professionalism', which is also covered in the syllabus. Candidates should also remember that knowledge gained during Stage 1(core level) of training, including advanced clinical sciences, may be required to answer CRQ questions satisfactorily.

Marking guides are provided for the examiners, and these are checked and rechecked against the question. The marking guide for the CRQs gives strict guidance as to what constitutes a correct answer and a detailed indication of where marks will not be awarded if an answer is incorrect or reflects poor judgement by a candidate.

Answering CRQ questions

Candidates are advised to read the paper carefully. Every word in each question is there for a purpose, and the questions should be answered by providing no more and no less than what is asked for. Where, for example, a question asks about

preoperative management, no marks will be given for operative or postoperative management. If a question says 'list' then a list is what is required.

Candidates are advised to read through the question before starting to answer it so as to understand what is needed to answer each subsection. This should leave 10–12 minutes writing time for each question. The examiners have given careful thought as to how much is expected in response to each question to ensure that it is achievable in the time allocated. Timing is crucial, and candidates will not give themselves the best chance of passing the whole paper if they spend too much time on some questions and leave too little for others.

As mentioned above the marks available for each subsection are shown, and candidates are strongly advised to allocate their time appropriately. For example, if a subsection commands 6 out of the 20 marks available for the question as a whole, a very brief answer to that part may not realise the full six marks.

Two questions should be answered in each of the six answer books provided to each candidate. Each question will contain space to answer each subsection in the booklet. Artefacts and data, if included in a question will be embedded into the answer booklet. Candidates should ensure their answers are contained within the relevant answer section; however, additional paper will be available if required. If candidates use extra paper, they should attach it to their booklets with the treasury tag provided and ensure that all answers are clearly marked indicating the question and subsection they apply to. Any answers provided on additional paper will be marked in a similar fashion to those contained within the answer booklet. Candidates should refrain from writing outside the answer section.

Finally, although marks are not deducted for poor handwriting, candidates should realise that examiners cannot award marks for material they cannot read, so please ensure that you write legibly.

There are example CRQs within this fourth edition of the guide. As CRQs are only now being introduced, we have been unable to provide examples of past papers or questions used in previous exams. The example questions in this guide are of a similar format to those that will be used in future examinations, as are the published answer templates. As the CRQ group continues to develop new questions, further examples of CRQs will be published in an online format.

Standard setting

Approximately 12 weeks before the written examination, the examiners meet in six teams and go over the two questions they are to mark. Minor adjustments to the question-and-answer template may be made at this time, and they discuss a preliminary pass mark for each question. Currently, about eight to ten examiners will

share the marking of each pair of questions for all the candidates sitting the written paper. For example, one group of examiners will mark all of question 1 and question 2, and so forth. Six examiners will therefore participate in marking any individual candidate's CRQ paper.

Increasing the number of markers involved in assessing each candidate's paper reduces the effect of any variability between examiners. Soon after the written paper has been marked, examiners in their groups convene at the College, and each group marks four anonymised CRQ answer booklets (without 'candidate' or 'college reference numbers'); each booklet contains two questions. College officials choose the four sets of booklets, on the basis of the candidates' MCQ scores, to represent the spectrum of ability within the candidate cohort. The MCQ results for the anonymous candidates are not given to the examiners.

Subsequent discussion within each team ensures that all these scripts are awarded every mark allowed by the answer template and that each examiner has applied a consistent standard across all four candidates. The examiners agree the pass mark for each question before they mark the papers. This is based on their expectation of what a borderline candidate, who is just at the pass standard, should achieve. This process is known as 'modified Angoff referencing'.

Marking

Each CRQ is marked out of 20 using the marking guide refined by the examiners. Questions span varying degrees of difficulty, and so pass marks for different questions vary accordingly. Typically, pass marks range from 11 to 14 out of 20 marks. The 'examiner generated' pass marks for the 12 questions are summed to give a total pass mark for the whole paper. To allow for variation in the examination's reliability this mark is then reduced by a standard error of measurement calculation to give the actual pass mark that is used for the CRQ paper. This mark is then combined with the pass mark for the MCQ paper to give the overall pass mark for the written examination. Each examiner will have approximately 60-80 books to mark (120-160 answers). Using the marking guides, they will allocate marks to each section of the question and, having completed marking the whole question, will add up the total.

Quality assurance

Once marking is completed, all of the marks are checked for mathematical accuracy. The performance of each question, and the performance of the paper as a whole, is scrutinised in detail and subjected to statistical analyses to determine reliability. Questions that have low pass rates are looked at closely to ascertain if there are any reasons to account for the poor performance. Examiners provide their comments on each question and identify any common themes in candidates' performance. The chair of the CRQ group produces a report on each CRQ paper, and this is published on the RCoA website for the benefit of candidates and trainers.

Summary

Candidates who have prepared thoroughly and have adequate experience of anaesthesia, intensive care medicine and pain management, together with a solid knowledge of basic sciences, will have the best chance of performing well in the CRQ examination.

Currently, questions used for the CRQ examination are newly created for that particular sitting. However, as time goes on, questions may be repeated and one or more previous question may be used in any CRQ paper. This will become an increasing feature as a question bank is built up. There are many reasons for this, but two important aspects are to facilitate a better, balanced paper, and to drive learning.

Finally, the most important advice is repeated. Read the question carefully, answer it no more and no less than is asked for, and pay strict attention to timing.

Multiple choice questions

Dr John Adams, Lead, Final FRCA MCQ subgroup
Dr Ros Bacon, Deputy Lead, Final FRCA MCQ subgroup
Dr Cameron Weir, Final FRCA MCQ subgroup

The Final FRCA written examination MCQs paper currently comprises 90 items to be completed in three hours. It is divided into two sections, with 60 multiple true/false (MTF) and 30 single best answer (SBA) questions. The proportion of SBA questions is to increase so that by 2023 the whole MCQ paper will consist of SBA-style questions.

Since the introduction of SBAs to the exam in September 2010, the Structure of the MCQ paper has remained as follows:

60 multiple true/false (MTF):

- 20 advanced sciences to underpin anaesthetic practice
- 20 general duties (essential units)
- 17 specialist (essential units)
- 3 optional units

30 single best answer (SBA):

- 15 general duties (essential units)
- 15 specialist (essential units)/optional units

The examiners from the MCQ subgroup are responsible for a databank of more than a thousand questions covering all aspects of the exams syllabus. Although most of the questions relate to subject areas covered in Stage 2 (the intermediate level curriculum), candidates are reminded that all components of the Final exam may include questions related to Stage 1 (the core-level curriculum), including basic sciences and professionalism in medical practice. New questions are constantly being developed and existing questions being modified by the examiners so as to make the question bank reflect the breadth of the curriculum. Up-to-date information about the format of the examination can be found on the RCoA website.

The MTF section is primarily a test of factual knowledge. Each MTF question stem has five options; each option can be true or false. All the questions are equally valuable, with a correct answer scoring one mark, and an incorrect answer or unanswered question scoring zero. It is possible for all five options of a question to be 'true' or, indeed, for all five options to be 'false'.

However, the MTF style of question does not allow facts to be placed in context, or lend itself to testing the application of knowledge and problem solving that is so essential in clinical practice. This is where SBAs are invaluable – they allow the

candidate to demonstrate that they 'know how' rather than simply 'know', thus assessing a higher level of understanding. This is the reason that the College has decided to phase out MTF questions and have an MCQ paper consisting entirely of SBA questions. This is in line with GMC guidance, and all the major medical royal colleges are now adopting this approach.

SBAs consist of a stem lead-in question and five options. The stem of the question focuses on a single problem. The lead-in is short and precise and poses a single question. The five options are listed alphabetically and are all possible solutions or responses to the question arising from the stem. However, one of the options will be the best response, and the remaining four will be inferior. A useful approach for candidates is to read the stem and lead-in question while covering up the five options so that they cannot be seen. The answer that occurs to a well-prepared candidate at this stage, and then appears in the list of options, is likely to be the correct response. Candidates make a single mark on their answer sheet next to their choice for each question. Four marks are scored for each correct answer. This mark is based on the premise that a candidate needs to discount four options in order to arrive at the single, best answer. If candidates make more than one response to a question then no marks will be awarded for that question.

A common mistake candidates make is to look for a 'perfect' answer to the SBA question. Please remember that you are being asked to choose the best or most appropriate response from the available options. It can therefore be helpful to consider the possible consequences of each of the answers when deciding which is the best option. Similarly, some questions may appear familiar and look similar to those seen in books or on exam courses. It is vital that you read the questions very carefully and consider all of the possible responses in detail before making your selection.

As there is no negative marking in the MCQ exam, it is in your interest to answer every question and every option. To leave answers out, will mean that you lose out on the possibility of getting the answer right and the mark that goes with it!

The pass mark varies slightly with each diet of the exam in order to reflect the inevitable variation in difficulty of a particular exam paper. The overall pass mark for the MCQ is around 72–75%. The MCQ subgroup meets approximately one week after the MCQ examination to set the pass mark. Prior to this meeting, 'Angoff referencing' is performed. In this process around 15 examiners are given the paper (without the answers) and each independently decides the probability of the minimally competent candidate knowing the correct answer for every question. This process of criterion referencing has been shown to have a high validity in determining the pass standard and helps to ensure that your examination is both fair and reliable. The subgroup carry out item analysis of all questions, and those questions that perform poorly are scrutinised very carefully. Candidates'

comments on questions, made at the time of the examination, are also taken into consideration. If it is deemed during this process that a question is ambiguous or unfair, it will be removed from the marking process.

It is recommended that you mark your answers on the question paper as you read through it and transfer them to the optical mark reader (OMR) mark sheet using the pencil provided when you have completed the paper and you are sure about your answers. You can change your answer on the OMR sheet by ensuring that you erase the incorrect response and indicate the new answer with a firm pencil mark. However you choose to complete your OMR mark sheet, please make sure that you allow sufficient time to transcribe your answers and mark them firmly. Transcription errors are all too easy to make if rushed. Please be aware that extra time will not be allowed for transcribing answers to the OMR mark sheet.

You will need a broad knowledge of the curriculum to pass the MCQ examination. Answering practice questions will help you become familiar with the style of the exam and the level of knowledge required. The questions included in this guide may have been asked previously or been adapted from those that are currently in the question bank. As mentioned above, candidates are reminded that questions are constantly under review, and small modifications may change the character of the question and thus the answers. There is therefore, little to be gained from simply memorising the answers to the questions published in this guide. You should regard these practice questions as a valuable part of your exam preparation, but this alone will not be sufficient to guarantee an overall pass.

Final FRCA structured oral examination

Dr Simon Logan, Dr Irwin Foo, Dr Mohamed Sameh Abdullatif, Dr Cyprian Mendoca, Leads, clinical science questions

Dr Andrew Norris and Dr Satya Francis Leads, clinical long cases

Dr Joe Cosgrove, Dr Elaine Wilson-Smith, Leads, clinical short cases

Introduction

In December 2018, a number of changes were introduced to the Final FRCA structured oral examination (SOE) structure and format. The overall purpose of the change was to improve the reliability and validity of the examination and provide a more intuitive approach to assessing clinical knowledge and the science that underpins it, while also ensuring a wider coverage of the curriculum.

The addition of a second table in SOE 1 (clinical short cases with linked applied clinical science questions) has increased the reliability of assessment and expanded curriculum coverage. Candidates now interact with four examiners in SOE 1 and two in SOE 2.

These changes also allow questions to be drawn from seven clinical areas/topics, (previously four) The Final SOE will therefore assess candidates in at least two topics from the general duties unit and four topics from the six essential units. One topic from optional units within the curriculum may also be used. The current Final SOE structure is set out below:

SOE 1 – clinical short cases with linked applied clinical science questions

This is normally held in the morning and is divided into two parts, A and B. Each part comprises two clinical short cases with linked applied clinical science, short cases and science questions are marked separately. SOE 1A is run on the first-floor examination room and has two short cases linked to anatomy and physiology science questions. SOE 1B is run on the second floor and consists of two short cases linked to pharmacology and physics/clinical measurement science questions. The clinical cases will usually precede the science question, although there may be some occasions when the science topic is asked first.

SOE 2 – clinical anaesthesia

This is normally held on both exam floors in the afternoon and consists of a two-section clinical long case followed by two stand-alone clinical short cases, all taken in one sitting.

General advice to candidates sitting the Final SOE

It is imperative that you arrive in good time for your SOE and relax as best you can. The examiners fully understand that you may feel anxious and nervous. Remember all of the examiners have been in the same position as you, some several times (not every examiner passed every part of the exam first time!) This is your opportunity to convince the examiners that you are worthy of passing the Final FRCA.

The candidates who impress the examiners are those who do most of the talking and present their answers in an **ordered**, **systematic**, coherent and **structured** manner. This is a skill that can only come from being confident of your own knowledge and with regular oral practice beforehand. The most common mistake is failure to practise speaking aloud coherently in answer to a question, it is a different skill from providing written answers.

Listen carefully to the question. **Answer the question that has been asked, not the question you hoped for**. If you do not understand the question, ask the examiner to repeat it or rephrase it. If you get off to a bad start and wish to start again, say so. If you realise you have made a mistake then say so and offer your alternative answer. If the answer to a question is not immediately obvious to you, try talking it through from first principles. If a diagram helps you to answer a question, draw one. Consider your body language and try not to mumble behind your hands or talk too fast or loudly. Avoid situations where your only answers are 'yes' or 'no' – the very reticent candidate is unlikely to pass the examination.

It can be very difficult for a candidate to judge how well they are performing in an oral examination. You may easily misjudge your performance – good examining technique is to establish the limit of your knowledge, so you may well be asked questions you do not know the answer to. Sometimes you may feel that you have failed when in reality you have passed. Take time to talk with colleagues who have recently passed the exam, and ask them about how they felt during and immediately after leaving the SOE. Remember that you do not have to get every single question correct to pass the SOE, and one question, which seems to have gone badly will not constitute a fail overall.

It is difficult for you to judge the level of knowledge required to pass, and so, occasionally, a candidate can successfully get through the structured questions quickly. The examiners may then choose to explore the candidate's depth and breadth of knowledge in more depth with further allied topics – this will only be scored with a view to you being a potential prize-winner if appropriate.

As anaesthetists, we often find ourselves acting as the patient's advocate. The role of the examiner in the SOEs is to ensure, that on behalf of the general-public, that candidates have demonstrated adequate knowledge and understanding of the professional requirements needed to fulfil that role.

Examination guidance

Dr Arun Krishnamurthy, Lead, CRQ subgroup

Guidance interviews are available to candidates who have been unsuccessful in either the written or the oral component of the Final FRCA examination on more than one occasion. In the case of a candidate on their last attempt, a second interview is permitted, and if they have not had a previous interview it is mandatory.

Interviews are held at the College or at various regional centres. Locally conducted interviews will be coordinated by the College and the relevant school of anaesthesia with input from FRCA examiners. This is because the College strongly believes that the issues that prevent candidates from being successful in the FRCA examinations must be considered in a local context and should involve input from the candidate's trainers and school officers.

In general, the candidate will meet with their local trainers and at least one current Final FRCA examiner. Everyone recognises that the interview may be stressful for the candidate, and everything is done to make the atmosphere as informal as possible. However, if the candidate feels they need more support they may wish to ask a personal mentor, a friend or a family member to sit in on the interview as well.

The aim of the guidance interview is to help the candidate identify their problems with the examinations and suggest possible solutions. The interviews typically last around 30 minutes. The examiner will lead a discussion and will highlight any themes that may have contributed to the candidate's difficulties with the exam. It is relatively easy to say to a candidate, 'Work harder, practise and improve this area'. More demanding on everyone is to identify why the candidate has not already done this. This is where input from the local trainers and mentors can be very important. Until the candidate understands the level of knowledge and commitment required, and is prepared to commit the time in the run-up to the exam, they will have difficulty in reaching the standard. There may be domestic or health-related problems that are preventing full engagement with exam preparation, and it may be appropriate to air these issues.

A certain level of clinical experience is needed to pass the Final FRCA. It is aimed at an anaesthetist with roughly 18 months experience at specialist registrar level. The examination focuses on the Stage 2 (intermediate level) curriculum, based around the major modules of training such as paediatrics, neuro, ICM, pain, etc. Sitting the Final too early, particularly the SOEs, without gaining adequate exposure to the major modules is often a theme of candidates who attend for guidance. Candidates should also be reminded that clinical science forms an important part of the Stage 2 (intermediate level) syllabus, and it is an area of the exam that is often underestimated. It is recommended, that candidates review the basic sciences listed in the Stage 1 (core-level) syllabus prior to sitting the Final FRCA.

At the end of the interview a summary of the discussion which is agreed with the candidate will be provided. The summary may include advice on when the candidate should next sit the examination. A copy of the summary form will be sent to the College for audit purposes only.

Finally, guidance interviews are provided to assist candidates who are struggling to pass the FRCA examinations. It is emphasised that they should be regarded as a means of maximising success in the future, and should not be used to dwell on performance and particularly their marks at previous attempts. If candidates feel aggrieved at how they were assessed in an examination, the College has review and appeal procedures for this which are available on the College website.

Examiner audit, assessment, and training

Dr Heike Romer, Lead, audit and assessment subgroup

The role of the examiner in the Final SOE examinations is to guide the candidate to show knowledge and understanding in the topics set for their oral examination in order that they can assess and mark the answer. As candidates have different levels of confidence and skill at giving explanations, the examiners need to be flexible in order to give the candidates the best chance to express themselves. Despite this, they must still cover the subject in question and elicit pertinent information. Each examiner will have their own style of questioning, but all are aiming to allow you, the candidate, to show your knowledge and understanding and therefore score as many marks as you are able. It is important that examiners test the depth of knowledge and understanding of subjects, so interruption and detailed questioning is often necessary.

In order that each candidate has the same chance of answering, examiners are regularly assessed (audited) on their examining skills. General areas that are assessed include the examiner's body language, eye contact, greeting and politeness. Assessment is also made of whether the examiner puts the questions concisely and clearly and interjects appropriately. The auditing examiner will make notes of the manner in which the two examiners clarify any parts of the given answer and mark the examination after the candidate has left the cubicle.

The auditor sits in the corner of the cubicle, to the side or behind the candidate. If you know the auditor or feel that their presence will adversely affect your performance in the examination, you can ask that they leave and they will do so. You do not have to change cubicle. However, they will be assessing the examiners and will not have any input into the conduct or marking of your examination.

Section 2: **Questions**

CRQ examination

CRQ Paper1

Question 1

a) List 3 possible pathophysiological changes in the lungs seen in asthma. (3 marks)

A 57-year-old female, who is known to have asthma, is having a laparoscopic cholecystectomy under general anaesthetic with endotracheal intubation.

b) Interpret her preoperative pulmonary function tests shown below. (2 marks)
Age: 57 Weight: 62 kg Height: 165 cm

	Predicted	Observed – pre bronchodilator	% predicted	Observed – post bronchodilator	% predicted
FEV_1 (L)	2.42	1.45	60	2.06	80
FVC (L)	3.26	2.75	90	3.10	95
FEV_1 / FVC (%)		53%		67%	

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c) List 6 factors that may cause her to develop bronchospasm during her general anaesthesia. (6 marks)

1 .....

2 .....

3 .....

4 .....

5 .....

6 .....

d) She does develop acute severe bronchospasm – what drugs, **including dosages** where applicable, can be used to treat this? (5 marks)

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e) List 4 other actions you would take in the early management of this emergency. (4 marks)

1 .....

2 .....

3 .....

4 .....

Question 2

a) List 2 of the main clinical features used to confirm a diagnosis of dementia. (2 marks)

1 .....

2 .....

b) Name 2 of the most common types of dementia in the UK. (2 marks)

1 .....

2 .....

c) You have been asked to see an 80-year-old man in the preoperative assessment clinic. He has a diagnosis of dementia and is taking rivastigmine, risperidone memantine and ginkgo biloba.

Complete the table by identifying which of his drugs belong to which category. (2 marks)

Drug category	Drug name
1 Acetylcholine esterase inhibitors	
2 N-methyl-D-aspartate (NDMA)	
3 Herbal medicines	
4 Atypical antipsychotics	

d) Outline the potential adverse perioperative effects of each drug. (4 marks)

Drug	Potential adverse perioperative effect
1 Ginkgo biloba	
2 Risperidone	
3 Memantine	
4 Rivastigmine	

e) The patient is scheduled to undergo an operation under general anaesthetic.

Give 6 ways in which intraoperative anaesthetic care can help to prevent him developing postoperative delirium. (6 marks)

1 .....

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2 .....

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3 .....

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4 .....

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5 .....

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6 .....

f) Why is it important to avoid postoperative delirium in this patient? (4 marks)

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Question 3

You are called to the emergency department to assist with the management of a 34-year-old gentleman who has sustained an **isolated** head injury following a road traffic accident; he requires an urgent CT scan. Upon arrival you find him to be restless, no eye opening to pain, making incomprehensible sounds and extending to pain. His blood pressure is 120/70 mmHg and heart rate 80bpm. He weighs 70 kg.

a) What is this man's Glasgow coma score? (1 mark)

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b) Why does he need intubation and ventilation? (2 marks)

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c) Describe how you would achieve intubation and ventilation. (5 marks)

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d) This is the result of the arterial blood gas analysis performed prior to transfer to the CT scanner. He is on an FiO_2 of 0.5 –

PaO_2	16.3 kPa
$PaCO_2$	6.8 kPa
H+	48 nmol/l
pH	7.31

Explain the most important reason why these results are unsatisfactory for this patient. (3 marks)

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e) He is admitted to the intensive care unit. His intracranial pressure (ICP) is measured at 30 mmHg, mean arterial blood pressure (MAP) is 83 mmHg and central venous pressure (CVP) is 7 mmHg. What is his CPP? (1 mark)

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f) Give 6 treatment options available to improve this patient's cerebral perfusion pressure. (6 marks)

1 .....

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2 .....

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3 .....

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4 .....

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5 .....

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6 .....

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g) List 2 intracerebral pathophysiological changes associated with secondary brain injury. (2 marks)

1 .....

2 .....

Question 4

A 38-year-old man is admitted to the intensive care unit critically ill with a diagnosis of suspected acute severe pancreatitis.

a) List 3 common causes of acute pancreatitis in the United Kingdom. (3 marks)

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2 .....

3 .....

b) Two out of three diagnostic criteria must be met in order to confirm the diagnosis of acute pancreatitis. What are the three criteria? (3 marks)

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c) What is the single most important aspect of the medical management of a patient with acute pancreatitis? (1 mark)

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d) Give 3 reasons why enteral nutrition would be preferred over parenteral nutrition in this patient. (3 marks)

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3 .....

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e) When should enteral nutrition be commenced? (1mark)

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The patient becomes increasingly hypoxic, requiring intubation and ventilation. A diagnosis of suspected Acute Respiratory Distress Syndrome (ARDS) is made.

f) What are the 4 criteria of the Berlin definition of ARDS? (4 marks)

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g) Give the pathophysiological mechanism whereby acute severe pancreatitis may cause ARDS. (1 mark)

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h) Despite a FiO_2 of 1.0, lung protective ventilation and maximal positive end-expiratory pressure he remains hypoxic. What additional strategies are available in an attempt to optimise his **ventilation**? (4 marks)

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2 .....

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3 .....

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4 .....

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Question 5

A 25-year-old woman who is 37 weeks pregnant is admitted to your labour ward with a blood pressure of 180/115mmHg and proteinuria. A diagnosis of severe pre-eclampsia is made.

a) What is the main reason that urgent blood-pressure control is needed? (1 mark)

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b) What associated symptoms might this patient have? (4 marks)

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c) Give 2 drugs you would use to treat this patient's blood pressure. (2 marks)

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2 .....

d) Why would magnesium sulphate be indicated in this patient (1 mark), and what dosing regimen would be used? (2 marks)

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The patient's blood pressure has settled to 150/90mmHg. She has been started on magnesium treatment and is being managed on the labour ward with a view to delivery within the next 24 hours as the continuous cardiotocograph (CTG) recording is currently normal.

e) What monitoring does she require? (5 marks)

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f) The patient has had a caesarean section. She has lost 500mls of blood and has had adequate, appropriate fluid replacement.

How would you manage ongoing fluid balance in the postoperative period? (4 marks)

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g) Why would this patient be particularly susceptible to pulmonary oedema? (1 mark)

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MCQ examination

Multiple true or false (MTF)

1 The following are indications for preoperative measurement of serum urea and electrolytes in patients admitted for elective surgery:

- **a** digoxin therapy
- **b** well-controlled, insulin dependent diabetes
- **c** recurrent urinary tract infections
- **d** diuretic therapy
- **e** all patients over 50 years old

2 Hazards of anaesthesia in a patient with chronic renal failure include:

- **a** left ventricular enlargement
- **b** pericarditis
- **c** hypertension
- **d** enhanced carotid sinus activity
- **e** cardiac tamponade

3 Hypophysectomy may result in:

- **a** atrophy of the thyroid
- **b** osteoporosis
- **c** atrophy of the adrenal cortex
- **d** diabetes insipidus
- **e** diabetes mellitus

4 The following groups of people have an increased risk of latex allergy:

- **a** healthcare workers
- **b** those with penicillin allergy
- **c** those with fruit allergy
- **d** those who have had repeated tracheal intubation
- **e** those who have had repeated surgical procedures

5 Myocardial stunning:

- **a** is irreversible
- **b** always follows myocardial ischaemia
- **c** is appropriately treated using dobutamine
- **d** causes beta adrenoceptor down-regulation
- **e** is reduced by cardioplegia solution

6 Supraclavicular brachial plexus block differs from axillary brachial plexus block because the supraclavicular block:

- **a** gives a lower incidence of analgesia for the lateral part of the forearm
- **b** is less likely to involve nerves to the intraosseous muscles
- **c** produces analgesia of the shoulder joint
- **d** is more likely to cause pneumothorax
- **e** is more likely to involve an intravascular injection of local anaesthetic

7 Severe middle third fractures of the face:

- **a** are associated with brain injury
- **b** cause breathing difficulties
- **c** always require immediate fixation
- **d** require the patient to be intubated through the nose for fixation
- **e** include fractures of the orbit and zygoma

8 Phantom limb pain:

- **a** is more common if there was pain in the limb before amputation
- **b** is effectively treated by sympathetic block
- **c** is treated by ablation of the relevant motor nerves
- **d** is treated by transcutaneous electrical nerve stimulation
- **e** is not a feature of traumatic amputation of a limb

9 Pain during the first stage of labour may be relieved by:

- **a** epidural block
- **b** spinal block
- **c** pudendal nerve block
- **d** paracervical block
- **e** lumbar sympathetic block

10 Symptoms or signs characteristic of amniotic fluid embolism include:

- **a** cyanosis
- **b** hypofibrinogenaemia
- **c** chest pain
- **d** hypoventilation
- **e** hypertension

11 At a core temperature of 30°C:

- **a** oxygen consumption is reduced to approximately 50% of that at 37°C
- **b** blood coagulability is increased
- **c** glomerular filtration ceases
- **d** blood viscosity is reduced
- **e** the solubility of carbon dioxide in the blood is increased

12 In a patient with porphyria:

- **a** etomidate may produce an acute attack
- **b** glycine should not be used in irrigating solutions during trans-urethral resection (TUR) of the prostate
- **c** dysautonomia may be present
- **d** preoperative fluid restriction protects against an acute attack intraoperatively
- **e** fentanyl may be used safely

13 In myotonic dystrophy, spasticity of muscles is relieved by:

- **a** succinylcholine
- **b** spinal anaesthesia
- **c** neostigmine
- **d** infiltration of the muscle with lidocaine
- **e** dantrolene

14 Cardioversion is indicated in the treatment of:

- **a** sinus tachycardia
- **b** atrial flutter
- **c** junctional bradycardia
- **d** ventricular tachycardia
- **e** electro-mechanical dissociation

15 Circulatory assistance by intra-aortic balloon pump is useful because it:

- **a** increases aortic diastolic pressure
- **b** increases aortic systolic pressure
- **c** decreases myocardial oxygen demand
- **d** increases left atrial pressure
- **e** increases left ventricular end-diastolic pressure

16 During storage of whole blood, the decrease in 2,3-diphosphoglycerate (2,3-DPG) concentration can be reduced by the addition of:

- **a** mannitol
- **b** adenosine
- **c** pyruvate
- **d** phosphate
- **e** glucose

17 In a sacral epidural (caudal) block in adults:

- **a** the sacral hiatus can be located by reference to the posterior superior iliac spines
- **b** the lower extremity of the dura is normally 3–4 cm below the level of the posterior superior iliac spines
- **c** the sacral canal can be identified using a technique based on the negative pressure in the canal
- **d** absorption of local anaesthetic is greater than from the lumbar epidural space
- **e** a subcutaneous malposition of the needle can be confirmed by injecting air

18 Structures supplied by sacral nerve (S2) include the:

- **a** skin of the buttock
- **b** skin of the back of the leg
- **c** bladder
- **d** flexor hallucis longus
- **e** gluteus maximus

19 Interruption of the cervical sympathetic chain results in:

- **a** dilatation of the pupil on the affected side
- **b** loss of taste sensation over the anterior two-thirds of the tongue
- **c** partial ptosis on the same side
- **d** dryness of the mouth
- **e** absence of thermal sweating on the same side of the face

20 The following agents may cause pulmonary fibrosis:

- **a** bleomycin
- **b** hydrocortisone hemisuccinate
- **c** beryllium
- **d** paraquat
- **e** organophosphate compounds

21 Likely preoperative problems in a 3-month-old infant scheduled for primary closure of a cleft lip include:

- **a** an abnormal bleeding time
- **b** cardiac anomalies
- **c** thromobocytopaenia
- **d** a low haemoglobin level
- **e** arterial hypoxaemia

22 In ophthalmic surgery:

- **a** the oculocardiac reflex is most likely to be seen when traction is applied to the lateral rather than the medial rectus muscle
- **b** isoflurane raises the intraocular pressure
- **c** thiopental lowers the intraocular pressure
- **d** succinylcholine is contraindicated for tracheal intubation before cataract surgery
- **e** desflurane decreases intraocular pressure

23 The ventilatory response to hypoxia is decreased in patients:

- **a** with cyanotic congenital heart disease
- **b** emerging from isoflurane anaesthesia
- **c** with chronic exposure to high altitude
- **d** with pulmonary fibrosis
- **e** on a patient-demand opiate infusion

24 The following drugs alter the level of thyroxine production:

- **a** amiodarone
- **b** propylthiouracil
- **c** propranolol
- **d** carbidopa
- **e** prazosin

25 Stimulation of postganglionic thoraco-lumbar autonomic nerve fibres produces:

- **a** cutaneous vasoconstriction
- **b** bronchiolar constriction
- **c** secretion of eccrine sweat glands
- **d** a reduction in myocardial rhythmicity
- **e** a reduction in myocardial contractility

26 The alveolar–arterial oxygen tension difference is increased by:

- **a** a high inspired oxygen concentration
- **b** nitrous oxide uptake
- **c** a reduction in functional residual capacity
- **d** an increase in ventilation/perfusion mismatch
- **e** hepatic failure

27 Pulmonary vascular resistance is reduced by:

- **a** hypoxia
- **b** hypercarbia
- **c** alkalosis
- **d** epoprostenol (prostacyclin)
- **e** nitric oxide

28 The following have been shown to be effective in the management of post-dural puncture headache in obstetrics:

- **a** elective delivery by forceps
- **b** epidural blood patch using 15–20 ml of autologous blood
- **c** lying supine for 24 hours
- **d** epidural infusion of physiological saline
- **e** intravenous platelet infusion

29 In a patient with a bronchopleural fistula, induction of general anaesthesia must include:

- **a** awake intubation
- **b** endobronchial intubation
- **c** the use of non-depolarising neuromuscular blocking drugs
- **d** the preoperative insertion of a chest drain
- **e** the avoidance of nitrous oxide

30 Xenon:

- **a** has a MAC value of approximately 70% in oxygen
- **b** acts preferentially at the N-methyl-D-aspartate (NMDA) receptor
- **c** can be measured by changes in the refractive index of light
- **d** is more soluble in blood than sevoflurane
- **e** produces analgesia when inhaled as a 50% mixture with oxygen

31 The following are true of day-case anaesthesia:

- **a** laparoscopy is an unsuitable procedure
- **b** patients should be accompanied home by a responsible person
- **c** the operation should be such that narcotic analgesics will not be required postoperatively
- **d** only ASA I patients are suitable
- **e** regional anaesthesia has no place

32 The recurrent laryngeal nerve innervates the:

- **a** cricothyroid muscle
- **b** posterior cricoarytenoid muscle
- **c** mucous membrane of the trachea
- **d** thyrohyoid muscle
- **e** vocalis muscle

33 The sacral canal contains:

- **a** no cerebrospinal fluid
- **b** less than 10 ml of injected local anaesthetic
- **c** roots of the sciatic nerve
- **d** roots of the genitofemoral nerve
- **e** roots of the ilioinguinal nerve

34 Characteristic features associated with tetralogy of Fallot include:

- **a** left ventricular hypertrophy
- **b** right ventricular hypertrophy
- **c** atrial septal defect
- **d** ventricular septal defect
- **e** overriding aorta

35 These drugs selectively increase renal blood flow:

- **a** dobutamine
- **b** dopamine
- **c** dopexamine
- **d** digoxin
- **e** diazoxide

36 The following factors enhance the diffusion of a drug across the blood–brain barrier:

- **a** high lipid solubility
- **b** high plasma protein binding
- **c** high plasma–brain concentration gradient
- **d** high degree of ionisation at physiological pH
- **e** high molecular weight

37 Sevoflurane:

- **a** has a boiling point of 50.2°C
- **b** has a blood-gas partition coefficient of 0.46
- **c** must be protected from light during storage
- **d** is degraded in the body with the production of fluoride ions
- **e** is a molecule which contains a chlorine atom

38 Intraocular pressure is lowered by:

- **a** hypocapnea
- **b** isoflurane
- **c** hypoxia
- **d** propofol
- **e** non-depolarising neuromuscular blocking drugs

39 Appropriate nerve blocks for the treatment of pain associated with chronic pancreatitis include:

- **a** lumbar sympathetic
- **b** thoracic paravertebral
- **c** coeliac plexus
- **d** thoracic extradural
- **e** intrathecal phenol

40 Causes of low arterial pressure upon initiation of cardiopulmonary bypass with total crystalloid prime include:

- **a** inadequate venous return
- **b** low haematocrit
- **c** low viscosity
- **d** hypothermia
- **e** inadequate oxygen carriage

41 Surgical closure of a patent ductus arteriosus produces:

- **a** obliteration of the murmur
- **b** increased oxygenation of blood
- **c** increased diastolic pressure
- **d** decreased pulmonary artery pressure
- **e** decreased left ventricular output

42 Emergency treatment of severe hypotension unresponsive to ephedrine in a fit patient undergoing cervical laminectomy in the sitting position includes:

- **a** turning the patient on to the right side
- **b** intra-aortic balloon counterpulsation
- **c** intravenous administration of $NaHCO_3$
- **d** placing the patient in the head-down position
- **e** withdrawing nitrous oxide

43 Paraplegic patients with spinal cord transection at T6 for more than one year manifest:

- **a** a labile arterial blood pressure
- **b** mass autonomic reflex
- **c** hyperkalaemia after intravenous succinylcholine
- **d** hypoventilation
- **e** causalgia

44 For laryngoscopy:

- **a** the ideal position for the head involves extension of the cervical spine
- **b** a polio Macintosh blade for difficult intubation is mounted at 180° to the handle
- **c** the Macintosh 3 blade is available in a left-handed version
- **d** the light emitted from a fibreoptic laryngoscope blade deteriorates when it is autoclaved
- **e** previous surgery for a thyroglossal cyst will make laryngoscopy with a Macintosh blade easier

45 Complications of deep cervical plexus block include:

- **a** Bell's palsy
- **b** hoarseness
- **c** bradycardia
- **d** dyspnoea
- **e** ipsilateral mydriasis

46 Inadvertent surgical stimulation of the fifth cranial nerve during posterior fossa craniotomy will produce:

- **a** jerking of the jaw
- **b** facial twitching
- **c** bradycardia
- **d** jerking of the shoulder
- **e** nystagmus

47 The hypertensive response to laryngoscopy and tracheal intubation may be attenuated by:

- **a** enalapril
- **b** buprenorphine
- **c** lidocaine spray to the cords and trachea
- **d** glycopyrrolate
- **e** intravenous lidocaine

48 Appropriate management of a mildly cyanotic child with a ventricular septal defect and pulmonary hypertension scheduled for multiple dental extractions under general anaesthesia includes:

- **a** perioperative antibiotic cover
- **b** avoidance of benzodiazepine premedication
- **c** maintaining moderate hypoxia and hypercarbia
- **d** intermittent positive pressure ventilation
- **e** intramuscular premedication

49 Appropriate management of a female patient with untreated thyrotoxicosis requiring repair of an incarcerated femoral hernia includes:

- **a** intravenous propranolol
- **b** atropine premedication
- **c** spinal anaesthesia
- **d** intravenous chlorpromazine
- **e** intravenous carbimazole

50 In assessing the adequacy of medullary perfusion during posterior fossa surgery, the appearance of the following are useful:

- **a** delta waves in the electroencephalogram
- **b** hypothermia
- **c** increase in mean arterial blood pressure
- **d** cardiac arrhythmia
- **e** irregularities in respiration

51 During general anaesthesia for laparoscopy, when the intra-abdominal pressure is 40 mmHg the following parameters would decrease:

- **a** central venous pressure
- **b** heart rate
- **c** cardiac output
- **d** systemic vascular resistance
- **e** airway pressure

52 A continuous positive pressure breathing system (CPAP) for an adult:

- **a** requires a fresh gas flow of 15L/min
- **b** improves oxygenation in patients by an increase in functional residual capacity
- **c** should maintain pressure during inspiration within 0.5 kPa (5 cm H_2O) of the pressure during expiration
- **d** if used correctly will reduce lung compliance
- **e** may increase the work of breathing

53 When performing the 'three-in-one' block for pain relief in lower limb surgery:

- **a** the needle is inserted medial to the femoral artery
- **b** the saphenous nerve will be blocked
- **c** good analgesia will be obtained for operations on the foot
- **d** the obturator nerve, femoral nerve, and the lateral cutaneous nerve of the thigh will be blocked
- **e** muscle relaxation is provided

54 The following conditions may be associated with difficulty in tracheal intubation:

- **a** Marfan's syndrome
- **b** acromegaly
- **c** Charcot-Marie-Tooth disease
- **d** Ludwig's angina
- **e** Down's syndrome

55 Appropriate immediate management of a neonate who suddenly becomes dusky and bradycardic with a reduced pulmonary compliance following repair of a left diaphragmatic hernia and re-expansion of the atelectatic lung includes:

- **a** obtaining a chest X-ray
- **b** left-sided needle decompression
- **c** right-sided needle decompression
- **d** measurement of arterial blood gases
- **e** reopening the abdomen

56 A neurolytic coeliac plexus block:

- **a** causes postural hypotension
- **b** is performed anterolateral to the body of L2
- **c** causes neuropathic pain in the upper thigh
- **d** causes diarrhoea
- **e** is performed with the needle placed anterior to the aorta

57 Surgical correction of scoliosis:

- **a** carries a high risk of spinal cord damage
- **b** is monitored by somatosensory evoked potentials
- **c** is facilitated by induced hypotension
- **d** may involve division of the diaphragm
- **e** typically requires postoperative ventilation for several days

58 After successful supraclavicular brachial plexus block, sensory anaesthesia will usually be incomplete on the:

a medial aspect of the forearm
b lateral aspect of the forearm
c lateral aspect of the upper arm
d medial aspect of the upper arm
e back of the elbow

59 Retrobulbar block:

a dilates the pupils
b causes enophthalmos
c reduces intraocular pressure
d prevents lacrimation
e increases the likelihood of vitreous prolapse

60 Premature neonates:

a are prone to develop hypocalcaemia
b are sensitive to non-depolarising relaxants
c have reduced insensible water loss
d have increased unconjugated bilirubin levels
e have excess Type 1 (oxidative) muscle fibres in the diaphragm

61 The TURP syndrome:

a is associated with hypokalaemia
b may present with convulsions
c is prevented by spinal anaesthesia
d is due to blood loss
e requires a diuretic for its treatment

62 Indications for the use of lumbar epidural analgesia during labour include:

a placenta praevia
b eclampsia
c High BMI
d incoordinate uterine action
e maternal exhaustion

63 The penicillins:

- **a** are bacteriostatic
- **b** interfere with bacterial cell wall synthesis
- **c** are more active against organisms which are not dividing
- **d** do not affect Gram-positive cocci
- **e** are all destroyed by penicillinase

64 The following are competitive antagonists:

- **a** neostigmine
- **b** naltrexone
- **c** buprenorphine
- **d** flumazenil
- **e** enoximone

65 Intraoperative signs of a haemolytic transfusion reaction include:

- **a** an increase in capillary bleeding
- **b** hypertension
- **c** fever
- **d** urticaria
- **e** periorbital oedema

66 Hoarseness or alteration in the quality of voice has been attributed to injury of the recurrent laryngeal nerve:

- **a** due to ischaemia resulting from an overinflated tracheal cuff
- **b** during ligation of a patent ductus arteriosus
- **c** during carotid-subclavian bypass graft operations
- **d** during carotid endarterectomy
- **e** during pneumonectomy

67 Lactic acid is:

- **a** formed during anaerobic ATP re-synthesis
- **b** increased in concentration in the blood during energy deficit
- **c** not formed by red blood cells
- **d** converted to glucose by the Cori cycle
- **e** oxidised without conversion back to glucose

68 Low molecular weight heparin:

- **a** activity is effectively measured by APTT
- **b** has a longer plasma half-life than standard heparin
- **c** strongly binds to plasma proteins
- **d** has its effect completely reversed by an equivalent dose of protamine
- **e** has prolonged plasma clearance in patients with renal failure

69 Hypoparathyroidism following thyroidectomy may be associated with:

- **a** a tingling sensation in the limbs
- **b** skeletal muscle flaccidity
- **c** tetany after vascular occlusion in a limb
- **d** bradycardia
- **e** hypothermia

70 In normal individuals with a normal $PaCO_2$, cerebral blood flow:

- **a** autoregulates between cerebral perfusion pressures of 50–100 mmHg
- **b** is reduced when breathing 100% oxygen
- **c** increases with hypothermia
- **d** is normally 45 ml/100g/min
- **e** increases following the administration of mannitol 0.5 g/kg

71 In normal pregnancy:

- **a** the plasma colloid osmotic pressure decreases to about 17 mmHg
- **b** the total quantity of plasma proteins is decreased
- **c** the concentration of most globulins increases
- **d** altered plasma protein levels increase the toxicity of bupivacaine
- **e** plasma volume increases to 60 ml/kg

72 The alpha-2 adrenoreceptor agonist clonidine:

- **a** reduces the dose requirement for inhalational anaesthetics
- **b** increases heart rate
- **c** reduces arterial blood pressure
- **d** antagonises the analgesic effect of opioids
- **e** increases the duration of epidurally administered bupivacaine

73 Intercostal nerves:

- **a** pass anterior to the posterior intercostal membrane
- **b** pass between the external and internal intercostal muscles
- **c** lie superior to the intercostal artery and vein
- **d** give rise to lateral and anterior cutaneous branches
- **e** supply the periphery of the diaphragm

74 Pulmonary vascular resistance is:

- **a** increased if the haematocrit is abnormally high
- **b** decreased when breathing 79% helium with 21% oxygen
- **c** increased by the application of 5 cm H_2O positive end-expiratory pressure
- **d** increased by breathing 2% sevoflurane in air
- **e** decreased by moderate exercise

75 The following are nephrotoxic:

- **a** angiotensin converting enzyme inhibitors
- **b** non-steroidal anti-inflammatory drugs
- **c** halothane
- **d** aminoglycosides
- **e** radio-contrast agents

76 Shock due to Gram-negative bacteraemia is frequently associated with:

- **a** oliguria
- **b** hypotension unresponsive to fluid replacement
- **c** pre-existing jaundice
- **d** intermittent fever
- **e** low cardiac output

77 After a severe burn (greater than 40% full thickness):

- **a** enteral nutrition should be started as soon as possible
- **b** vascular access should never be placed through burnt skin
- **c** fluid requirements are maximal in the first 12 hours
- **d** tissue swelling is maximal between 24 and 48 hours
- **e** prophylactic antibiotics should be given

78 In the critically ill, skeletal muscle:

- **a** has decreased free intracellular glutamine
- **b** demonstrates decreased muscle protein synthesis
- **c** breakdown can be prevented by early nutritional support
- **d** breakdown is prevented by endogenous cortisol
- **e** shows an increased myofibrillar protein synthesis when insulin is administered

79 The use of propofol for sedation on the intensive care unit is associated with:

- **a** a calorie load of 0.1 kcal/ml
- **b** raised serum triglycerides
- **c** increased cerebral blood flow
- **d** a reduction in mean arterial pressure
- **e** reduced shunt

80 Mixed venous oxygen saturation:

- **a** is increased in anaemia
- **b** is increased in hypothermia
- **c** is decreased when cardiac output is low
- **d** is decreased in established systemic sepsis
- **e** can be measured continuously using fibreoptics

81 Crush syndrome:

- **a** results from extensive tissue ischaemia
- **b** results in myoglobinuria
- **c** is more likely to cause renal damage if the urine is acidic
- **d** commonly causes disseminated intravascular coagulation
- **e** is seen in compartment syndromes

82 Important measures to prevent hospital acquired infections in intensive care include:

- **a** adequate separation of beds as specified in national standards
- **b** separation of new admissions from the rest of the intensive care patients
- **c** plastic overshoes
- **d** routine culture of the environment and equipment
- **e** changing ventilator tubing every 24 hours

83 Potential complications of the use of neuromuscular blocking agents in the critically ill include:

- **a** venous thromboembolism
- **b** critical illness neuropathy
- **c** cardiac arrhythmias
- **d** protracted muscle weakness
- **e** peripheral nerve injury

84 Electrocardiographic changes during hypothermia to 28°C include:

- **a** ventricular extrasystole
- **b** peaked T waves
- **c** atrial fibrillation
- **d** left bundle branch block
- **e** bigeminy

85 Ionised calcium:

- **a** may be measured in a sodium-heparin (blood gas) sample
- **b** is measured in a 'clotted' (serum) specimen
- **c** is affected by pH
- **d** falls during massive blood transfusion
- **e** is affected by changes in serum proteins

86 In thermal dilution techniques for the measurement of cardiac output:

- **a** the bolus of injectate should have a volume of at least 20 ml
- **b** it is necessary to obtain a reading of wedge pressure
- **c** the result is inaccurate if the patient is febrile
- **d** the bolus should be injected rapidly
- **e** the result is unaffected by the phase of the respiratory cycle in which the injection is made

87 A typical daily regimen for total parenteral nutrition in an adult:

- **a** includes 14 g nitrogen per day
- **b** should avoid fat emulsions in patients with liver failure
- **c** includes glucose
- **d** includes magnesium
- **e** includes approximately 1 ml water for each kilocalorie given

88 The effectiveness of defibrillation is increased by:

- **a** delivery during inspiration
- **b** acidosis
- **c** pretreatment with class 1a antiarrhythmics
- **d** amiodarone
- **e** ensuring uniform distribution of applied current within the heart

89 Appropriate treatment of a 10 kg infant whose urine output declines to 2 ml/hr two hours after resection of obstructed small bowel includes:

- **a** 10 ml of 25% mannitol
- **b** 100 ml sodium chloride 0.18% and glucose 4%
- **c** 100 ml sodium chloride 0.9%
- **d** 100 ml Hartmann's solution
- **e** 60 ml whole blood

90 In the following situations the measured pulmonary artery occlusion pressure (PAOP) will not reflect left ventricular end-diastolic pressure (LVEDP):

- **a** catheter placement in West Zone III
- **b** mitral incompetence
- **c** tricuspid incompetence
- **d** pulmonary embolus
- **e** aortic stenosis

91 Hypophosphataemia gives rise to:

- **a** difficulty in weaning patients from a ventilator
- **b** shift of the oxygen dissociation curve to the right
- **c** increased red cell fragility
- **d** reversible myocardial dysfunction
- **e** a peripheral neuropathy

92 The following are endogenous pro-inflammatory cytokines:

- **a** tumour necrosis factor alpha
- **b** interleukin 6
- **c** interleukin 1 receptor antagonist
- **d** interleukin 10
- **e** nuclear factor kappa B

93 The treatment of amitriptyline poisoning includes:

- **a** forced diuresis
- **b** an isoprenaline infusion
- **c** digitalisation
- **d** intravenous atropine sulphate
- **e** beta adrenoceptor antagonists

94 Conditions associated with smoke inhalation injury include:

- **a** the immediate development of pulmonary oedema
- **b** sloughing of the mucosa of the upper airway
- **c** a shift of the oxyhaemoglobin dissociation curve to the left
- **d** heat injury to the lung parenchyma
- **e** increased carboxyhaemoglobin concentration

95 Amniotic fluid embolism:

- **a** can occur during therapeutic abortion
- **b** can occur 24 hours after delivery
- **c** may present as haemorrhage
- **d** is a diagnosis of exclusion
- **e** is more common in multiparae

96 Likely causes of severe hypotension following surgical removal of a phaeochromocytoma include:

- **a** inadequate preoperative alpha adrenoceptor blockade
- **b** acute adrenal cortical failure
- **c** hypersensitive beta receptors
- **d** diminished plasma volume
- **e** splanchnic pooling

97 Criteria applied in the diagnosis of 'brain death' include:

- **a** absence of activity in any cranial nerve
- **b** fixed non-reactive pupils
- **c** absent doll's eye reflex
- **d** upgoing plantar reflexes
- **e** two 'flat' EEG tracings repeated 24 hours apart

98 The effects of Ecstasy (3,4-methylenedioxymethamphetamine):

- **a** are usually dose related
- **b** include hyperpyrexia, hypercalcaemia, and hyperkalaemia
- **c** are due to inhibition of 5-hydroxytryptamine
- **d** are due to drinking large amounts of water
- **e** include renal failure due to rhabdomyolysis

99 Initial treatment of haemorrhage after delivery of a complete placenta includes:

- **a** fibrinogen intravenously
- **b** ergometrine intravenously
- **c** bimanual uterine compression
- **d** aortic compression
- **e** uterine packing

100 In acute hepatic failure:

- **a** the prothrombin time is in excess of 20 seconds
- **b** serum alkaline phosphatase may be normal
- **c** serum albumin levels are usually normal
- **d** plasma bilirubin is a sensitive indicator of hepatocellular damage
- **e** serum LDH is a sensitive index of hepatocellular damage

101 In children, death from severe burns in the second week after injury is likely to be due to:

- **a** haemoconcentration
- **b** anaemia
- **c** toxaemia from protein destruction
- **d** hepatic failure
- **e** infection of the burnt area

102 You are called to the labour ward to see a patient who is having generalised seizures 45 minutes after delivery under epidural anaesthesia. Possible causes of the convulsions include:

- **a** grand mal epilepsy
- **b** eclampsia
- **c** local anaesthetic toxicity
- **d** hypocapnic tetany
- **e** maternal hypoxia

103 A rapid shallow breathing pattern in the critically ill:

- **a** is seen in patients in acute respiratory failure
- **b** is associated with failure to wean from ventilation
- **c** results from a high P_aCO_2
- **d** is due to hypoxaemia
- **e** almost always reflects respiratory muscle weakness

104 Fluoroquinolones:

- **a** are chemically related to nalidixic acid
- **b** are effective against pneumococci
- **c** are effective in Gram-negative pneumonia
- **d** may cause seizures
- **e** are chelated by aluminium salts

105 Common side effects of intrathecal opioids in the management of acute postoperative pain include:

- **a** itching
- **b** hypotension
- **c** hypoventilation
- **d** sedation
- **e** urinary retention

106 Side effects of amiodarone include:

- **a** peripheral neuropathy
- **b** hypothyroidism
- **c** corneal microdeposits
- **d** photosensitisation
- **e** bigeminal rhythm

107 Acute inversion of the uterus following delivery is directly associated with:

- **a** cyanosis
- **b** hypotension
- **c** bradycardia
- **d** hypofibrinogenaemia
- **e** severe haemorrhage

108 In a patient suffering from paroxysmal nocturnal dyspnoea, the following signs would favour diagnosis of asthma rather than left ventricular failure:

- **a** raised jugular venous pressure
- **b** basal crepitations
- **c** expiratory wheeze in the absence of other signs
- **d** central cyanosis early in the attack
- **e** hypotension

109 Trans-oesophageal echocardiography:

- **a** can be used to measure intraventricular pressure changes
- **b** is useful for observing tricuspid regurgitation
- **c** can give an index of stroke volume
- **d** is helpful in assessing myocardial ischaemia
- **e** is helpful in assessing myocardial contractility

110 Morbid obesity:

- **a** results in a lower blood volume on a volume-per-weight basis
- **b** decreases oxygen flux
- **c** reduces hypoxic pulmonary vasoconstriction
- **d** can result in left axis deviation on the ECG
- **e** causes insulin resistance

111 In an otherwise normal person, chronic iron deficiency anaemia with a haemoglobin concentration of 60 g/L is associated with:

- **a** metabolic acidosis
- **b** decreased right atrial PO_2
- **c** decreased left atrial PO_2
- **d** increased heart rate
- **e** shift of the oxyhaemoglobin curve to the left

112 The pulmonary artery wedge pressure is a good indicator of left ventricular end-diastolic pressure in patients suffering from:

- **a** myocardial infarction
- **b** mitral stenosis
- **c** aortic stenosis
- **d** pulmonary stenosis
- **e** cardiomyopathy

113 The development of high titres of anti-D antibodies in a Rhesus negative mother with a Rhesus positive fetus:

- **a** is due to fetal red blood cells entering the maternal circulation
- **b** will result in anaemia of the newborn
- **c** will result in jaundice of the newborn
- **d** is due to antigen alone entering the maternal circulation
- **e** always occurs before the third month of gestation

114 An acutely developing blood coagulation defect associated with massive transfusion may be due to:

- **a** thrombocytopenia
- **b** disseminated intravascular coagulation
- **c** deficiency of clotting Factors V and VIII
- **d** incompatible transfusion reaction
- **e** fibrinolysis

115 Platelet concentrate:

- **a** remains viable for two weeks
- **b** is stored at 4ºC
- **c** contains citrate
- **d** requires cross-matching
- **e** significantly elevates plasma histamine concentrations

116 In pulmonary contusion is associated with:

- **a** crepitations on auscultation
- **b** radiological evidence of pulmonary opacity within six hours of blunt chest trauma
- **c** blood tinged tracheal secretions
- **d** an increased alveolar–arterial oxygen tension gradient
- **e** increased lung compliance

117 Recognised complications of bronchial neoplasms include:

- **a** hypercalcaemia
- **b** hyperkalaemia
- **c** inappropriate ADH secretion
- **d** Cushing's syndrome
- **e** hypothyroidism

118 The following symptoms strongly suggest a diagnosis of transient cerebral ischaemia:

- **a** monocular visual loss of two-hour duration
- **b** transient global amnesia
- **c** deafness
- **d** dysphasia that almost resolves by 72 hours
- **e** three episodes of dysarthria, each of which recovers completely within six hours

119 A history of alcoholism is associated with:

- **a** malnutrition
- **b** increased adrenocortical response to surgery
- **c** delayed gastric emptying
- **d** an MCV of 95 fL
- **e** a raised plasma albumin level

120 Effects of hypermagnesaemia include:

- **a** inhibition of acetylcholine release at the neuromuscular junction
- **b** decreased sensitivity of the motor end-plate to acetylcholine
- **c** augmented action of succinylcholine
- **d** reduced action of pancuronium
- **e** decreased myocardial contractility

121 Bilateral hilar lymphadenopathy is a feature of:

- **a** pulmonary tuberculosis
- **b** Hodgkin's disease
- **c** erythema multiforme
- **d** pneumoconiosis
- **e** systemic lupus erythematosus

122 A low fixed cardiac output is associated with:

- **a** aortic stenosis
- **b** constrictive pericarditis
- **c** mitral stenosis
- **d** cor pulmonale
- **e** digoxin toxicity

123 Collapse of the lower lobe of the right lung is characterised by:

- **a** an increased alveolar–arterial oxygen tension difference
- **b** an increased P_aCO_2
- **c** an area of stony dullness to percussion
- **d** a decreased arterial pH
- **e** tachypnoea

124 A haemoglobin of 8 g/L with a reticulocyte count of 10% is associated with:

- **a** aplastic anaemia
- **b** untreated pernicious anaemia
- **c** polycythaemia
- **d** haemolytic anaemia
- **e** acute leukaemia

125 Causes of atrial fibrillation include:

- **a** thyrotoxicosis
- **b** rheumatic heart disease
- **c** cardiomyopathy
- **d** hypertension
- **e** atropine administration

126 There is a recognised association between ulcerative colitis and:

- **a** hepatic cirrhosis
- **b** iritis
- **c** finger clubbing
- **d** arthritis
- **e** cholangitis

127 Endocrine syndromes associated with primary bronchogenic carcinoma include:

- **a** inappropriate ADH secretion
- **b** hyperglycaemia
- **c** thyrotoxicosis
- **d** hyperparathyroidism
- **e** carcinoid syndrome

128 Signs of a successful stellate ganglion block may include:

- **a** anhydrosis of the ipsilateral side of the face
- **b** ptosis of the contralateral eye
- **c** relief of pre-existing causalgia in the arm
- **d** a decrease in temperature of the ipsilateral forearm
- **e** systemic hypotension

129 In primary adrenocortical failure:

- **a** blood cortisol is low
- **b** plasma ACTH is unchanged
- **c** serum potassium is low
- **d** serum sodium is low
- **e** blood glucose is low

130 You would expect to find sensory changes in the following conditions:

- **a** syringomyelia
- **b** poliomyelitis
- **c** tabes dorsalis
- **d** motor neurone disease
- **e** carpal tunnel syndrome

131 The metabolic response to major surgery includes:

- **a** an increased utilisation of glucose with a reduction in fasting blood sugar
- **b** a reduction in the amount of sodium excreted in the urine
- **c** a decrease in circulating free fatty acids
- **d** an increased excretion of potassium in the urine
- **e** a moderate increase in oxygen consumption

132 An anaesthetic technique suitable for nasal septoplasty is likely to include the use of

- **a** a throat pack
- **b** induced hypotension
- **c** nasal preparation with 4% cocaine
- **d** a non-kinking endotracheal tube
- **e** anticholinergic premedication

133 Hepatitis B infection:

- **a** is transmitted by droplets
- **b** is highly contagious
- **c** is common in intravenous drug users
- **d** can be prevented by immunisation
- **e** predisposes to carcinoma of the liver

134 Radiological evidence of enlargement of the pulmonary artery is a recognised feature of:

- **a** atrial septal defect
- **b** persistent ductus arteriosus
- **c** mitral stenosis
- **d** Fallot's tetralogy
- **e** Eisenmenger's syndrome complex

135 The following are recognised causes of thrombocytopenia:

- **a** systemic lupus erythematosus
- **b** infectious mononucleosis
- **c** cirrhosis of the liver
- **d** treatment with a thiazide diuretic
- **e** splenectomy

136 The carcinoid syndrome is associated with elevated plasma levels of:

- **a** adrenaline
- **b** insulin
- **c** glucagon
- **d** prostaglandins
- **e** serotonin

137 Clinical findings consistent with persistent vomiting for two months include:

- **a** vitamin B_{12} deficiency anaemia
- **b** a blood urea of > 12 mmol/L
- **c** hypokalaemia
- **d** hypochloraemia
- **e** tetany

138 Ankylosing spondylitis:

- **a** over the age of 40, occurs more commonly in women than men
- **b** is associated with low-grade pyrexia
- **c** may present as sciatica
- **d** may be complicated by arthropathy affecting the hips
- **e** may be complicated by iritis

139 The following may relieve severe pain from osseous metastases of carcinoma of the prostate:

- **a** orchidectomy
- **b** short wave diathermy
- **c** stilboestrol
- **d** testosterone
- **e** radiotherapy

140 Subarachnoid haemorrhage:

- **a** causes an increase in intracranial pressure
- **b** is associated with a maximal incidence of vasospasm from the third to the tenth day after the bleed
- **c** can be detected on a CT scan
- **d** is more common in males
- **e** is precipitated by dehydration

141 Patients with acromegaly have a:

- **a** sensitivity to insulin
- **b** normal life expectancy
- **c** greater incidence of laryngeal stenosis
- **d** basophil adenoma
- **e** greater incidence of colonic cancer

142 In trigeminal neuralgia:

- **a** the VI cranial nerve is affected
- **b** symptoms are controlled in the majority of cases with carbamazepine
- **c** glycerol injection into the Gasserian ganglion may be beneficial
- **d** the Gasserian ganglion is approached through the foramen spinosum
- **e** pain in the ophthalmic branch is always associated with loss of the corneal reflex

143 Criteria for discharging an adult patient from the recovery area of a day-stay surgical unit include:

- **a** stable vital signs
- **b** return of cognitive skills to pre-anaesthetic levels
- **c** absence of vomiting
- **d** ability to pass urine
- **e** orientation in place and time

144 Applications of the Doppler effect in clinical practice involve measurement of a change in:

- **a** electrical conductivity of a moving stream of blood
- **b** frequency response of the arterial wall
- **c** frequency of reflected ultrasonic waves
- **d** temperature of blood as it moves peripherally
- **e** harmonic waves of reflected arterial pulses

145 Gas properties that influence resistance during laminar flow include:

- **a** critical temperature
- **b** viscosity
- **c** density
- **d** diffusion rate
- **e** molecular weight

146 FEV_1/FVC ratio measurement is useful in the detection of:

- **a** restrictive pulmonary lesions
- **b** increased functional residual capacity
- **c** obstructive pulmonary disease
- **d** inspiratory flow rate
- **e** changes in the elastic recoil of the lung

147 Potential complications of radial artery cannulation for continuous measurement of arterial blood pressure include:

- **a** fatal haemorrhage
- **b** cerebral arterial emboli
- **c** distal limb necrosis
- **d** pulmonary oedema
- **e** anaesthesia of the thenar eminence

148 In cardiac output measurement by thermodilution:

- **a** the thermistor is accurate to 0.1°C
- **b** measurements under-read after 48 hours in place
- **c** the thermistor measures true 'core' temperature
- **d** measurements under-read during inspiration
- **e** the thermistor bead is proximal to the balloon

149 Carbon dioxide crosses biological membranes 20 times more readily than oxygen because carbon dioxide:

- **a** has a higher Reynolds number than oxygen
- **b** is more soluble than oxygen in body fluids
- **c** has a greater molecular weight than oxygen
- **d** has a different electric charge from oxygen
- **e** is actively transported across biological membranes

150 Calculation of systemic vascular resistance requires measurement of:

- **a** coronary blood flow
- **b** pulmonary artery pressure
- **c** mean arterial blood pressure
- **d** cardiac output
- **e** rate of peripheral arteriolar flow

151 Helium:

- **a** has a viscosity similar to oxygen
- **b** is stored as a liquid in cylinders
- **c** increases vocal pitch when breathed
- **d** decreases the work of breathing in bronchospasm
- **e** supports combustion

152 In the newborn, a decrease in body temperature is accompanied by:

- **a** increased oxygen consumption
- **b** systemic arterial hypertension
- **c** metabolic alkalosis
- **d** hyper irritability
- **e** shivering

153 The pneumotachograph:

- **a** directly measures pressure change across a resistance
- **b** must have a resistance of sufficient diameter to ensure laminar gas flow
- **c** is suitable for accurate breath-by-breath monitoring
- **d** accuracy is affected by temperature change
- **e** accuracy is unaffected by alterations in gas composition

154 Intraoperative heat loss due to convection may be minimised by:

- **a** increasing the ambient theatre temperature
- **b** increasing theatre humidity
- **c** humidifying inspired gas
- **d** the use of a heated mattress
- **e** the avoidance of evaporation of spirit-based skin preparations

155 When the statistical P value is reported as being < 0.001:

- **a** there is less than one chance in 1,000 that differences between two sample means could have occurred by chance
- **b** the distribution of the measured variable is normal
- **c** the null hypothesis is rejected
- **d** the difference between two sample means is not statistically significant
- **e** the results are clinically significant

156 In a patient undergoing spinal anaesthesia using hyperbaric bupivacaine for repair of an inguinal hernia, bilateral sensory block up to the level of the umbilicus may be associated with:

- **a** sympathetic block up to T8
- **b** incomplete motor block of the femoral quadriceps
- **c** postoperative pruritis
- **d** inability to pass urine
- **e** bradycardia

157 Measurement of peak expiratory flow rate:

- **a** reveals a normal diurnal variation of less than 10%
- **b** is usually made using a Vitalograph
- **c** with a Wright peak flow meter uses the principle of a constant orifice with a variable pressure drop
- **d** can be achieved using a 'rapid' capnograph
- **e** produces a reading which is normal at 450–650L/min in the adult

158 Class 1 indications for cardiac pacing include:

- **a** P-R interval of less than 0.1 seconds
- **b** atrial tachycardia with ectopic focus
- **c** Wenckebach block (Mobitz 1)
- **d** complete heart block
- **e** type II atrioventricular conduction block with widened QRS complexes

159 The air in an operating theatre:

- **a** has a dew point of 37°C
- **b** is tested for pollution with anaesthetic gases by means of infrared analysis
- **c** should be used in the calibration of an oxygen analyser
- **d** has a higher PO_2 when the temperature is raised
- **e** should undergo a statutory minimum of 15 changes per hour

160 The end-tidal partial pressure of carbon dioxide:

- **a** may be overestimated if measured by infrared absorption in the presence of nitrous oxide
- **b** may be overestimated if measured by mass spectrometry in the presence of nitrous oxide
- **c** may be underestimated if measured by mass spectrometry in the presence of water vapour
- **d** during IPPV will be a more accurate estimate of arterial PCO_2 if positive end-expiratory pressure is applied
- **e** exceeds the arterial PCO_2 if the patient is in the prone position

161 On the day of major abdominal surgery, a normal adult will have:

- **a** their calorie requirement supplied by 1.5 litres of 5% dextrose in water
- **b** their daily potassium requirement supplied by 2 litres of Hartmann's solution
- **c** a maximum urinary osmolarity of 700 mOsm/L
- **d** approximately 800 mOsm of solute which the kidneys must excrete
- **e** a maintenance fluid requirement of 10 ml/kg/hr

162 Likely findings in an elderly, dehydrated patient with prolonged intestinal obstruction who is hypotensive, tachypnoeic and confused, breathing air include:

- **a** hypomagnesaemia
- **b** low arterial oxygen saturation
- **c** metabolic acidosis
- **d** uraemia
- **e** hyperglycaemia

163 Preoperative preparation of a patient with primary hyperparathyroidism will necessitate the use of:

- **a** intravenous fluid replacement using 0.9% sodium chloride
- **b** furosemide
- **c** 10% dextrose
- **d** vitamin D
- **e** hydrocortisone

164 Airway characteristics of an adult with acromegaly include:

- **a** increased patency of the oropharynx and nasopharynx
- **b** small aperture between the vocal cords
- **c** underdevelopment of the oral and nasopharyngeal structures
- **d** increased distance from the upper incisors to the larynx
- **e** subglottic stenosis

165 The success of cricoid pressure in preventing aspiration into the lungs during a rapid sequence induction depends upon:

- **a** a complete cricoid cartilage
- **b** absence of a nasogastric tube
- **c** an extended neck
- **d** compressing the oesophagus against a vertebral body
- **e** pre-oxygenation for five minutes before induction

166 Airway obstruction at the tracheal level may be caused by:

- **a** tracheomalacia
- **b** vascular rings
- **c** stenosis secondary to intubation
- **d** cystic hygroma
- **e** pulmonary hypertension

167 Features of pulmonary function after upper abdominal surgery include:

- **a** a reduction in functional residual capacity of up to 50%
- **b** a decreased respiratory rate
- **c** the maintenance of normal values with effective pain relief
- **d** a shift of the majority of ventilation to the apices of the lungs
- **e** abnormal diaphragmatic function

168 In induced hypothermia:

- **a** MAC decreases by approximately 7% per °C reduction in temperature
- **b** there is a significant risk of ventricular fibrillation at 32°C
- **c** the oxyhaemoglobin dissociation curve is shifted to the right
- **d** the pulmonary vasoconstrictor response to hypoxia is decreased
- **e** urine output falls

169 To repair lacerations on the palm of the hand the following nerves must be blocked:

- **a** musculocutaneous
- **b** ulnar
- **c** medial cutaneous nerve of forearm
- **d** median
- **e** radial

170 Compartment syndrome:

- **a** occurs only in the lower limb
- **b** is not painful when muscles are passively stretched
- **c** is manifest by paraesthesia in a peripheral nerve distribution
- **d** is not compatible with the presence of a palpable distal pulse
- **e** cannot be diagnosed by observing capillary refill

171 Fat embolism syndrome:

- **a** arterial hypoxaemia is an early presenting feature
- **b** most frequently presents with respiratory symptoms and signs
- **c** causes a petechial rash usually on the conjunctiva, oral mucous membranes and skin folds of the neck and axillae
- **d** is frequently associated with focal neurological signs such as hemiparesis
- **e** is most common following lower-limb fractures

172 Nitric oxide:

- **a** has a high affinity for haemoglobin
- **b** is synthesised in the body from aspartate
- **c** is a bronchodilator
- **d** shows significant tachyphylaxis
- **e** is used therapeutically at 10–100 ppm

173 In patients with compartment syndrome:

- **a** paralysis of muscles is an early sign
- **b** tissue pressures greater than 45 mmHg suggest decreased capillary blood flow
- **c** low systemic blood pressure may be an aetiological factor
- **d** myoglobinuria is uncommon
- **e** splintage should be gently released and retained on the affected limb

174 Acupuncture produces:

- **a** increased muscle tone
- **b** a decrease in circulating catecholamines
- **c** an increase in adrenocorticotrophic hormone
- **d** an increase in circulating substance P
- **e** generalised histamine release

175 The radial nerve:

- **a** lies lateral to the radial artery at the wrist
- **b** innervates the deltoid muscle
- **c** innervates the triceps muscle
- **d** has no sensory branches
- **e** produces dorsiflexion of the wrist joint

176 In the fetal circulation:

- **a** the umbilical arteries originate from the internal iliac arteries
- **b** the umbilical arteries convey deoxygenated blood to the placenta
- **c** there are two umbilical veins
- **d** all the blood returning to the fetus passes through the fetal liver
- **e** ductus arteriosus closure is normally complete by 24 hours after delivery

177 Pain in the area of an upper arm tourniquet is mediated via the:

- **a** circumflex nerve
- **b** musculocutaneous nerve
- **c** suprascapular nerve
- **d** intercostobrachial nerve
- **e** ulnar nerve

178 Angiotensin converting enzyme inhibitors may cause:

- **a** peripheral vasodilation
- **b** cough
- **c** increased total body water
- **d** a decreased pressor response to tracheal intubation
- **e** angioedema

179 Hepatic blood flow decreases:

- **a** during anaesthesia with isoflurane
- **b** in proportion to a decrease in hepatic oxygen consumption
- **c** during spinal anaesthesia
- **d** during propofol infusion
- **e** when the patient is placed in the lateral position

180 The following are true of the use of dibucaine in the detection of abnormal serum cholinesterase:

- **a** dibucaine inhibits serum cholinesterase
- **b** 97% of the population possess the normal enzyme
- **c** in patients homozygous for the atypical enzyme, the dibucaine number is in excess of 80
- **d** in the 3% of patients who are heterozygous for the abnormal enzyme, the dibucaine number is approximately 55
- **e** fluoride is used as an alternative enzyme inhibitor

Single best answer (SBA)

SBA Paper 1

Question 1

A neonate born at 28 weeks gestation and now six weeks old develops apnoeic episodes following an inguinal herniotomy performed under GA.

Which of the following blood results/vital signs are LEAST likely to be associated with apnoeic spells in this age group?

a blood glucose 1.7 mmol/L
b core temperature 35.2°C
c core temperature 39.5°C
d haemoglobin 115 g/L
e serum ionised calcium 0.8 mmol/L

Question 2

A 37-year-old man has an uneventful total colectomy performed under GA. Surgery, lasting five hours, was performed in the Lloyd Davies position. One hour postoperatively, with a 0.1% L-bupivacaine thoracic epidural infusion in progress, he has no abdominal pain but does have pain in both calves. There are decreased lower limb movements bilaterally with reduced pinprick sensation in all dermatomes below the knees.

What is the most appropriate initial investigation in this scenario?

a compartment pressure measurement in both calves
b Doppler arterial pulse measurement in both legs
c electromyography of leg flexor and extensor muscles
d magnetic resonance imaging of the thoracolumbar spine
e ultrasound scan of deep venous system in both calves

Question 3

A previously fit 54-year-old woman presents to the emergency department with severe sore throat and increasingly noisy breathing for the past 12 hours. She finds it difficult to swallow her saliva and cannot tolerate lying flat. Her tympanic temperature is 39.2°C, pulse rate 110 beats/min, BP 130/85 mmHg, S_PO_2 92% on 35% oxygen via facemask. There is marked inspiratory stridor.

What is the most appropriate management plan?

a administer intravenous steroids and antibiotics, nebulised adrenaline and high-flow oxygen by CPAP facemask in a high dependency area
b after direct examination of the oropharynx, the patient should have blood cultures taken, receive oral antibiotics, high-flow oxygen and be observed in a high dependency area
c the airway should be secured by awake fibreoptic intubation under local anaesthesia, followed by admission to an intensive care unit
d the airway should be secured by tracheal intubation following direct laryngoscopy under deep inhalational anaesthesia
e the patient should be transferred, fully monitored, to the operating theatre for immediate tracheostomy under local anaesthesia

Question 4

A seven-year-old child weighing 24 kg is having squint correction surgery under general anaesthesia.

During the procedure, his heart rate falls abruptly to 45 beats per minute and his blood pressure is 70/40 mmHg.

What is the most appropriate initial action to take?

a ask the surgeon to release the globe of the eye
b give atropine 480 µg intravenously
c give ephedrine 6 mg intravenously
d give glycopyrrolate 240 µg intravenously
e reduce the inspired concentration of sevoflurane

Question 5

A 45-year-old woman with a past history of mild asthma and anxiety undergoes left shoulder arthroscopic surgery under interscalene brachial plexus block. Postoperatively she complains of dyspnoea and light headedness. Breath sounds are slightly reduced on the left side of the chest. SpO_2 92% (on air), BP 110/70 mmHg and peak flow 290 L/min. A standard portable chest x-ray appears normal.

What is the most likely cause of her symptoms?

a exacerbation of asthma
b left phrenic nerve palsy
c left recurrent laryngeal nerve palsy
d psychogenic dyspnoea
e subarachnoid local anaesthetic injection

Question 6

A 72-year-old man is ventilated on the intensive care unit (ICU) four hours following elective coronary artery bypass surgery. His pulse is 110 beats/min, BP 85/45 mmHg, CVP 17 mmHg, urine output 25 ml/hr in the previous two hours and tympanic temperature 37.6°C. Heart sounds are difficult to hear but breath sounds are normal. A 12-lead ECG is unchanged from preoperatively.

What is the most likely cause of the patient's current clinical condition?

a developing septic shock
b hypovolaemia
c myocardial ischaemia
d pericardial tamponade
e tension pneumothorax

Question 7

A 56-year-old woman who had a total colectomy develops a tachyarrhythmia 12 hours postoperatively on the high dependency unit (HDU). She has a past history of hypertension treated by bendroflumethiazide but no history of cardiac problems.

Which of the following serum electrolyte abnormalities is the most likely to contribute to the arrhythmia?

a ionised calcium 1.88 mmol/L
b magnesium 0.38 mmol/L
c phosphate 0.58 mmol/L
d potassium 3.4 mmol/L
e sodium 129 mmol/L

Question 8

You need to anaesthetise a woman who does not speak English, for a category 3 caesarean section.

What is the best way to take a history and provide information to this patient?

a a professional telephone translation service
b the obstetric registrar who has some understanding of the patient's language
c the patient's husband who has a limited command of English
d the patient's 11-year-old daughter who is bilingual
e written translated materials

Question 9

A 10-month-old, apparently well, infant presents for religious circumcision under GA. Routine examination reveals a soft systolic murmur; the rest of the examination is normal.

The most appropriate action to take is:

a postpone surgery and obtain an urgent cardiac echocardiogram
b postpone surgery and refer the child back to the GP
c proceed with anaesthesia because this is an 'innocent' murmur
d proceed with anaesthesia giving antibiotic cover
e proceed with surgery under local anaesthesia

Question 10

You administer a general anaesthetic to a previously fit young man for arthroscopic repair of a ruptured left anterior cruciate ligament. The thigh tourniquet was inflated to 200 mmHg above the systolic blood pressure for 110 minutes. Postoperatively, he complains of paraesthesia in his left calf and sole of the foot.

Which of the following is the single most likely cause of the paraesthesia?

a compartment syndrome in the thigh
b compression injury to the sciatic nerve
c deep venous thrombosis in the calf
d ischaemic injury to the calf muscles
e pressure injury from the edge of the operating table

Question 11

A 40-year-old man is scheduled for an elective craniotomy. You commence intravenous induction with thiopentone but after injecting 100 mgs the patient complains of an intense burning pain in his hand associated with blanching of the fingers.

What is the most important next step to take in managing this situation?

a arrange for a stellate ganglion block to be performed in the affected limb
b insert an IV cannula in the contralateral limb and administer opioid analgesia
c insert an IV cannula in the contralateral limb and administer papaverine
d leave the IV cannula *in situ* and flush with heparinised saline
e remove the IV cannula, apply local pressure and elevate the limb

Question 12

A 75-year-old man is scheduled for a total knee replacement under general anaesthesia supplemented by a femoral nerve block for perioperative analgesia.

What is the most effective way to reduce the likelihood of local anaesthetic toxicity during placement of the block?

a adding a vasoconstrictor to the local anaesthetic
b injecting the local anaesthetic slowly and aspirating at regular intervals
c monitoring the patient with ECG, SpO_2 and non-invasive blood pressure measurement
d not exceeding the maximum permissible dose of local anaesthetic
e using a nerve stimulator to guide block placement

Question 13

A 60-year-old man is scheduled for a palmar fasciectomy. He has angina, with several episodes of chest pain each week and says that he is 'allergic to local anaesthetics'. 15 years ago he had a local anaesthetic block at the dentist, following which he developed palpitations and became very anxious for 10–15 minutes.

Which is the most likely explanation for his previous experience at the dentist?

a adverse reaction to adrenaline absorbed from the local anaesthetic solution
b anaphylactic reaction to a preservative in the local anaesthetic solution
c episode of angina brought on by the stress of the situation
d systemic toxicity due to accidental intravascular injection of local anaesthetic
e systemic toxicity due to overdose of local anaesthetic

Question 14

An otherwise fit 80-year-old man had uneventful resection of a bladder tumour under general anaesthesia. A three-way irrigating urinary catheter is inserted at the end of the procedure. In recovery, he looks pale and has severe abdominal discomfort. His pulse rate is 48 beats/min and blood pressure is 75/30 mmHg. The drained irrigating fluid appears clear.

What is the most appropriate action that would resolve the clinical situation in this patient?

a atropine 0.3 mgs IV bolus
b ephedrine 6 mgs IV bolus
c flush the 3-way catheter
d morphine 5 mgs IV bolus
e rapid infusion of 500 ml 0.9% saline

Question 15

A patient develops anaphylactic shock shortly after induction of general anaesthesia, is treated with intravenous adrenaline, and makes an uneventful recovery.

Which is the best explanation of the therapeutic action of adrenaline in the treatment of anaphylaxis?

a causes increased myocardial contractility and bronchodilation
b causes increased myocardial contractility and tachycardia
c causes peripheral vasoconstriction and decreases mast cell degranulation
d causes peripheral vasoconstriction and increased myocardial contractility
e causes tachycardia and decreases mast cell degranulation

Question 16

A previously fit 60-year-old woman is oliguric (<0.5 ml/kg/hr) 48 hours after a laparotomy for colonic carcinoma. Laboratory testing of her urine reveals the following:

Specific gravity = 1.020
Sodium 2 mmol/L
Osmolarity 600 mOsm/L

What is the most likely diagnosis?

a acute tubular necrosis
b analgesic nephropathy
c hypovolaemia
d renal calculi
e bilateral ureteric injury

Question 17

A 59-year-old man with a caecal carcinoma requiring a right hemicolectomy has been referred for preoperative assessment. Following an episode of crescendo angina three months previously, he had a coronary angioplasty and multiple coronary stent insertion. He is currently well with no further angina, and he is taking aspirin and clopidogrel.

What would be the most appropriate management plan for this patient?

a continue both antiplatelet drugs and give a preoperative platelet transfusion
b postpone surgery until he has completed his antiplatelet therapy
c schedule urgent surgery and continue both antiplatelet drugs perioperatively
d stop aspirin for seven days preoperatively but continue clopidogrel
e stop clopidogrel for seven days preoperatively but continue aspirin

Question 18

A 64-year-old man with a BMI of 41 kg/m^2 had a laparotomy for resection of hepatic metastases one hour ago. In the recovery room his SpO_2 is 85% breathing room air, but 98% when supplemental oxygen is delivered by nasal prongs at 2 L/min .

Which is the most likely explanation for his current respiratory status?

a alveolar atelectasis
b alveolar hypoventilation
c diffusion hypoxia due to nitrous oxide use
d residual inhalational anaesthesia
e residual neuromuscular blockade

Question 19

Lumbar chemical sympathectomy has a variety of potential therapeutic indications.

Which condition has the best chance of sustained improvement with this technique?

a complex regional pain syndrome type 1
b hyperhidrosis
c intermittent claudication
d ischaemic rest pain in the foot
e venous ulceration around the ankle

Question 20

An 18-year-old male patient is admitted to a district hospital with an isolated severe head injury and is promptly intubated, ventilated and sedated. Soon afterwards his SpO_2 is 99% (FiO_2 0.5), $ETCO_2$ 4.5 kPa, BP 200/120 mmHg, pulse 44 beats/min and he has a fixed dilated left pupil.

What is the most appropriate next action to take?

a actively cool the patient to 35°C
b arrange an urgent head CT scan
c arrange transfer to the nearest neurosurgical unit
d give an intravenous bolus of mannitol 0.5 g/kg
e insert an arterial line

Question 21

You are called to the emergency department to see a previously well 20-year-old woman who has been admitted following a grand mal fit outside a nightclub. After administration of lorazepam she stops fitting and is now not responsive to commands. Her SpO_2 is 94% on air and blood glucose is 4.5 mmol/L. No other history is available.

What is the next most useful investigation you would perform on this patient?

a arterial blood gases
b blood alcohol level
c drug toxicology screen
d full blood count
e serum electrolytes

Question 22

A 78-year-old woman has had severe, lancinating episodes of pain below the right eye for four months, which are sometimes triggered by face washing. Carbamazepine in full doses has produced little improvement in her pain. She has a past history of hypertension and transient ischaemic episodes.

What therapeutic intervention should be considered next?

a amitriptyline
b gabapentin
c microvascular decompression surgery
d rhizolysis of the trigeminal ganglion
e slow-release oral morphine

Question 23

A previously fit 70-year-old man undergoes radical neck dissection for malignant disease. The patient is stable until the surgeon dissects the tumour away from the carotid sheath. Suddenly, the systolic BP falls from 110 mmHg to 60 mmHg, heart rate increases to 110 beats/min, SpO_2 falls to 87% and end-tidal CO_2 concentration falls to 1.9 kPa.

What is the most likely cause for the change in vital signs?

a anaphylactic shock
b carotid sinus manipulation
c myocardial ischaemia
d tension pneumothorax
e venous air embolism

Question 24

A previously fit five-year-old child is distressed and in severe pain in the recovery room following emergency appendicectomy. He is awake and cardiovascularly stable. Intraoperatively, he received fentanyl 3 µg/kg IV, paracetamol 15 mg/kg IV and diclofenac 1 mg/kg PR.

What would be the most appropriate management option now?

a administer Entonox until the child's mother arrives
b commence a nurse-controlled analgesia (NCA) pump using morphine
c dihydrocodeine 1 mg/kg intramuscularly
d dihydrocodeine 1 mg/kg orally
e morphine 0.1 mg/kg IV bolus

Question 25

A 26-year-old primigravida (BMI = 47) with a twin pregnancy is in established labour at 38 weeks gestation. She requests an epidural for pain relief, but on inserting the epidural needle at L 3, 4 an accidental dural puncture occurs.

What is the most appropriate action to take?

a abandon the epidural and use inhalational analgesia
b abandon the epidural and use opioid-based analgesia
c insert the epidural catheter intrathecally and use it for spinal analgesia
d perform an epidural blood patch to prevent post-dural puncture headache
e resite the epidural at an adjacent spinal interspace

Question 26

A 70-year-old woman had a gastrectomy 48 hours ago, and she has a thoracic epidural for postoperative analgesia which is functioning well. Warfarin, for atrial fibrillation, was stopped seven days ago and she was converted to low molecular weight heparin. Clotting studies and platelet count are in the normal range. Today she is noted to have a white, cold left leg.

What is the most appropriate initial management?

a Doppler studies of the arterial supply of the left leg
b increase the dose of low molecular weight heparin
c organise an urgent MRI scan of the spine
d top up the epidural with her lying on the left side
e ultrasound of the deep veins of the lower limbs

Question 27

A 64-year-old man presents to the emergency department with an exacerbation of COPD.

His arterial blood gases breathing air show the following:

pH	7.30
pO_2	5.5 kPa
pCO_2	7.5 kPa
HCO_3	35 mmol L
Hb	185 g/L

Which is the most appropriate device to initiate oxygen therapy?

a Hudson mask
b medium concentration (MC) mask
c nasal prongs
d non-rebreathing reservoir mask
e Venturi mask

Question 28

A 35-year-old male suffered a severe isolated traumatic brain injury 10 days ago. There is no neurological recovery or respiratory effort 48 hours after cessation of propofol sedation and neuromuscular blockade with atracurium. The serum sodium concentration is 152 mmol/L, core temperature is 37.5°C serum glucose concentration is normal. The patient's family know that brain stem death is suspected.

What is the most appropriate action to take now?

a contact the specialist nurse for organ donation
b cool the patient to 36.50C
c perform an EEG
d reduce serum sodium below 152 mmol/L
e undertake brain stem death tests

Question 29

A 70-year-old patient with a long history of severe depression and hypertension is admitted as an emergency with severe peritonitis. He is taking bendroflumethiazide, enalapril and phenelzine. During laparotomy, his blood pressure falls to 65/30 mmHg and his heart rate rises to 100 beats/min. There is no cardiovascular improvement in response to a fluid bolus which raises the CVP to +10 mmHg.

Which is the most appropriate initial pharmacological intervention?

a ephedrine
b metaraminol
c noradrenaline
d phenylephrine
e vasopressin

Question 30

A 19-year-old man is listed for a cervical lymph node biopsy after a six-week history of generalised lymphadenopathy and intermittent pyrexia. He is breathless on mild exertion and needs to sleep with four pillows.

Which is the most important preoperative investigation that will influence your anaesthetic management?

a chest X-ray
b CT scan of the neck
c flow volume loops
d full blood count
e spirometry

SBA Paper 2

Question 1

You are performing a percutaneous (dilational) tracheostomy on an ITU patient as an aid to weaning from mechanical ventilation. A more junior colleague is assisting with a bronchoscope. On passing the guidewire down the seeker needle cannula it becomes apparent that the cannula and guidewire can no longer be seen within the trachea.

The most appropriate action at this point is to:

a leave cannula and wire *in situ* and call for surgical assistance
b remove the cannula and wire, abandoning/deferring the procedure
c remove the cannula and wire and call for surgical assistance
d remove the cannula and wire and repeat attempted access of the airway
e remove the wire and check whether air can be aspirated from the cannula

Question 2

In an anaesthesia pre-assessment clinic, you are seeing a patient listed for an elective open aortic abdominal aneurysm repair. The referring team suspect a diagnosis of significant obstructive sleep apnoea, and your assessment has included the STOP-BANG questionnaire along with usual history and examination. The results of a sleep study are also available to you.

The finding of greatest overall concern to you is:

a a body mass index (BMI) of 36 kg/m^2
b a history of observed apnoeic episodes in sleep
c an Apnoea-Hypopnoea Index (AHI) of 18
d collar size 17 inches (neck circumference 43.2 cm)
e Mallampati score 3

Question 3

A 22-year-old student with Brugada syndrome requires open reduction and fixation of his right humerus. His preoperative electrolytes are within the normal ranges. Anaesthesia is induced with fentanyl, propofol and rocuronium, and his lungs are ventilated in air, oxygen and isoflurane. After skin incision, his ECG shows ST segment elevation and polymorphic ventricular tachycardia.

The most appropriate action would be:

a administer amiodarone
b administer calcium chloride
c administer isoprenaline
d administer quinidine
e stop isoflurane and maintain anaesthesia with propofol

Question 4

You have been asked to transfer a sedated and ventilated woman from your local hospital to a neurosurgical centre which is 50 miles away. At a rate of 12 breaths per minute, the lungs are ventilated with a tidal volume of 500 ml. The fractional inspired oxygen concentration is 60% and the ventilator consumes additional oxygen of 2.4 litres per minute. On average, the paramedic crew drives at 60 miles per hour for this journey.

For this journey, the minimum portable oxygen volume that is most likely to be recommended is:

a 300 litres
b 420 litres
c 600 litres
d 840 litres
e 900 litres

Question 5

After a failed attempt at instrumental delivery, a 28-year-old nulliparous woman is taken to theatre for a lower segment caesarean section (LSCS). A spinal anaesthetic is easily inserted, and the operation begins. The surgeons now ask for uterine relaxation to be given as the baby's head is too far into the pelvis.

What would be the most appropriate first line of action?

a administration of intravenous magnesium infusion
b administration of nebulised salbutamol
c administration of intravenous terbutaline increments
d administration of sublingual glyceryl trinitrate (GTN) spray
e conversion of spinal to a general anaesthetic

Question 6

A 15-year-old girl presents for evacuation of retained products of conception after a spontaneous miscarriage. She has presented at the surgical unit without a parent and is refusing to let you contact them. She seems to have capacity to understand the nature of the planned procedure and the complications.

What is the most appropriate course of action?

a complete a lack of capacity consent form with the surgeon and anaesthetist
b contact the Court of Protection for the authority to treat the child in their best interests
c continue with the surgery with the child's consent
d reschedule the surgery after a parent has consented
e telephone a parent to obtain consent

Question 7

A 78-year-old obese woman is having an elective laparoscopic cholecystectomy.

Which of the following is most likely to be responsible for the risk of her developing postoperative cognitive dysfunction (POCD)?

a abdominal surgery
b administration of ondansetron
c BMI >30 kg/m^2
d general anaesthesia
e previous history of stroke

Question 8

With regards to postoperative nausea and vomiting, the most significant risk factor is:

a gynaecological surgery
b non-smoking status
c otological surgery
d use of neostigmine
e use of nitrous oxide

Question 9

An otherwise fit 47-year-old man has a seemingly uneventful elective anterior cervical discectomy for radiculopathy. Postoperatively he has new severe weakness in all four limbs, but an urgent MRI does not show evidence of haematoma or cord compression. His heart rate is 85 bpm, blood pressure 110/60 mmHg and oxygen saturation 96% on 2 L/min oxygen.

The most appropriate immediate action is:

a augment blood pressure with vasopressors
b commence intravenous dexamethasone 4 mg qds
c insert a lumbar drain for urgent CSF drainage
d refer him urgently for hyperbaric oxygen therapy
e return to theatre for urgent neck exploration

Question 10

A 68-year-old female patient is admitted to the intensive care unit with sepsis secondary to acute pancreatitis. She requires a central venous catheter for vasopressors and is warned about potential complications including pneumothorax. Despite an uneventful line insertion, the post-procedure x-ray demonstrates a very small pneumothorax that does not require any intervention. The nurse tells you that a duty of candour letter will be required.

The most appropriate response is:

a a duty of candour letter will be required as it is a significant complication
b a duty of candour letter will not be required as this is not a moderate harm incident and an apology will suffice
c agree to discuss the matter urgently with the trust's risk manager
d duty of candour does not apply as it is a recognised complication
e duty of candour does not apply as the incident occurred in the context of treating a life-threatening illness

Question 11

A 57-year-old male is admitted for C3/4 anterior cervical decompression for cervical myelopathy. He gives a history of snoring and his BMI is 32.

Which of the following factors is the most significant predictor of difficult facemask ventilation?

a limited jaw protrusion
b mallampati score of 3 or 4
c neck circumference >40 cm
d presence of beard
e previous neck irradiation

Question 12

A 37-year-old man is admitted with an isolated head injury and a GCS of 12. He is agitated and uncooperative and so is sedated and intubated for a CT scan. The scan shows bifrontal contusions with obliteration of the basal cisterns and compression of the ventricles. Following transfer to ICU he is stable. His HR is 78 beats per minute, MAP 80 mmHg and SaO_2 98%. Pupils are equal and reactive.

What is the most appropriate initial management plan?

a continue sedation and insertion of an ICP monitor
b extubate, as haemodynamically stable and prior GCS was 12
c increase blood pressure with fluids and vasopressors, as ICP will be high
d inform the family that the outcome is likely to be poor
e lighten sedation to allow assessment of his neurological status

Question 13

Local anaesthetic toxicity is a potential complication of regional anaesthesia.

Which of the following is associated with the highest risk of local anaesthetic toxicity?

a a combination of popliteal nerve block and saphenous nerve block for ankle surgery in a 75-year-old male patient
b axillary brachial plexus block augmented with median and ulnar nerve blocks in the forearm of a 40-year-old male patient
c bilateral transabdominal plane (TAP) blocks in a woman undergoing caesarean section
d interscalene brachial plexus block for shoulder surgery in a 50-year-old woman
e spinal anaesthesia augmented by adductor canal block for a 65-year-old female patient undergoing a total knee replacement

Question 14

A 43-year-old man with multiple injuries after a high energy impact is in the emergency department. His serum lactate on arterial blood gas analysis is 5.5 mmol/L.

Serum lactate level is high because:

a it is a marker for anaerobic respiration secondary to hypoxia
b it is a marker for damage to or hypoperfusion of the liver
c it is an indirect marker of oxygen debt, tissue hypoperfusion, and the severity of haemorrhagic shock
d it is correlated to the degree of tissue damage throughout the body
e it is correlated to the severity of haemorrhagic shock and the associated coagulopathy and hypothermia

Question 15

A 50-year-old woman has suffered a traumatic brain injury and is presently in the emergency department. She is being ventilated via an endotracheal tube.

Which of the following best describes your rationale for oxygen therapy and ventilation in this patient?

a high inspired oxygen concentrations are generally used to ensure oxygen delivery to ischaemic areas in or near the injured areas of the brain
b high inspired oxygen concentrations must not be applied so as to avoid hyperoxic vasoconstriction
c hyperventilation should be used to optimise oxygen delivery and reduce the arterial CO_2 partial pressure
d inspired oxygen concentration should be tailored to ensure oxygen saturations of 93-98%
e the use of optimal PEEP reduces pulmonary shunt and optimises oxygen delivery to the brain

Question 16

A 48-year-old woman with insulin dependent diabetes mellitus presents for day-case excision of Dupuytren's contracture of the ring and little fingers. She is keen to be awake for the operation.

The choice of an axillary nerve block is most influenced by the fact that:

a it allows for the median and ulnar nerves to be precisely anaesthetised and provides a still and anaesthetised upper limb
b it avoids phrenic nerve palsy and inadvertent pneumothorax
c it is the least technically difficult of brachial plexus blocks
d it provides analgesia for tourniquet pain
e nerve block of the ulnar and median nerves at the level of the forearm does not provide analgesia for the tourniquet

Question 17

A 34-year-old man with a BMI of 35 presents for surgery for a dental abscess. He suffers from severe reflux and his mouth opening is limited to 1 cm

The most suitable option for securing the airway at induction is:

a induce anaesthesia with propofol and fentanyl and insert a flexible size 4 LMA
b induce the patient with TIVA and perform an asleep nasal fibreoptic intubation
c perform a rapid sequence induction with propofol and rocuronium, and attempt direct laryngoscopy
d perform an awake nasal fibreoptic intubation, and then anaesthetise the patient once the airway is secure
e perform an awake oral fibreoptic intubation, and then anaesthetise the patient once the airway is secure

Question 18

A 29-year-old woman weighing 76 kg presents at 36 weeks for a category 1 lower segment caesarean section (LSCS) due to placental abruption. You suspect she has developed a coagulopathy. A rapid sequence induction is performed with thiopentone and suxamethonium, but you are unable to intubate her.

The most appropriate way to manage her airway would be:

a insert an oral airway, keep cricoid pressure on, allow her to breathe spontaneously and proceed with the LSCS
b keep cricoid pressure on, insert a size 4 i-gel® (2nd generation supraglottic airway), allow her to breathe spontaneously and proceed with the LSCS
c paralyse with rocuronium, maintain cricoid pressure, insert a size 4 LMA, ventilate her and proceed with the LSCS
d paralyse with rocuronium, remove cricoid pressure, insert a size 4 i-gel®, ventilate her and proceed with the LSCS
e perform bag-mask ventilation, wake her up and perform a spinal anaesthetic

Question 19

A six-week-old infant presents to the emergency department with signs and symptoms suggestive of pyloric stenosis.

The initial treatment should be:

a 4-5 ml/kg 0.45% NaCl with 5% glucose
b 10 ml/kg 0.9% NaCl bolus
c insert a nasogastric tube
d make arrangements for surgical correction
e ultrasound scan to confirm diagnosis

Question 20

A six-year-old girl with sickle-cell disease who is generally well presents for umbilical hernia repair.

The optimal perioperative management to prevent complications would be to:

a ensure active warming and oxygenation during surgery.
b give IV fluids to prevent dehydration
c transfuse blood to ensure Hb >100 g/L and HbS <30%
d transfuse blood to ensure Hb >100 g/L and HbS <60%
e treat as a day case to reduce the risks of hospital acquired infection

Question 21

A 63-year-old man presents to the emergency department with syncope. His heart rate is 40 beats/min and blood pressure 80/40 mmHg. He is a known hypertensive with stable ischaemic heart disease and is taking diltiazem, atenolol, simvastatin and aspirin. There has been no response to 6 doses of atropine 500 mcg.

The most appropriate treatment is:

a adrenaline 10 mcg/min
b dopamine 10 mcg/kg/min
c glucagon 10 mg
d isoprenaline 5 mcg/min
e theophylline 100 mg

Question 22

An 84-year-old gentleman develops confusion, nausea and vomiting 48 hours after endovascular aortic vascular repair (EVAR) for a complex aneurysm. He is apyrexial, cardiovascularly stable, with a respiratory rate of 20 breaths per minute. His arterial blood gas on 4 L/min O_2 and his ABG on 4 L O_2 shows:

pH 7.30, pCO_2 4.9 kPa, pO_2 9.0 kPa, HCO_3 19, BE -8.0 and lactate of 1.9 mmol/L.

What is the most likely diagnosis?

a acute kidney injury (AKI)
b ischaemic bowel
c post-implantation syndrome
d sepsis
e type 2 endoleak

Question 23

A fit and well 70-year-old man having TCI propofol sedation during total knee replacement under spinal anaesthetic starts coughing and becomes restless.

What is the most appropriate course of action?

a ask the surgeon to stop the diathermy to decrease the irritation from plume
b decrease the sedation
c give a small bolus of opiate as an antitussive
d increase the sedation
e stop the sedation and allow the patient to wake up

Question 24

A 71-year-old male patient with chronic stable angina and hypertension is undergoing abdominal aortic aneurysm repair. Prior to the release of aortic cross clamp the blood pressure is 117/74 mmHg, heart rate 68/min, SpO_2 97%. Sixty seconds following the clamp-release the parameters are BP 90/40 mmHg, HR 90/min, SpO_2 93% (FiO_2 0.5), $ETCO_2$ 6.2 kPa. The arterial blood gas shows pCO_2 7.0, pH 7.3 BE -5, pO_2 16, lactate 3 mmol/L.

What is the most likely cause of the hypotension?

a acute myocardial infarction
b arterial transducer malfunction
c bleeding from the vascular anastomotic site
d decreased systemic vascular resistance leading to relative hypovolaemia
e myocardial depression from toxic metabolites from reperfusion

Question 25

A five-year-old child weighing 20 kg is brought to the emergency department unresponsive and not breathing. He was recently discharged following an atrial septal defect repair. Following an initial round of CPR, the ECG shows ventricular fibrillation.

The most appropriate immediate response is:

a defibrillate using an energy of 80 J
b fast-bleep the cardiac surgeons to assess him
c give 100% oxygen using a supraglottic airway
d intubate with a size 5.5 uncuffed endotracheal tube
e secure intravenous access

Question 26

A 54-year-old man undergoes an uneventful L4/5 microdiscectomy. He smokes 30 cigarettes/day, he is recovering from a recent chest infection and takes inhalers for newly diagnosed asthma. You are asked to review him in recovery as his blood pressure is falling despite several fluid challenges. On examination, his BP is 80/40 mmHg, HR 128 bpm and he has cool peripheries. His SaO_2 is 95% on 2 L/min oxygen. His left leg is swollen and the pulses are difficult to palpate.

Which of the following is the most likely cause of his symptoms?

a major vascular injury
b myocardial infarction
c pulmonary embolism
d sepsis syndrome
e tension pneumothorax

Question 27

A 70-year-old man with community-acquired pneumonia develops delirium seven days after admission to the intensive care unit. He is non-compliant with nursing care.

In addition to daily CAM-ICU assessment (confusion assessment method-ICU score), which strategy is the most effective for managing his delirium?

a dexmedetomidine infusion
b intravenous boluses of lorazepam
c padded gloves and boluses of intravenous haloperidol
d remove unnecessary invasive lines/catheters
e sublingual olanzapine

Question 28

A 30-year-old primigravida is undergoing an elective caesarean section at 37 weeks for twins under spinal anaesthesia. She has a phenylephrine infusion running at 25 mcg/min. Shortly following skin incision she starts to feel nauseous and dizzy. Her blood pressure has fallen from 110/60 to 84/50 mmHg. Her heart is 55 bpm.

What is the most appropriate treatment?

a ephedrine bolus of 6 mg
b glycopyrrolate bolus of 200 mcg
c increase the phenlyephrine infusion to 75 mcg/min
d metaraminol bolus of 0.5 mg
e phenlyephrine bolus of 50 mcg

Question 29

A 35-year-old male patient presents to the pre-assessment clinic prior to an elective inguinal hernia repair. He gives a history of poorly controlled asthma despite taking regular inhaled corticosteroids. He tells you that he is using his salbutamol inhaler 4-5 times per day. On examination he is apyrexial and his chest is clear. What would you advise the patient and his GP?

a continue current regime and add in a long-acting inhaled beta agonist
b increase the dose of inhaled corticosteroid and commence a leukotriene receptor antagonist
c measure peak flows twice daily and reassess in two weeks
d prescribe a one week course of oral prednisolone and amoxicillin
e refer to a chest physician prior to surgery

Question 30

A previously healthy 21-year-old woman telephones the day surgery unit in the early evening, four hours after discharge following an uneventful knee arthroscopy under general anaesthesia. She reports that she is well but that her husband has unexpectedly had to go to work and she will be alone overnight. What would you advise?

a ask her to return to the ward by taxi for an assessment by the doctor
b inform her that she must return to hospital for an overnight stay
c telephone her husband and explain that he must return home to look after his wife as agreed earlier
d telephone the district nursing service and request a visit at home to assess whether she is fit to remain at home
e tell her that she can remain at home alone but to telephone the ward if there are any problems

SOE examination

SOE 1 – Clinical anaesthesia short cases with linked clinical science questions

The cases are presented as if in a real structured oral examination (SOE). They are deliberately grouped together in examination format to cover the range of the syllabus (planned and emergency anaesthetic care, core and subspecialty practice). Questions cover topics of varying difficulty. Each specific question also covers a range of areas, often of increasing complexity, to fully explore a candidate's knowledge and understanding.

All examiners will start with the same opening question and cover the same subject area in the question. However, the SOE is an interaction between two professionals, so the style, order and direction of subsequent questioning, will be partly directed by the candidate's response to previous questions. Examiners will ask supplementary questions to both clarify and explore answers given.

Candidates will run through a question at different speeds. Most candidates will cover most of the areas in the allotted time. For candidates that progress through the topic quickly, due to either very good or very poor knowledge, there are topics labelled 'Fillers'. These are not topics that must be covered to pass the case, but are present to avoid embarrassing silences. They are included below to give candidates a true reflection of the examination.

Paper 1

Question 1A: Clinical short case 1 –Tracheostomies and their complications

You are called urgently to see a 22-year-old male, level-2 critical care patient. They sustained an isolated severe closed traumatic head injury two weeks previously. They underwent a planned percutaneous tracheostomy (PDT) and have been self-ventilating for three days. The physiotherapists have reported difficulty in passing a suction catheter and that he has developed increasing difficulty in breathing.

How would you approach this problem?

Supporting information

Nil

How would you approach this problem?

Possible supplementary questions:

1 What airway information might you need before performing a secondary emergency airway manoeuvre?

2 What equipment might you need during a secondary emergency oxygenation manoeuvre?
(Bedside equipment, emergency equipment)

3 What are the indications for a tracheostomy in critical care?

Question 1A: Clinical science question 1 – Anatomy

Describe the anatomy relevant to performing a percutaneous tracheostomy, starting with the larynx.

1 Ask candidate to draw cross section of neck at C4 and thoracic inlet at T1 to demonstrate relations

2 What are the complications of a PDT?

3 What are the contraindications to bedside tracheostomy?

(Filler: What techniques are available to perform PDT?)

Question 2A: Clinical short case 2 – Neurofibromatosis

Supporting information

Nil

A 75-year-old man with neurofibromatosis and bullous lung disease presents for resection of an occipital lobe SOL that is causing neurological symptoms.

Describe the features of neurofibromatosis.

Possible supplementary questions:

1 How urgent is the case?
2 The patient has been optimised; how would you proceed with the induction?
3 How would you prone this patient and what are the adverse effects of prone positioning?
4 How would you maintain anaesthesia for this patient and what are the advantages/disadvantages of your chosen technique?

(Filler: How would you manage emergence?)

Question 2A: Clinical science question 2– physiology

Opening question

1 What compromises cerebral blood flow (CBF) in a patient with a head injury? What are the factors controlling CBF?
2 What strategies do you use to maintain CBF?

Question 1B: Clinical short case 3 – Pheochromocytoma

Supporting information

Nil

What is a pheochromocytoma?

Possible supplementary questions:

1 What are the principles preoperative preparation?
2 Which other drugs may be required to control response to fluctuating catecholamine release?

Question 1B: Clinical science question 3 – Pharmacology

What are the common indications for the use of calcium-channel blocking drugs and which drugs are used?

Possible supplementary questions:

1 What are the anaesthetic implications of calcium-channel blockers?
2 Describe the basic pharmacology of calcium-channel blocking drugs?

(Filler: Management of cerebral vasospasm following SAH)

Question 2B: Clinical short case 4 – ASD for MRI

You have been asked to anaesthetise a 7 year old child with autistic spectrum disorder for an elective MRI.

Supporting information

Nil

What is autistic spectrum disorder?

Possible supplementary questions:

1 What are the issues with children who have autistic spectrum disorder?
2 How would you manage this child for MRI?
3 Describe other precautions you should take while a patient is having an MRI scan?

Question 2B: Clinical science question 4– Clinical measurement

What are the problems facing the anaesthetist in the MRI scanner?

Possible supplementary questions:

1 What precautions should be taken to prevent burns caused by monitoring equipment used in an MRI scanner?
2 What adaptions are there in the monitoring used?
3 What are the principles of MRI operation?

Paper 2

Question 1A: Clinical short case 1 – Maternal obesity

Supporting information

Nil

You are asked to see a woman expecting her first baby in the antenatal anaesthetic clinic. She has a BMI of 53, but no other medical problems. She is currently 34 weeks pregnant.

1 What are the risks of maternal obesity in pregnancy?
2 What would you discuss with this lady in the antenatal anaesthetic clinic?

She presents to the delivery unit at 39 weeks in active labour. She has been self administering *therapeutic* low-molecular-heparin for a deep-vein thrombosis. Her previous injection was 8 hours ago.

3 What pharmacological analgesic options are available to her during her labour?
4 What are the possible side effects of a remifentanil PCA in labour?
5 What precautions should be taken when using a remifentanil PCA in labour?

(Filler: If you wanted to introduce a remifentanil PCA service, how would you go about it and what barriers might you encounter?)

Question 1A: Clinical science question 1 – Anatomy of epidural space and differences with obesity

What approaches can be used to access the epidural space?

1 Describe the anatomy of the epidural space at L3/4.
2 Describe the anatomy of the sacral canal?
3 What are the challenges of siting an epidural for labour analgesia in a morbidly obese patient?

(Filler: What techniques can you employ to achieve correct epidural catheter placement in an obese patient?)

Question 2A: Clinical short case 2 – Intensive Care Unit Acquired Weakness (ICUAW)

A 76-year-old lady has been ventilated for one week on the ICU following an episode of severe pneumonia and septic shock. She is now improving but is slow to wean from the ventilator and appears profoundly weak.

Supporting information

Nil

What do you think is the cause of this patient's weakness?

1 Is it common?
2 What are the risk factors for its development?
3 How is it diagnosed?
4 What clinical problems does it cause?
5 What can be done to reduce the incidence of this condition?

(Fillers: What do you understand by ICU care bundles, such as VAP, CVP, PVC bundle.?)

Question 2A: Clinical Science question 2 – Physiology

What are the causes of muscle weakness in ITU?

What is the physiological basis of electromyography (EMG)?

Question 1B: Clinical short case 3 General duties – Day surgery

A young female presents for day-case laparoscopic sterilisation. She has had a previous anaesthetic (breast augmentation) and was nauseous and sick repeatedly after the previous surgery. She asks you, will she be sick after this operation?

What would you say?

Supporting information

Nil

What would you say?

1 Is PONV still a significant problem?
2 What are the risks associated with PONV?
3 Which patients are particularly at risk?
4 Clinically, how would you try and stop PONV in this young lady?
5 How effective are the various strategies?

(Filler: If asked to write one, what would be in your departmental policy for reducing rates of PONV? How would you audit the effectiveness of policy?)

Question 1B: Clinical science question 3 – Pharmacology

1 Which receptors, on activation lead to nausea and vomiting?
2 How does each class of antiemetics act to reduce nausea and vomiting? What are their side effects?

Question 2B: Clinical short case 4 – Pre-eclampsia

A 32-year-old primigravida of 36 weeks gestation has been in labour for 6 hours. No epidural is in place. The obstetricians have decided that she should undergo caesarean section because of a 'non-reassuring CTG'.

She has hypertension and ankle swelling, and has been started on a hydralazine infusion. BP 150/102, HR 126, RR 24 bpm and T 37.2°C What problems will we need to consider?

Supporting information

Nil

Opening question

What problems will we need to consider?

Does this patient have pre-eclampsia?

Does this patient require *additional* drugs before having the LSCS?

How are you going to anaesthetise this patient for LSCS?

(Filler: TEG in pre-eclampsia)

Examiner guidance

Pass candidate if can recognise and define pre-eclampsia, and demonstrates safe and sensible approach to anaesthetic options for LSCS care.

Question 2B: Clinical science question 4 – Clinical measurement

What factors should you consider when selecting a breathing system for a particular patient?

1 Could you describe in detail the pathway taken by gas in a circle breathing system
2 How is the problem of carbon monoxide production avoided?
3 How would you suspect carbon monoxide poisoning?

SOE 2 – Clinical long case with stand-alone short cases

Long case 1

Information given to candidate

You have been called to the emergency department to assess a 53-year-old woman. She has been involved in a road traffic collision in which the car she was driving was struck by a lorry. It took one hour to cut her from the wreckage. She was GCS 8 initially at scene. GCS 15 on arrival in ED, with stable vital signs. She is on a board with C-spine stabilisation and a pelvic binder in-situ. CT scan showed no skull or C-spine or intracranial bleed. There is a pelvic acetabular fracture and a fracture of mid-femur, as well as free fluid in her abdomen.

On examination

The patient is conscious.
She is complaining of right-sided chest and hip pain.
She appears breathless with rapid shallow breathing and is receiving oxygen via a face mask.
An intravenous infusion is running.
She is overweight and provisionally assessed as:
Weight 90 kg and Height 168 cm
Pulse 100 bpm, BP 90/45 , Temp 34.6ºC
RR: 40 breaths per minute. Chest movements: asymmetrical with paradoxical movement of the right side.
Clinical and radiological confirmation has been obtained of fractures of the pelvis and right femur. CT scans of head and neck show no fractures or intracerebral haematoma.

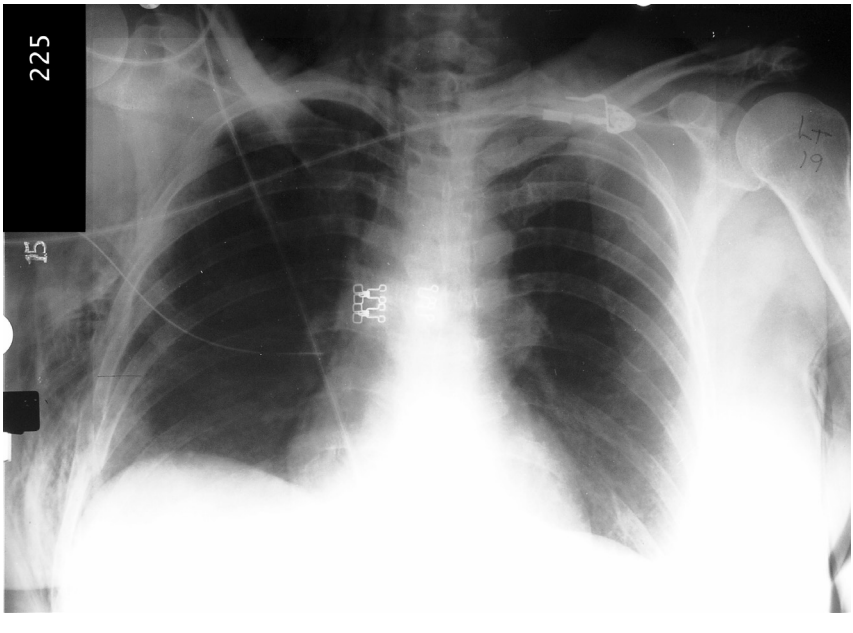
Provided for the candidate are:

1 Haematology
2 Biochemistry
3 Arterial blood gas
4 Chest x-ray

Clinical details			Current therapy	
RTA fractured pelvis and right femur				
Patient No.	Age	Sex	Weight	Date
225	53	female	~90kg	_ _/_ _/_ _
			Reference values	
Hb	115	g/L	150+/-20.0	g/L
RBC	4.2	$x10^{12}/L$	5.0 ± 0.8	$x10^{12}/L$
PCV	0.37		0.45 ± 0.05	
MCH	27	pg	29 ± 2	pg
MCHC	31	%	34 ± 2	%
MCV	88	fl	87 ± 5	fl
Platelets	201	$x10^9/L$	150–400	$X10^9/L$
WBC	18.6	$x10^9/L$	7.0 ± 3	$X10^9/L$

Clinical details			Current therapy	
RTA fractured pelvis and right femur			15 litres/min oxygen by face mask	
Patient No.	**Age**	**Sex**	**Weight**	**Date**
225	53	female	~90kg	_ _/_ _/_ _

Arterial blood gas analysis			**Reference values**	
pH	7.26		7.35–7.45	
$PaCO_2$	4.92	kPa	4.67–6.0	kPa
$Pa0_2$	31.8	kPa	12.0–13.3	kPa
$HC0_3$	16.6	mmol/L	22–26	mmol/L
Total CO_2	17.8	mmol/L	23–27	mmol/L
Base excess	-8.9		-2 to +2	mmol/L
Lactate	4.2	mmol/L	0.5-2	mmol/L
0_2 Saturation	99.7	%		



Clinical details			Current therapy	
RTA fractured pelvis and right femur				
Patient No.	Age	Sex	Weight	Date
225	53	female	~90kg	_ _/_ _/_ _
			Reference values	
Sodium	141	mmol/L	135–145	mmol/L
Potassium	4.2	mmol/L	3.5–5.0	mmol/L
Bicarbonate	17.5	mmol/L	24–31	mmol/L
Chloride	104	mmol/L	95–105	mmol/L
Urea	7.4	mmol/L	3.0–6.5	mmol/L
Creatinine	85	µmol/L	66–104	mmol/L
Calcium	2.1	g/L	2.15–2.55	mmol/L
ALP (Alk Phos)		mmol/L	2.5–6.0	mmol/L
Glucose (random)		11.4 mmol/L	(fasting)	

Long case 2

Information given to candidate

A 62-year-old man has been re-admitted for excision/de-bulking of a brain tumour, which is scheduled to take place tomorrow. His operation was cancelled a month ago because he had a chest infection, and since then, he has been treated with antibiotics at home. Over the past two weeks, his neurological condition has deteriorated in that his personality has altered, and he exhibits 'inappropriate behaviour'. He smokes two cigarettes a day. Negligible alcohol intake.

Drugs: dexamethasone 4 mg bd. Allergies: Nil

On examination

Height 1.71 m. Wt 65 kg. Pulse 110 bpm. BP 130/90. Temp 37.8ºC

He is aggressive but is willing to undergo surgery. Shows signs of recent weight loss.

He has bilateral coarse crepitations and reduced air entry at the left base.

Provided for the candidate are:

1 Haematology
2 Biochemistry
3 Chest x-ray
4 CT scan of head

Clinical details			Current therapy	
Preoperative craniotomy			Dexamethasone	
Patient No.	**Age**	**Sex**	**Weight**	**Date**
321	62 years	male	65kg	_ _/_ _/_ _
			Reference values	
Sodium 140 mmol/L Potassium 4.6 mmol/L Urea 7.6 mmol/L Creatinine 64 µmol/L Bicarbonate 30 mmol/L			135– 145 mmol/L 3.5–5.0 mmol/L 3.0–6.5 mmol/L 60–125 µmol/L 23–31 mmol/L	

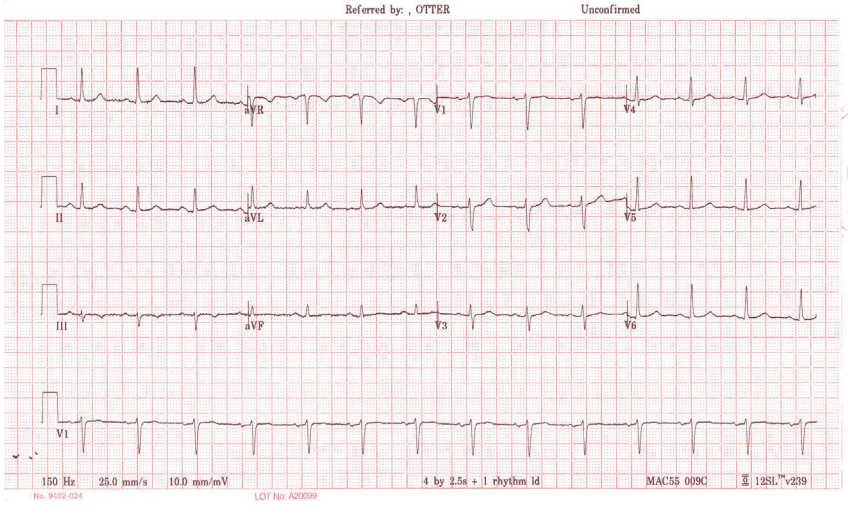
Clinical details			Current therapy	
Preoperative craniotomy Previous chest infection			Dexamethasone	
Patient No	**Age**	**Sex**	**Weight**	**Date**
321	62 years	male	65kg	_ _/_ _/_ _
			Reference values	
Hb	121 g/l		150 ± 20 g/L	
RBC	4.09 $x10^{12}$/1		5.0 ± 0.8 $x10^{12}$/L	
PCV	0.358		0.45 ± 0.05	
MCH	29.7 pg		29 ± 2 pg	
MCHC	33.9 %		34 ± 2 %	
MCV	87.4 fl		87 ± 5 fl	
Platelets	189 $x10^9$		150 – 400 $x10^9$	
WBC	20.6 $x10^9$		7.0 ± 3 $x10^9$	
gran	18.5 $x10^9$		2.0–7.5 $x10^9$	
lymph	1.4 $x10^9$		1.5–4.0 $x10^9$	
mono	0.6 $x10^9$		0.2–0.8 $x10^9$	
eosin	0 $x10^9$		0.0–0.8 $x10^9$	
INR	1			
APPT	27.1 secs		26–39 secs	

Long case 3

Information given to candidate

A 37-year-old teacher with high-grade ductal carcinoma *in situ*, is scheduled for a skin-sparing mastectomy, sentinel lymph node biopsy and immediate reconstruction with a latissimus dorsi flap.
PMH: Crohn's Disease. Previous GA uneventful (TOP)
DH: Nil
Allergies: Nil
Weight: 47 kg, Height: 161 cm, BMI: 18.
P = 75 regular, BP: 110/70. Chest: clear
Bloods: Mild anaemia (normocytic, hypochromic). ECG: normal
Provided for the candidate are:

1 FBC
2 U&E
3 Clotting studies
4 ECG



Pathology Report

Surname	UNKNOWN	**Forename**	UNKNOWN
Age	37	**Sex**	F
Clinical Details	Skin sparing mastectomy, SLNB and Reconstruction		
Sample Type	Blood		

Full Blood Count FBC

Result	Value	Units	Ref. Range	Result Comment
White cell count	9.7	10*9/L	4.00–11.00	
Platelets	299	10*9/L	150–400	
Mean cell volume MCV	87.6	fL	78–100	
Mean corpusc Hb MCH	30.8	pg	27.0–32.0	
Packed cell volume	0.40		0.40–0.52	
Haemoglobin	133	g/L	135–180	

Clotting screen

Result	Value	Units	Ref. Range	Result Comment
INR	0.9			
Prothrombin time	11	s	9–14	
APTT	29	s	25–39	

U&E

Result	Value	Units	Ref. Range	Result Comment
Sodium	139	mmol/L	133–146	
Potassium	4.3	mmol/L	3.5–5.3	
eGFR	> 90	mL/min/1.73m^2		
Creatinine	68	µmol/L	64–104	
Urea	4.1	mmol/L	2.5–7.8	
Glucose	6.1	mmol/L		

Stand-alone clinical short questions

Paper 1

Paper 1: Short case 1 – GGU

A 68-year-old male patient has an incarcerated inguinal hernia requiring exploration. They have ankylosing spondylitis with associated cervical kyphosis. Their FEV_1 is 1.35 and most recent and relevant clinical observations are: RR=23/min; HR=112/min (regular); BP=97/54; and temp= 38.5°C Their mouth opening is 2cm and their only medications are paracetamol and ibuprofen PRN.

Supporting information

Nil

Can you summarise the epidemiology and pathogenesis of ankylosing spondylitis?

Subsequent questions:

What will you focus on in your preoperative assessment?

What is the current definition of sepsis, and when managing potential sepsis what is meant by the phrase 'septic-six'?

What perioperative problems does ankylosing spondylitis pose?

Outline how you would perform an AFOI.

Paper 1: Short case question 2 – Perioperative Medicine

You are asked to review a 62-year-old male patient for an urgent femoral endarterectomy. They have a PMH of HT and schizophrenia with associated depressive illness. Their medications include amlodipine, lisinopril, terbutaline inhaler, salbutamol inhaler, olanzapine and citalopram. They continue to smoke between 40 and 50 cigarettes per day.

Supporting information

Nil

Opening question:

Can you describe the major implication of general anaesthesia in this patient?

Subsequent questions:

Can you describe what is meant by informed consent with respect to surgical procedures?

What do you understand by the term capacity?

What is a 'best-interests process'?

Paper 2

Paper 2: Short case 3 – Morbid obesity and laparotomy

A 45-year-old female patient on a surgical ward admitted as an emergency has a NEWS of 12, including temp= 38.9°C. The patient has had abdominal pain for 4–5 days and is noted to be cellulitic in her left iliac fossa. The surgical team want to perform explorative surgery. She weighs 243 kg with a BMI of 58.2, and has been unable to fit into a CT scanner. The patient has hypertension (Ramipril 10 mg OD) and type 2 diabetes (gliclazide 80 mg BD).

Supporting information:

Nil

What are your concerns about the patient's size?

Subsequent questions:

How will you investigate and manage the diabetes over the perioperative period?

What postoperative complications can occur?

The patient is undergoing an emergency laparotomy. What are the key themes to the NELA audit?

(Filler: Diagnosis of obstructive sleep apnoea (STOP-BANG))

Paper 2: Short case 4 – Metastatic Ovarian Cancer

A 38-year-old female patient has metastatic ovarian cancer and is undergoing palliative chemotherapy. She requires a general anaesthetic for insertion of a ureteric stent due to locally invasive tumour in her left ureter, close to the cysto-ureteric junction. Outline your preoperative assessment and likely anaesthetic implications.

Supporting information

Nil

Opening question:

What likely implications are there for your perioperative management with respect to metastatic ovarian cancer?

(Filler: What other practical considerations may be necessary in postoperative period?

- may have young family so area of nursing may need to be reviewed
- poor prognosis: consideration of 'treatment escalation plan' and DNACPR).

Paper 3

Paper 3: Short case question 5 – Upper limb regional anaesthesia and Never Events

A 78-year-old male patient with COPD (FEV_1= 0.61) is scheduled to undergo an arthrodesis of their left wrist for degeneration of their carpal bones.

Supporting information

Nil

Opening question:

What regional anaesthetic options are available for wrist arthrodesis?

Subsequent questions:

How do you minimise the likelihood of wrong-sided block?

What situations can lead to a wrong-sided block?

What are the implications of a wrong-sided block for a patient?

Wrong-sided block is listed as a Never Event. Can you define a Never Event and provide examples?

What are sentinel events?

(**Filler**: Pitfalls/inequities of Never Events: concept originated in part from insurance-based healthcare so motivation for their implementation may not be completely altruistic. Can be construed as being excessively punitive. Some may not necessarily be wholly preventable, eg, PPH after elective LSCS)

Paper 3: Short case 6: ICM Pancreatitis

You are called to see 58-year-old female patient with gallstone pancreatitis who has collapsed on the surgical ward. She has been in hospital for 10 days and is scheduled to undergo a staging CT scan of her abdomen. Her NEWS score is 12. RR=36/min; temp. 38.10°C; HR = 138/min and regular; BP=94/52; agitated but tolerating 15 L/min of oxygen. Resuscitative attempts include high-flow oxygen, 2000 ml of IV Hartmann's solution and 4.5 g bolus of tazocin.

Supporting information

Nil

Opening question:

Can you outline the salient features of this case that give cause for concern, and are there any additional investigations that you would perform?

Subsequent questions:

If this is severe acute pancreatitis what are the likely causes of deterioration?

Outline your management in order to ensure that the patient is transferred safely to CT.

Section 3: **Answers**

CRQ examination

Question 1

a) List 3 possible pathophysiological changes in the lungs seen in asthma. (3 marks)

A 57-year-old female, who is known to have asthma, is having a laparoscopic cholecystectomy under general anaesthetic with endotracheal intubation.

b) Interpret her preoperative pulmonary function tests shown below. (2 marks)
Age: 57 Weight: 62 kg Height: 165 cm

	Predicted	Observed – pre-bronchodilator	% Predicted	Observed – post bronchodilator	% Predicted
FEV_1 (L)	2.42	1.45	60	2.06	80
FVC (L)	3.26	2.75	90	3.10	95
FEV_1 / FVC (%)		53%		67%	

c) List 6 factors that may cause her to develop bronchospasm during her general anaesthesia. (6 marks)

d) She does develop acute severe bronchospasm - what drugs, **including dosages** where applicable, can be used to treat this? (5 marks)

e) List 4 other actions you would take in the early management of this emergency. (4 marks)

Syllabus	General PR_IK_10, CI_BK_19, IO_BS_9
Question type	Easy: pass mark 13
Topic	**Management of severe asthma, critical incident**
Aim	Knowledge of severe asthma in the context of anaesthesia
Pass requirements	Should know precipitating factors and treatment for acute severe asthma.

Q	Answer	Mark	Guidance
a)	Chronic inflammation Mucosal oedema Excess mucous production Bronchial smooth muscle contraction and hypertrophy Infiltration of inflammatory cells	3	Accept epithelial damage, loss of cilia Don't accept airway hyper-reactivity (it's a consequence) Max 3 marks Accept mast cells, macrophages, eosinophils, goblet cells
b)	Reduced FEV_1/FVC ratio = obstructive Evidence of reversibility	1 1	1 mark (must say obstructive picture) 1 mark No mark for stating reduce FEV_1
c)	Airway manipulation Anaphylactic/anaphylactoid reactions Histamine release from IV drugs Inadequate depth of anaesthesia Aspiration Administration of anti-cholinesterase reversal Administration of other drugs Pre-existing infection Preoperative non-compliance with asthma medication Use of desflurane	6	Accept use of ETT Accept surgical stimulation/pain if too light (only 1 mark for either statement) eg NSAIDs, beta-blocker
d)	Increase inhaled volatile concentration Salbutamol (8-10 puffs into circuit, 2.5–5mg neb, 250mcg slow IV) Aminophylline 5mg/kg slow IV Adrenaline 10-100mcg titrated Magnesium 1.2–2g IV Ketamine 1-3mg/kg/hr or 10-20mg bolus Hydrocortisone 100-200mg IV Ipratropium 500mcg neb.	5	No mark if says desflurane No mark for oxygen (does not treat bronchspasm) Accept 500mg No mark for antihistamine
e)	Call for help Alert surgeon/stop surgery/deflate abdomen Increase FiO_2 Assess ventilation Adjust ventilation - increase I:E ratio, use pressure control ventilation Auscultate chest – exclude pneumothorax	4	 Accept 100% O_2 Accept manual ventilation Must state what adjustment is made, allow 1 mark if says increase RR

Question 2

a) List 2 of the main clinical features used to confirm a diagnosis of dementia. (2 marks)

b) Name 2 of the most common types of dementia in the UK. (2 marks)

c) You have been asked to see an 80-year-old man in the preoperative assessment clinic. He has a diagnosis of dementia and is taking rivastigmine, risperidone, memantine and ginkgo biloba.

Complete the table by identifying which of his drugs belong to which category. (2 marks)

Drug category	Drug name
1 Acetylcholine esterase inhibitors	
2 N-methyl-D-aspartate (NDMA)	
3 Herbal medicines	
4 Atypical antipsychotics	

d) Outline the potential adverse perioperative effects of each drug. (4 marks)

Drug	Potential adverse perioperative effect
1 Ginkgo biloba	
2 Risperidone	
3 Memantine	
4 Rivastigmine	

e) The patient is scheduled to undergo an operation under general anaesthetic.

Give six ways in which intraoperative anaesthetic care can help to prevent him developing postoperative delirium. (6 marks)

f) Why is it important to avoid postoperative delirium in this patient? (4 marks)

Syllabus	PR_IK_20; POM_IS_01
Question type	Hard: pass mark 10
Topic	**Neurocognitive decline**
Aim	Management of patient with dementia in relation to anaesthesia
Pass requirements	Should know the classes of drugs and potential interactions. Should also be aware of ways of avoiding postoperative delirium and the importance of doing so.

Q	Answer	Mark	Guidance
a)	■ loss of cognitive function ■ memory loss ■ loss of social competence	**Any 2**	Accept loss of executive functions or loss of frontal control
b)	■ Alzheimer's disease ■ vascular dementia ■ dementia with Lewy Bodies	**Any 2**	Accept multi-infarct dementia
c)	1 Rivastigmine 2 Memantine 3 Ginkgo Biloba 4 Risperidone	**2**	No half marks so 1 mark for 2 correct answers
d)	Potential adverse effect 1 Interferes with platelet function 2 Enhances risk of vasodilation and hypotension with anaesthetics 3 Enhances side effects of anticholinergics and dopaminergic agonists 4 Prolongs the effect of depolarising and reduce or reverse the effect of non-depolarising muscle relaxants. Enhanced cholinergic effects	**4**	
e)	■ BIS guided anaesthesia to reduce dosage ■ multimodal analgesia ■ use of supplemental regional blocks ■ avoid benzodiazepines ■ avoid anticholinergics ■ keep well hydrated ■ ensure physiological normality, eg, BP	**4**	Accept: ■ minimum possible dose of anaesthetic to avoid awareness instead of BIS ■ avoid opiates instead of multimodal analgesia No marks for recovery as this is not intraoperative
f)	Prolongs hospital stay Increases complications Increases mortality Increases the progress of dementia	**4**	Accept: Increases falls or increases pneumonia instead of increases complications

Question 3

You are called to the emergency department to assist with the management of a 34-year-old gentleman who has sustained an **isolated** head injury following a road traffic accident, he requires an urgent CT scan. Upon arrival you find him to be restless, no eye opening to pain, making incomprehensible sounds and extending to pain. His blood pressure is 120/70 mmHg and heart rate 80bpm. He weighs 70kg.

a) What is this man's Glasgow coma score? (1 mark)

b) Why does he need intubation and ventilation? (2 marks)

c) Describe how you would achieve intubation and ventilation. (5 marks)

d) This is the result of the arterial blood gas analysis performed prior to transfer to the CT scanner, he is on an FiO_2 of 0.5 –

PaO_2	16.3 kPa
$PaCO_2$	6.8 kPa
H+	48 nmol/l
pH	7.31

Explain the most important reason why these results are unsatisfactory for this patient. (3 marks)

e) He is admitted to the intensive care unit. His intracranial pressure (ICP) is measured at 30 mmHg, mean arterial blood pressure (MAP) is 83 mmHg and central venous pressure (CVP) is 7 mmHg. What is his cerebral perfusion pressure (CPP)? (1 mark)

f) Give 6 treatment options available to improve this patient's cerebral perfusion pressure. (6 marks)

g) List 2 intracerebral pathophysiological changes associated with secondary brain injury. (2 marks)

Syllabus	MT_IK_04, NA_IK_20, NA_IK_04
Question type	Moderate: pass mark 13
Topic	**Head injury**
Aim	Understanding of immediate and ICU management of closed head injury and its pathophysiology.
Pass requirements	Must know management in ED, physiological goals, some pathophysiology, CPP calculation and target.

Q	Answers	Mark	Guidance
a)	GCS 5	1	Accept E1, V2, M2 Do not accept individual parts
b)	To protect his airway	1	No mark for 'needs CT scan'
	As his GCS <8	1	
	To prevent secondary brain injury	1	
c)	Rapid sequence induction	1	Accept 'modified'
	Mention cervical spine control	1	
	Use of emergency intubation checklist	1	
	Induction agent – any appropriate one	1	Propofol Thiopentone Ketamine
	Muscle relaxant	1	Suxamethonium or rocuronium
	Addition of opiate to obtund hypertensive response to laryngoscopy	1	No mark for lignocaine or beta blocker
d)	Hypercapnoea	1	Accept raised $PaCO_2$ as a result of under ventilation. No mark for acidosis. Accept any 3 points
	Causes cerebral vasodilatation/increased cerebral blood flow	1	
	Results in raised ICP	1	
	Results in reduced CPP	1	
e)	46 mmHg	1	
f)	Ensure adequate sedation – reduces CBF	1	
	Optimise CO_2 – low end of normal – 4.0-4.5 kPa	1	Accept 4.5-5.0 kPa
	Nurse slightly head up – avoids venous congestion	1	No mark for avoid ETT ties – not a treatment
	Consider use of mannitol	1	Hypertonic saline/furosemide acceptable
	Consider vasopressor to increase MAP	1	
	Discuss with neurosurgeons – consider decompressive craniectomy	1	Accept EVD/CSF drainage
	Consider thiopentone to reduce ICP (bolus or infusion)	1	In addition to adequate sedation
g)	Focal areas of cerebral ischaemia	1	No marks for Monro-Kellie/closed box, or simply stating raised ICP – must give an explanation of why ICP rises
	Disruption of the blood-brain barrier	1	
	Cerebral oedema/hyperaemia	1	
	Impaired cerebral autoregulation	1	
	Release of high levels of oxygen free radicals following injury	1	
	Cellular inflammatory response - increased excitatory amino acids (glutamate, aspartate)	1	
	Cell death and apoptosis	1	

Question 4

A 38-year-old man is admitted to the intensive care unit critically ill with a diagnosis of suspected acute severe pancreatitis.
a) List 3 common causes of acute pancreatitis in the United Kingdom. (3 marks)
b) Two out of three diagnostic criteria must be met in order to confirm the diagnosis of acute pancreatitis. What are the three criteria? (3 marks)
c) What is the single most important aspect of the medical management of a patient with acute pancreatitis? (1 mark)
d) Give 3 reasons why enteral nutrition would be preferred over parenteral nutrition in this patient. (3 marks)
e) When should enteral nutrition be commenced? (1 mark)
The patient becomes increasingly hypoxic requiring intubation and ventilation. A suspected diagnosis of acute respiratory distress syndrome (ARDS) is made.
f) What are the 4 criteria of the Berlin definition of ARDS? (4 marks)
g) Give the pathophysiological mechanism whereby acute severe pancreatitis may cause ARDS. (1 mark)
h) Despite a FiO_2 of 1.0, lung protective ventilation and maximal positive end expiratory pressure he remains hypoxic. What additional strategies are available in an attempt to optimise his **ventilation**? (4 marks)

Syllabus	Annexe F 3.8, 3.1
Question type	Moderate: pass mark 12
Topic	**ITU management of patient with severe acute pancreatitis and ARDS**
Aim	To test knowledge of the diagnosis and management of conditions seen commonly in ITU
Pass requirements	The candidate should know the common causes of pancreatitis and how to diagnose it. They should be able to explain the rationale for using enteral nutrition. They should know the diagnostic criteria for ARDS and alternative ventilatory strategies.

Q	Answers	Mark	Guidance
a)	Gallstones	**1**	Max 3 but must include gallstones and alcohol
	Alcohol related	**1**	
	Idiopathic	**1**	
	Post endoscopic procedure	**1**	
	Infection	**1**	
b)	Abdominal pain consistent with disease	**1**	Accept epigastric or generalised, not just 'abdominal pain'
	Raised serum amylase or lipase	**1**	
	Characteristic findings from abdominal CT/MRI/USS imaging	**1**	Give mark if say imaging not needed if first 2 criteria met
c)	Adequate fluid resuscitation	**1**	Accept goal directed fluid therapy
d)	Maintains gut integrity	**1**	Accept prevents bacterial translocation
	Reduced infection	**1**	Accept reduced incidence of sepsis/line infection
	Reduces morbidity/mortality	**1**	Accept reduced incidence of organ failure/ pancreatic necrosis
e)	Within 48-72 hours	**1**	
f)	Acute onset within 1 week	**1**	Must say within 1 week to get mark
	Bilateral opacities on CXR	**1**	
	$PaO_2/FiO_2 \leq 300$ (39.9kPa)	**1**	No need to include PEEP in definition but do not penalise if included
	Not fully explained by cardiac failure or fluid overload	**1**	
g)	Production and excretion of inflammatory mediators causing damage to the alveolocapillary membrane	**1**	May get mark if mentions destruction of pneumocytes or decreased surfactant. No mark for sepsis as a cause
h)	Neuromuscular paralysis	**1**	
	Prone positioning	**1**	
	Inverse ratio	**1**	
	Alternate modes of ventilation	**1**	
	Recruitment manoeuvres	**1**	Must give an example, eg, APRV, BIPAP, high frequency Accept open lung ventilation No marks for NO or ECMO as they are not ventilatory strategies

Question 5

A 25-year-old woman who is 37 weeks pregnant is admitted to your labour ward with a blood pressure of 180/115mmHg and proteinuria. A diagnosis of severe pre-eclampsia is made.
a) What is the main reason that urgent blood pressure control is needed? (1 mark)
b) What associated symptoms might this patient have? (4 marks)
c) Give 2 drugs you would use to treat this patient's blood pressure. (2 marks)
d) Why would magnesium sulphate be indicated in this patient (1 mark) and what dosing regimen would be used? (2 marks)
The patient's blood pressure has settled to 150/90mmHg. She has been started on magnesium treatment and is being managed on the labour ward with a view to delivery within the next 24 hours as the continuous cardiotocograph (CTG) recording is currently normal. **e)** What monitoring does she require? (5 marks)
f) The patient has had a caesarean section. She has lost 500mls of blood and has had adequate, appropriate fluid replacement. How would you manage ongoing fluid balance in the postoperative period? (4 marks)
g) Why would this patient be particularly susceptible to pulmonary oedema? (1 mark)

Syllabus	OB_IK_01, OB_BK_05
Question type	Easy: pass mark 14
Topic	**Management of a pre-eclamptic patient**
Aim	Understanding of management of complicated obstetric patient
Pass requirements	Must understand reason for blood-pressure control, how and why to use magnesium, and the importance of fluid management. Must also know symptoms to look out for in worsening pre-eclampsia.

Q	Answers	Mark	Guidance
a)	To prevent intracranial haemorrhage	**1**	Accept: to prevent CVA or stroke
b)		**4**	Any 4 of list –
	Headache		Accept:
	Visual disturbance		Blurred/double vision/flashing lights
	Abdominal pain		Upper quadrant/liver pain
	Vomiting		Nausea
	Worsening of oedema of face, hands or feet		Swelling but must specify location
c)	Labetalol Nifedipine Hydralazine	**2**	Need labetalol PLUS one other to be awarded 2 marks
d)	Magnesium is effective in preventing seizures	**1**	No marks for stating reduction in blood pressure
	4g bolus over 5–10 minutes followed by 1g/hr infusion	**1** **1**	Allow 5-20 minutes for bolus
e)	ECG	**5**	
	Hourly non-invasive blood pressure		Accept arterial line
	Pulse oximetry		
	Respiratory rate		
	Fluid input / urine output		Accept fluid balance monitoring
	Hourly reflexes and ankle clonus every hour		Accept either
			Do not give a mark for plasma magnesium levels unless candidate states that there is renal impairment
f)	Restrict all IV fluids to 80-100mls/hr in total	**4**	No marks for restrict IV fluids – accept 1-1.5ml/kg/hr
	Ideally stop IV fluids and give oral fluid		Accept no IV fluids and free oral fluid
	Record fluid input and output accurately		
	If urine output <0.5mls/kg/hr give fluid challenge		Must mention figures for required output (accept 25-30mls/hr or 100mls over 4 hours)
	If no response consider invasive monitoring		
g)	Leaky capillaries	**1**	
	Low serum albumin		Accept low oncotic pressure instead of low proteinv

MCQ examination

Multiple true or false (MTF)

1 The following are indications for preoperative measurement of serum urea and electrolytes in patients admitted for elective surgery:

✓ Digoxin toxicity is enhanced by hypokalaemia. Diuretic therapy causes
✓ hypokalaemia. Insulin-dependent diabetics and patients with recurrent urinary
✓ tract infections are prone to disturbances of serum urea and electrolytes.
✓ In the absence of a specific indication it is not appropriate to perform
✗ this investigation just because the patient is over 50 years old.

2 Hazards of anaesthesia in a patient with chronic renal failure include:

✓ Hypertension and pericarditis are complications of chronic renal failure.
✓ Left ventricular enlargement is associated with hypertension. Cardiac
✓ tamponade may result from a pericardial effusion or haemorrhage into
✗ the pericardium.
✓

3 Hypophysectomy may result in:

✓ After hypophysectomy secretion of TSH and ACTH may cease, resulting in
✗ atrophy of the thyroid and the adrenal cortex. Diabetes insipidus does
✓ occur but is rare after hypophysectomy because the hypothalamus
✓ usually continues to secrete ADH bypassing the posterior pituitary.
✗

4 The following groups of people have an increased risk of latex allergy:

✓ Health workers and those who have repeated surgical procedures have a
✗ greater response to latex. There is cross reactivity between some fruit (kiwi
✓ fruit, avocados and bananas) and latex. There is no greater risk in patients
✗ with penicillin allergy. Disposable tracheal tubes do not contain latex.
✓

5 Myocardial stunning:

✗ Myocardial stunning is reversible, does not always follow myocardial
✗ ischaemia, and is not a cause of beta adrenoceptor down regulation.
✓
✗
✓

6 Supraclavicular brachial plexus block differs from axillary brachial plexus block because the supraclavicular block:

✗ Axillary brachial plexus block is less likely than supraclavicular block to
✗ provide analgesia for the lateral part of the forearm and more likely to
✓ involve intravascular injection of local anaesthetic. Both blocks
✓ will involve nerves to the intraosseous muscles to a similar extent.
✗

7 Severe middle third fractures of the face:

✓ Any severe blow to the head can cause brain injury. Fractures to the face
✓ can obstruct the airway and cause bleeding into the airway. Fixation
✗ can wait for several days in the absence of continuing haemorrhage and
✗ obstruction of the airway. The patient does not require nasal
✓ ntubation which may be harmful if there is a base-of-skull fracture.

8 Phantom limb pain:

✓ Motor nerves make no contribution to phantom limb pain. It is associated
✗ with preoperative pain, but evidence for this may be questioned now.
✗ Phantom limb pain occurs after traumatic amputation of a limb.
✓
✗

9 Pain during the first stage of labour may be relieved by:

✓ A, B and E are true because pain during the first stage of labour is
✓ transmitted centrally with T11, T12 and L1 sympathetic nerves.
✗ Pudendal nerve block provides perineal analgesia only. Paracervical
✗ block only relieves pain associated with dilation of the cervix.
✓

10 Symptoms or signs characteristic of amniotic fluid embolism include:

✓ Amniotic fluid embolism causes DIC and consumption of fibrin. Pulmonary
✓ embolism causes chest pain. The patient will be hypoxic and will
✓ hyperventilate. Hypotension is likely because of reduced
✗ delivery of blood to the left side of the heart.
✗

11 At a core temperature of 30°C:

✓ Blood coagulability is decreased during hypothermia. Glomerular filtration
✗ is reduced but does not cease. Blood viscosity increases on cooling.
✗
✗
✓

12 In a patient with porphyria:

✓ Dysautonomia is a feature of porphyric crisis. Glycine is safe, and fluid
✗ restriction has no effect.
✓
✗
✓

13 In myotonic dystrophy, spasticity of muscles is relieved by:

✗ Succinylcholine and neostigmine cause muscle spasticity in myotonic
✗ dystrophy. Spinal anaesthesia and dantrolene have no effect on
✗ spasticity.
✓
✗

14 Cardioversion is indicated in the treatment of:

✗ Sinus tachycardia can be slowed by carotid sinus massage and beta-
✓ blockers. Cardioversion will not help and may cause harm in
✗ junctional bradycardia or electro mechanical dissociation.
✓
✗

15 Circulatory assistance by intra-aortic balloon pumping is useful because it:

✓ The balloon inflates in diastole raising aortic diastolic pressure and deflates
✗ in systole reducing afterload and myocardial work. It will tend to reduce
✓ aortic systolic pressure and reduce or have no effect on left atrial
✗ pressure and left ventricular end-diastolic pressure.
✗

16 During storage of whole blood, the decrease in 2,3-diphosphoglycerate (2,3-DPG) concentration can be reduced by the addition of:

✗ Mannitol helps to prevent oxidative damage to red blood cells in storage
✓ and has no effect on 2,3-DPG. Pyruvate does not have an important role
✗ in blood storage.
✓
✓

17 In a sacral epidural (caudal) block in adults:

✓ ✗ ✗ ✓ ✓ The sacral hiatus and the posterior superior iliac spines form an equilateral triangle. The dura normally ends at S2. The pressure in the sacral canal is not negative. If the needle is subcutaneous the injection of air will cause palpable subcutaneous emphysema.

18 Structures supplied by segment S2 include the:

✗ ✓ ✓ ✓ ✓ The skin of the buttock is supplied by the posterior rami of S3, 4, 5.

19 Interruption of the cervical sympathetic chain results in:

✗ ✗ ✓ ✗ ✓ Interruption of the cervical sympathetic chain will cause constriction of the pupil. Taste sensation of the anterior two-thirds of the tongue is supplied by the facial nerve via the chorda tympani. Salivation is controlled by parasympathetic nerves.

20 The following agents may cause pulmonary fibrosis:

✓ ✗ ✓ ✓ ✗ Hydrocortisone and organophosphate compounds do not cause pulmonary fibrosis.

21 Likely preoperative problems in a three-month-old infant, scheduled for primary closure of a cleft lip include:

✗ ✓ ✗ ✓ ✗ Anaemia due to psychological or nutritional or nutritional causes is seen with cleft lip. A number of associated syndromes have cardiac anomalies.

22 In ophthalmic surgery:

✗ ✗ ✓ ✗ ✓ All induction agents (apart from ketamine) and all inhalational anaesthetic agents reduce IOP. Succinylcholine can lead to an increase in IOP but it is not contraindicated in cataract surgery.

23 The ventilatory response to hypoxia is decreased in patients:

✓ ✓ ✓ ✗ ✓ Peripheral chemoreceptors mediate this response and are depressed by anaesthesia and opioids. Acclimatisation to altitude resets this reflex. The reflex is also reset in patients with cyanotic congenital heart disease. Patients with pulmonary fibrosis have a normal ventilatory response to hypoxia and hyperventilate.

24 The following drugs alter the level of thyroxine production:

✓ ✓ ✗ ✗ ✗ Propranolol is useful to slow the heart rate in thyrotoxicosis but does not reduce thyroxine levels. Carbidopa is used in the treatment of Parkinson's disease. Prazosin is an alpha-adrenergic blocking agent. Amiodarone contains iodine and modifies thyroxine production.

25 Stimulation of postganglionic thoraco lumbar autonomic nerve fibres produces:

✓ ✗ ✓ ✗ ✗ The postganglionic thoraco-lumbar autonomic nerve fibres are sympathetic and cause bronchodilation, an increase in myocardial rhythmicity and an increase in myocardial contractility.

26 The alveolar–arterial oxygen tension difference is increased by:

✓ ✗ ✓ ✓ ✓ Nitrous oxide uptake by the concentration effect will increase alveolar oxygen concentrations but only in perfused alveoli, so the alveolar–arterial oxygen difference will not increase. Ventilation/perfusion mismatch increases the differences and a reduction in FRC and hepatic failure increases V/Q mismatch.

27 Pulmonary vascular resistance is reduced by:

✗ ✗ ✓ ✓ ✓ Hypoxic pulmonary vasoconstriction raises pulmonary vascular resistance. Alkalosis in the pulmonary vascular bed mimics the effect of acidosis in the systemic capillaries. Nitric oxide and prostacyclin have a direct effect on the vascular smooth muscle.

28 The following have been shown to be effective in the management of post-dural puncture headache in obstetrics:

✗ ✓ ✗ ✗ ✗ Epidural blood patch has been shown to be effective in the treatment of PDPH. Epidural saline is ineffective as is conservative treatment such as lying supine for 24 hours. Elective delivery by forceps and intravenous platelets have no role.

29 In a patient with a bronchopleural fistula, induction of general anaesthesia must include:

✗ ✓ ✗ ✗ ✗ Awake intubation, deep inhalational and modified rapid sequence are all techniques that can be used. Endobronchial intubation is essential to protect the 'good' lung.

30 Xenon:

✓ ✓ ✓ ✗ ✓ Xenon is an inert gas which has a blood-gas solubility coefficient of 0.14. It is a potent analgesic comparable to nitrous oxide. It inhibits the N-methyl-D-aspartate (NDMA) receptor, with little effect on GABA-A or non-NMDA glutamate receptors. it has no significant presynaptic effects.

31 The following are true of day-case anaesthesia:

✗ ✓ ✗ ✗ ✗ It is recommended that after a general anaesthetic most patients should have a responsible adult to accompany them home and remain with them for 24 hours after surgery. The historical limitations on arbitrary ASA status are no longer necessary. Peripheral nerve blocks, spinal/epidural blocks and intravenous regional anaesthesia often provide excellent conditions for day surgery.

32 The recurrent laryngeal nerve innervates the:

✗ ✓ ✓ ✗ ✓ The recurrent laryngeal nerve supplies all the intrinsic muscles of the larynx with the exception of the cricothyroid muscle, which is supplied by the superior laryngeal nerve. The thyrohyoid, one of the extrinsic laryngeal muscles, is supplied by the hypoglossal nerve.

33 The sacral canal contains:

✗ ✗ ✓ ✗ ✗

The dura extends to S2 in the sacral canal which has a volume of approximately 33 ml in the adult. The genitofemoral and ilioinguinal nerves arise from the lumbar plexus.

34 Characteristic features associated with tetralogy of Fallot include:

✗ ✓ ✗ ✓ ✓

The four main anatomical features of Fallot's are: a large ventricular septal defect, overriding aorta, right ventricular outflow obstruction and right ventricular hypertrophy. An atrial septal defect can occur in 8-10% of cases but is not characteristic.

35 These drugs selectively increase renal blood flow:

✗ ✓ ✓ ✗ ✗

Dopamine receptor stimulation results in renal vasodilatation. Dopexamine is an inodilator with dopaminergic activity. Dobutamine acts on beta-1 and beta-receptors only.

36 The following factors enhance the diffusion of a drug across the blood–brain barrier:

✓ ✗ ✓ ✗ ✗

The blood–brain barrier comprises tight junctions of capillary endothelium. Lipid solubility facilitates diffusion as does the concentration gradient between plasma and brain.

37 Sevoflurane:

✗ ✗ ✗ ✓ ✗

Sevoflurane is a fluorinated ether which boils at 58.6°C and has a blood-gas solubility of 0.69.

38 Intraocular pressure is lowered by:

✓ ✓ ✗ ✓ ✓

IOP is influenced by venous drainage, arterial pressure, extraocular muscle tone, and choroidal blood volume which is sensitive to $PaCO_2$.

39 Appropriate nerve blocks for the treatment of pain associated with chronic pancreatitis include:

✗ ✓ ✓ ✓ ✗ Coeliac plexus block is used traditionally to block autonomic afferent activity. Paravertebral block at T8–10 is necessary for pancreatitis. block of the same segments will abolish the pain of chronic pancreatitis.

40 Causes of low arterial pressure upon initiation of cardiopulmonary bypass with total crystalloid prime include:

✓ ✗ ✗ ✗ ✗ Arterial pressure is a product of peripheral resistance and cardiac output. Cardiac output is determined by preload, afterload and contractility although, cardiac output is set by the perfusionist during cardiopulminary bypass.

41 Surgical closure of a patent ductus arteriosus produces:

✓ ✗ ✓ ✓ ✓ An oesophageal stethoscope placed during surgery confirms closure. Resultant decrease in left to right shunting accounts for greater systemic perfusion and decreased venous return from the lungs.

42 Emergency treatment of severe hypotension unresponsive to ephedrine in a fit patient undergoing cervical laminectomy in the sitting position includes:

✗ ✗ ✗ ✓ ✓ Venous pooling in the seated position renders hypotension likely. Intra-aortic balloon pump is inappropriate as an immediate treatment. Nitrous oxide (if employed) will increase the volume of an air embolus that is a likely cause of severe hypotension. Sodium bicarbonate will worsen tissue acidosis.

43 Paraplegic patients with spinal cord transection at T6 for more than one year manifest:

✓ ✓ ✓ ✗ ✗ Autonomic denervation of the sympathetic outflow below T6 predisposes to autonomic hyperreflexia. Intracellular potassium efflux is maximal at 14 days post injury, declines after six months, but may still be present thereafter.

44 For laryngoscopy:

✗ Atlanto-occipital extension and cervical flexion result in the optimum
✗ position. Anterior neck surgery may result in fibrosis. The polio
✓ blade angle is 135°.
✓
✗

45 Complications of deep cervical plexus block include:

✗ The phrenic nerve may be affected, and a Horner's syndrome with ipsilateral
✓ meiosis may occur as a result of sympathetic block. Local anaesthetic
✓ may diffuse to the recurrent laryngeal nerve leading to hoarseness, and
✓ subarachnoid injection is possible.
✗

46 Inadvertent surgical stimulation of the fifth cranial nerve during posterior fossa craniotomy will produce:

✓ The trigeminal nerve is motor to muscles of mastication and mylohyoid.
✗ Stimulation of VIII nerve causes nystagmus. Stimulation of
✗ the trigeminal nerve increases circulating catecholamines and causes
✗ tachycardia and hypertension.
✗

47 The hypertensive response to laryngoscopy and tracheal intubation may be attenuated by:

✓ The afferent reflex is depressed by anaesthetic and analgesic agents,
✓ and the efferent beta sympathetic effects are attenuated by antagonists.
✗ Glycopyrrolate will reduce parasympathetic tone and increase
✗ the hypertensive response. Spraying the cords requires laryngoscopy and
✓ therefore will cause a hypertensive response.

48 Appropriate management of a mildly cyanotic child with a ventricular septal defect and pulmonary hypertension, scheduled for multiple dental extractions under general anaesthesia includes:

✗ Antibiotic cover is no longer recommended. Hypercarbia and hypoxia can
✗ be detrimental both increasing PVR. Sedative premedication can reduce
✗ the amount of induction agent required.
✓
✗

49 Appropriate management of a female patient with untreated thyrotoxicosis requiring repair of an incarcerated femoral hernia includes:

✓ Control of end-organ sympathetic stimulation can be achieved with beta
✗ blockade in the acute situation. Potassium iodide may be used in
✗ addition. Spinal anaesthesia is inappropriate in this case because of
✗ the possible need for small bowel surgery. Atropine will worsen
✗ arrhythmias and carbimazole cannot be given intravenously.

50 In assessing the adequacy of medullary perfusion during posterior fossa surgery, the appearance of the following are useful:

✗ Medullary cardiovascular centre activity can be judged by monitored
✗ cardiovascular variables. Respiratory activity can be useful
✓ only if ventilation is spontaneous, but is a more sensitive indicator of brain
✓ stem dysfunction than cardiovascular changes. EEG changes and body
✓ temperature are not useful in this context.

51 During general anaesthesia for laparoscopy when the intra-abdominal pressure is 40 mmHg the following parameters would decrease:

✓ The pressure in the IVC is exceeded by intra-abdominal pressures in excess
✗ of 15 mmHg. Decreased venous return to the heart results in decreased
✓ filling pressure and decreased cardiac output. Systemic vascular
✗ resistance and heart rate will increase due to increased
✗ baroreceptor activity.

52 A continuous positive-pressure breathing system (CPAP) for an adult:

✗ CPAP can be applied using a mask delivering a fresh gas flow near to the
✓ peak inspiratory flow rate. Increasing FRC to greater than closing capacity
✓ results in alveolar recruitment and will tend to improve lung compliance.
✗
✓

53 When performing the 'three-in-one' block for pain relief in lower limb surgery:

✗ The femoral nerve lies lateral to the artery. Analgesia will be obtained over
✓ the medial side of the ankle only.
✗
✓
✓

54 The following conditions may be associated with difficulty in tracheal intubation:

✓ Marfan's syndrome, acromegaly, Ludwig's angina and Down's syndrome are
✓ all associated with difficulty in tracheal intubation. Charcot–Marie–
✗ Tooth disease is a hereditary motor and sensory neuropathy.
✓
✓

55 Appropriate immediate management of a neonate who suddenly becomes dusky and bradycardic with a reduced pulmonary compliance following repair of a left diaphragmatic hernia and re-expansion of the atelectatic lung includes:-

✗ The likely cause is pneumothorax due to barotrauma on the left or right side,
✓ therefore immediate management is needle decompression.
✓
✗
✗

56 A neurolytic coeliac plexus block:

✓ Coeliac plexus block is performed anterolateral to the body of L1 and with
✗ the needle posterior to the aorta.
✓
✓
✗

57 Surgical correction of scoliosis:

✗ Spinal cord damage is very rarely associated with surgical correction of scoliosis. If postoperative ventilation is required it is usually short-lived.
✓
✓
✓
✗

58 After successful supraclavicular brachial plexus block, sensory anaesthesia will usually be incomplete on the:

✗ Sensory anaesthesia is usually complete on the back of the elbow and the
✗ medial and lateral aspects of the forearm. An area on the tip of the
✓ shoulder and an area on the medial aspect of the upper arm,
✓ supplied by the intercostohumeral nerve, are not blocked.
✗

59 Retrobulbar block:

✓ Retrobulbar block tends to cause exophthalmos. It has no effect on
✗ lacrimation, and because it reduces intraocular pressure will tend
✓ to reduce the likelihood of vitreous prolapse.
✗
✗

60 Premature neonates:

✓ Insensible water loss tends to be increased. Neonates have
✓ disproportionately fewer Type 1 slow muscle fibres in the
✗ diaphragm than children aged two years, and are therefore prone to
✓ respiratory fatigue.
✗

61 The TURP syndrome:

✓ The TURP syndrome is caused by absorption of irrigating fluid into the
✓ circulation. This causes hypokalaemia and hyponatraemia.
✗ It is just as likely to occur during spinal anaesthesia as during general
✗ anaesthesia.
✓

62 Indications for the use of lumbar epidural analgesia during labour include:

✗ Epidural analgesia is indicated in pre-eclampsia, but once eclampsia is
✗ established control of seizures and delivery is paramount.
✓ Patients with placenta praevia should have an elective LSCS.
✓
✓

63 The penicillins:

✗ The penicillins interfere with bacterial cell wall synthesis, are more effective
✓ against organisms which are dividing and are bactericidal. They are
✗ effective against some Gram-positive cocci and some are
✗ penicillinase resistant.
✗

64 The following are competitive antagonists:

✗ Naltrexone and flumazenil are competitive antagonists. Neostigmine
✓ antagonises neuromuscular blockade by preventing the
✗ breakdown of acetylcholine. Buprenorphine is a mixed opioid agonist/
✓ antagonist. Enoximone is a phosphodiesterase inhibitor preventing the
✗ breakdown of cyclic AMP.

65 Intraoperative signs of a haemolytic transfusion reaction include:

✓ ✗ ✓ ✓ ✓

Haemolytic transfusion reactions will be associated with an increase in capillary bleeding and hypotension intraoperatively. Fever, urticaria and periorbital oedema are also intraoperative signs of a severe transfusion reaction.

66 Hoarseness or alteration in the quality of voice has been attributed to injury of the recurrent laryngeal nerve:

✓ ✓ ✓ ✓ ✓

All can cause recurrent laryngeal nerve injury.

67 Lactic acid is:

✓ ✓ ✗ ✓ ✓

Lactic acid is formed during anaerobic ATP re-synthesis and increases in concentration in the blood during energy deficit. It is formed by red blood cells converted to glucose by the Cori cycle and oxidised without conversion back to glucose.

68 Low molecular weight heparin:

✗ ✓ ✗ ✗ ✓

Low molecular weight heparin (LMWH) does not have any direct inhibitory action on thrombin, so its activity is not effectively measured by APTT. It has a longer plasma half-life than standard heparin and has prolonged plasma clearance in renal failure. It is only weakly protein bound and has a high bioavailability. It is only partially reversible by protamine.

69 Hypoparathyroidism following thyroidectomy is characterised by:

✓ ✗ ✓ ✗ ✗

Hypoparathyroidism may present with perioral tingling, twitching, or tetany. If left untreated, it can progress to seizures or ventricular arrhythmias. The diagnosis may be made clinically by precipitating carpopedal spasm through cuff inflation (Trousseau's sign) or facial twitching by tapping over the facial nerve at the parotid gland (Chvostek's sign). The ECG may show prolonged QT intervals.

70 In normal individuals with a normal $PaCO_2$, cerebral blood flow:

✓ The autoregulatory limits for CBF are cerebral perfusion pressures of
✓ 50–140 mmHg so CBF will autoregulate between 50 and 100 mmHg.
✗ 100% oxygen causes cerebral vasoconstriction. Hypothermia reduces
✗ CBF which has a normal value of 50 ml/100g/min. Mannitol reduces
✓ blood viscosity and initially increases CBF which will return to normal fairly quickly if autoregulation is intact.

71 In normal pregnancy:

✗ Plasma volume increases to approximately 60 ml/kg in pregnancy, so
✗ the total quantity of plasma proteins will increase despite a reduction in
✓ plasma concentrations. Bupivacaine is bound to albumin which is
✓ reduced in concentration in pregnancy so free plasma levels of
✓ bupivacaine are increased.

72 The alpha-2 adrenoreceptor agonist clonidine:

✓ Alpha-2 agonists reduce MAC for inhalational anaesthetics and potentiate
✗ the analgesic effects of opioids. They reduce heart rate and arterial
✓ pressure. They increase the duration of epidural block with bupivacaine.
✗
✓

73 Intercostal nerves:

✓ The intercostal nerves pass anteriorly to the posterior intercostal membrane
✗ then between the internal intercostals and the innermost intercostal
✗ muscles running inferior to the intercostal vein and artery. They divide
✓ into lateral and anterior cutaneous branches. Intercostal nerves supply the
✓ periphery of the diaphragm.

74 Pulmonary vascular resistance is:

✓ A high haematocrit increases the viscosity of the blood and resistance
✗ to flow. Helium has no effect on pulmonary vascular resistance, and
✓ sevoflurane decreases it. Moderate exercise causes pulmonary
✗ vasodilation. PEEP squeezes the pulmonary capillaries and
✓ increases pulmonary vascular resistance.

75 The following are nephrotoxic:

✓ Halothane, unlike the other commonly used volatile anaesthetics, is not
✓ normally metabolised to fluoride. Therefore, nephrotoxic levels of
✗ fluoride are not achieved. All the other agents are nephrotoxic.
✓
✓

76 Shock due to Gram-negative bacteraemia is frequently associated with:

✓ Gram-negative bacteraemia frequently complicates obstructive jaundice.
✓ The shock associated with Gram-negative bacteraemia is characterised by
✓ a high cardiac output with very low systemic vascular resistance.
✓
✗

77 After a severe burn (greater than 40% full thickness):

✓ Enteral nutrition should be started as soon as possible. Antibiotics should
✗ only be given when there is proven infection to avoid the development of
✓ bacterial resistance.
✓
✗

78 In the critically ill, skeletal muscle:

✓ Early nutritional support does not prevent muscle breakdown. Endogenous
✓ cortisol tends to increase muscle breakdown.
✗
✗
✓

79 The use of propofol for sedation on the intensive care unit is associated with:

✗ The calorie load is approximately 1 kcal/ml for 1% propofol solution.
✓ Propofol reduces cerebral blood flow and does not reduce the shunt
✗ fraction. It may increase the shunt fraction due to hypotension.
✓
✗

80 Mixed venous oxygen saturation is:

✗ Mixed venous oxygen saturation is reduced in anaemia because of the
✓ reduced oxygen carrying capacity. It is increased in established systemic
✓ sepsis because of impairment of oxygen utilisation in the tissues with
✗ reduced peripheral extraction of oxygen. Measurement may be
✓ intermittent or by means of a central venous oximetric catheter.

81 The crush syndrome:

✓ Alkalinisation of the urine reduces precipitation of myoglobin in the renal
✓ tubules and ameliorates haem-induced toxicity.
✓
✓
✓

82 Important measures to prevent hospital acquired infections in intensive care include:

✓ Plastic overshoes and routine cultures do not reduce the risk of infection.
✓ Changing the ventilator tubing every 24 hours does not reduce the
✗ risk of developing a chest infection. Sterilisation of ventilator patient
✗ circuits between patients is appropriate.
✗

83 Potential complications of the use of neuromuscular blocking agents in the critically ill include:

✓ Venous thromboembolism is likely if muscle tone in the lower limbs is
✗ reduced. Cardiac arrhythmias can be induced by suxamethonium
✓ due to changes in serum potassium levels. Protracted muscle weakness
✓ and peripheral nerve injury are associated with the use of muscle
✓ relaxants. Critical illness neuropathy is not caused by the use of muscle relaxants.

84 Electrocardiographic changes during hypothermia to 28°C include:

✓ Peaked T waves are associated with hyperkalaemia and will tend to
✗ be reduced in size during hypothermia. J waves are associated with
✓ hypothermia.
✓
✓

85 Ionised calcium:

✓ Normally the blood sample should be allowed to clot and not be
✓ anticoagulated but it is possible to measure ionised calcium in
✓ a heparinised sample when measuring blood gases. Calcium is bound by
✓ the citrate used as an anticoagulant in stored blood. Serum proteins do
✗ not affect ionised calcium levels.

86 In thermal dilution techniques for the measurement of cardiac output:

✗ The volume of the injectate is not critical but must be measured accurately.
✗ The wedge pressure is not required in the calculation and the patient's
✗ temperature has no effect on the measurement. The phase of the
✓ respiratory cycle can affect the measurement by as much as 20%.
✗

87 A typical daily regimen for total parenteral nutrition in an adult:

✓ Fat emulsions are not contraindicated in patients with liver failure, but fat
✗ clearance from the plasma should be ensured.
✓
✓
✓

88 The effectiveness of defibrillation is increased by:

✗ ✗ ✗ ✓ ✓

Delivery during expiration results in a greater conductivity. Large plate contact area with plates correctly applied results in more uniform current spread within the heart and thus improved effectiveness.

89 Appropriate treatment of a 10 kg infant whose urine output declines to 2 ml/hr two hours after resection of obstructed small bowel includes:

✗ ✗ ✓ ✓ ✗

The infant needs fluid resuscitation with isotonic solutions.

90 In the following situations the measured pulmonary artery occlusion pressure (PAOP) will not reflect left ventricular end-diastolic pressure (LVEDP):

✗ ✓ ✗ ✓ ✗

Changes in right-sided pressures as a result of valve disease do not affect per se left-sided pressures. The presence of aortic stenosis does not alter left atrial and hence pulmonary artery occlusion pressure.

91 Hypophosphataemia gives rise to:

✓ ✗ ✓ ✓ ✗

Hypophosphataemia shifts the dissociation curve to the left and does not cause a peripheral neuropathy. Muscle weakness is often described in patients with prolonged hypophosphataemia.

92 The following are endogenous pro-inflammatory cytokines:

✓ ✓ ✗ ✗ ✗

Interleukin 10 and interleukin 1 receptor antagonist act as anti- inflammatory cytokines. Nuclear factor kappa B is a transcription factor which promotes the formation of a range of proteins including cytokines, but it is not itself a cytokine.

93 The treatment of amitriptyline poisoning includes:

✗ ✗ ✗ ✗ ✓ Forced diuresis does not speed elimination significantly. Isoprenaline will increase the risk of tachyarrhythmias as will atropine. Amitriptyline has anticholinergic properties. Digitalis may increase the risk of arrhythmias. Beta adrenoceptor antagonists are appropriate for the treatment of tachyarrhythmias.

94 Conditions associated with smoke inhalation injury include:

✗ ✓ ✓ ✗ ✓ Heat causes sloughing and oedema of the mucosa of the upper airway. Smoke inhalation is often associated with carbon monoxide (the presence of carboxyhaemoglobin shifts the oxyhaemoglobin dissociation curve to the left) and cyanide inhalation.

95 Amniotic fluid embolism:

✓ ✓ ✓ ✓ ✓ Amniotic fluid embolism can occur during therapeutic abortion, is more common in multiparous women, and may present as haemorrhage. It can occur up to 48hrs after delivery.

96 Likely causes of severe hypotension following surgical removal of a phaeochromocytoma include:

✗ ✗ ✗ ✓ ✓ Patients are prepared for surgery using catecholamine antagonists and should not therefore be vasoconstricted. Adrenal cortical failure would result in mild hypotension over a more chronic time frame. Plasma volume is diminished in such patients even with preoperative preparation and along with splanchnic pooling it is the most likely cause of hypotension in such a patient.

97 Criteria applied in the diagnosis of 'brain death' include:

✓ ✓ ✗ ✗ ✗ The diagnosis of brain death is dependent upon demonstrating lack of activity in the medulla and brain stem. Upgoing plantars are a spinal response. EEG evidence is not required for the diagnosis of brain-stem death.

98 The effects of ecstasy (3,4-methylenedioxymethamphetamine):

✗ Ecstasy increases monoamine release from nerve terminals and also reduces
✓ the reuptake of serotonin. It has similar but weaker effects on dopamine.
✗ The toxic effects, such as hyperpyrexia, are often not dose related. Thirst
✗ occurs from ADH release and loss of salt during excess sweating;
✓ increased water intake may lead to hyponatraemia.

99 Initial treatment of haemorrhage after delivery of a complete placenta includes:

✗ Ergometrine can be given cautiously intravenously and bimanual uterine
✓ compression can halt bleeding or buy time. FFP and blood should
✓ be given in a 1.1 ratio initially and fibrinogen concentrate IV to keep level
✗ >2g/litre on the basis of investigations.
✗

100 In acute hepatic failure:

✓ Assuming the liver is not totally destroyed, protein production is often
✓ increased. Alkaline phosphatase, lactate dehydrogenase and
✗ bilirubin are not sensitive indicators of liver damage.
✗
✗

101 In children, death from severe burns in the second week after injury is often due to:

✗ Haemoconcentration, anaemia and protein destruction are all acute events
✗ and should not be associated with late death. Death from liver failure
✗ within two weeks of burn injury would be most unlikely.
✗
✓

102 You are called to the labour ward to see a patient who is having generalised seizures 45 minutes after delivery under epidural anaesthesia. Possible causes of the convulsions include:

✓ Grand mal epilepsy and maternal hypoxia are causes of generalised
✓ seizures. Eclampsia can occur in the postpartum period. There is no
✓ indication when the previous dose of local anaesthetic has been
✗ given and this could also be a cause.
✓

103 A rapid shallow breathing pattern in the critically ill:

✓ The cause of rapid shallow breathing in the critically ill is unknown, although
✓ stretch receptor stimulation may be involved. It is a common cause
✗ of failure to wean from ventilation.
✗
✓

104 Fluoroquinolones:

✓ The spectrum of activity varies within the class of fluoroquinolones, but all
✓ are active against Gram-positive as well as Gram-negative bacteria.
✓ Many antibiotics when given orally are chelated by aluminium salts and are
✓ then not absorbed.
✓

105 Common side effects of intrathecal opioids in the management of acute postoperative pain include:

✓ Itching, hypoventilation and urinary retention are common side effects of
✗ intrathecal opiates.
✓
✗
✓

106 Side effects of amiodarone include:

✓ Although widely used, amiodarone causes a range of side effects, some
✓ of which are frequent and serious; although some reverse on stopping the
✓ drug, others are permanent.
✓
✗

107 Acute inversion of the uterus following delivery is directly associated with:

✗ Hypotension and bradycardia due to parasympathetic action and severe
✓ haemorrhage are all features of an inverted uterus.
✓
✗
✓

108 In a patient suffering from paroxysmal nocturnal dyspnoea the following signs would favour diagnosis of asthma rather than left ventricular failure:

✗ ✗ ✓ ✓ ✗ Expiratory wheeze is a sign of bronchospasm. Central cyanosis occurs later in left ventricular failure. A raised JVP, basal crepitations and hypotension are features of cardiac failure.

109 Trans-oesophageal echocardiography:

✗ ✓ ✓ ✓ ✓ Echocardiography cannot quantify intracardiac pressures but can image flow. It can help assess myocardial ischaemia and contractility by imaging motion of the walls of the heart. Ejection fraction can be estimated using the echocardiogram.

110 Morbid obesity:

✓ ✗ ✗ ✓ ✓ The blood volume is higher in morbidly obese patients, but on a weight-per-volume basis is lower: 50 versus 70 ml/kg. Oxygen flux is increased in obesity. Hypoxic pulmonary vasoconstriction is unaffected. Left ventricular hypertrophy is common because of the associated hypertension, and insulin resistance is associated with obesity.

111 In an otherwise normal person, chronic iron deficiency anaemia with a haemoglobin concentration of 60 g/L is associated with:

✗ ✓ ✗ ✓ ✗ The mixed venous PO_2 is reduced because less oxygen is available for delivery to metabolically active tissues. Heart rate increases to increase cardiac output to compensate for the reduced oxygen carriage. Metabolic acidosis does not occur because of compensatory mechanisms to maintain oxygen delivery. The left atrial PO_2 will be normal but the oxygen content will be reduced. The oxyhaemoglobin dissociation curve is shifted to the right to enable more oxygen to be off-loaded to the tissues.

112 The pulmonary artery wedge pressure is a good indicator of left ventricular end-diastolic pressure in patients suffering from:

✓ ✗ ✓ ✓ ✓ In mitral stenosis the left atrial pressure is greater than the LVEDP because of the resistance to flow through the valve.

113 The development of high titres of anti-D antibodies in a Rhesus negative mother with a Rhesus positive fetus:

✓ Haemolysis in the fetus causes anaemia and jaundice. The antigen is on
✓ the red cells and cannot enter the maternal circulation independently.
✓ The development of high titres usually occurs later in pregnancy.
✗
✗

114 An acutely developing blood coagulation defect associated with massive transfusion may be due to:

✓ Thrombocytopenia and deficiency of Factors V and VIII occur by dilution
✓ during massive transfusion. DIC and fibrinolysis can be precipitated
✓ by major haemorrhage and massive transfusion. Incompatible blood
✓ transfusion will cause a coagulopathy.
✓

115 Platelet concentrate:

✗ Platelet concentrate has a maximum shelf life of five days, and platelet
✗ function is best maintained at 22°C. Citrate is used as an
✓ anticoagulant. Cross-matching is not required routinely.
✗ Plasma histamine levels do not change significantly on administration.
✗

116 In pulmonary contusion there will be:

✓ Lung compliance is reduced with pulmonary contusion.
✓
✓
✓
✗

117 Recognised complications of bronchial neoplasms include:

✓ Bronchial neoplasms can secrete calcitonin, ADH and ACTH. They do not
✗ cause hyperkalaemia or hypothyroidism.
✓
✓
✗

118 The following symptoms strongly suggest a diagnosis of transient cerebral ischaemia:

✓ ✗ ✗ ✗ ✓

The predominant feature of transient ischaemic attacks is one of fleeting focal neurological dysfunction lasting minutes or hours. This would therefore rule out B, C and D.

119 A history of alcoholism is associated with:

✓ ✗ ✓ ✓ ✗

Alcoholics tend to be overweight but malnourished because alcohol is a good source of calories, but alcoholics tend otherwise not to eat well. They therefore have reduced plasma albumin concentrations. Usually, a mild macrocytic anaemia is seen, possibly due to direct effects of alcohol on the bone marrow rather than a vitamin deficiency. Alcoholics are at risk of hypotension due to a polyneuropathy causing impaired vasoconstrictor reflexes.

120 Effects of hypermagnesaemia include:

✓ ✓ ✗ ✗ ✓

Magnesium is the second most abundant cation of the intracellular space after potassium. Magnesium acts as a non-competitive inhibitor of the IP3-gated calcium channel and of IP3 binding, therefore it may be considered as an intracellular calcium antagonist. High magnesium concentrations inhibit the release of acetylcholine from the presynaptic nerve terminal and also have an inhibitory effect on the post-junctional potentials. It was thought that high magnesium concentrations potentiated the effect of depolarising muscle relaxants. However, a recent study has shown an antagonism of the block caused by suxamethonium. Hypermagnesaemia is associated with a shortened onset time and a reduced ED50 for most non-depolarising muscle relaxants. Magnesium is used as an antiarrhythmic agent and decreases myocardial excitability and contractility.

121 Bilateral hilar lymphadenopathy is a feature of:

✓ ✓ ✗ ✗ ✗

The usual diagnosis of bilateral hilar lymphadenopathy is sarcoid, but included in the differential diagnosis is lymphoma (both Hodgkin's and non-Hodgkin's) and tuberculosis (although here unilateral lymphadenopathy may be more usual).

122 A low fixed cardiac output is associated with:

✓ Cor pulmonale may be associated with a low cardiac output, but it is not
✓ fixed. Digoxin is an inotrope.
✓
✗
✗

123 Collapse of the lower lobe of the right lung is characterised by:

✓ Collapse of a lobe of a lung causes hypoxia and induces tachypnoea
✗ resulting in a decreased $PaCO_2$. Stony dullness to percussion is
✗ seen in consolidation rather than collapse.
✗
✓

124 A haemoglobin of 80 g/L with a reticulocyte count of 10% is associated with:

✗ Anaemia in the presence of a high reticulocyte count is seen in haemolysis
✗ and suggests active red cell regeneration in the presence of red-cell loss.
✗ Aplastic anaemia, untreated pernicious anaemia, polycythaemia and acute
✓ leukaemia are not associated with a high reticulocyte count.
✗

125 Causes of atrial fibrillation include:

✓ A, B and C are true. Rheumatic heart disease and thyrotoxicosis commonly
✓ cause atrial fibrillation. Atropine increases heart rate and may result in a sinus
✓ tachycardia but not atrial fibrillation.
✗
✗

126 There is a recognised association between ulcerative colitis and:

✓ Like many other conditions listed here, ulcerative colitis is a bowel
✓ manifestation of what may be a more generalised inflammatory
✓ state. The true cause of clubbing is still unknown.
✓
✓

127 Endocrine syndromes associated with primary bronchogenic carcinoma include:

✓ Bronchogenic tumours are known to secrete ADH, PTH and serotonin, with
✗ biochemical effects that may require treatment prior to anaesthesia
✓ and surgery. Normoglycaemia or rarely hypoglycaemia would be more
✓ likely.
✓

128 Signs of a successful stellate ganglion block may include:

✓ Anhydrosis and ptosis of the ipsilateral side of the face and relief of
✗ causalgia are signs of a successful block.
✓
✗
✗

129 In primary adrenocortical failure:

✓ Primary adrenocortical insufficiency, Addison's disease, results in decreased
✗ release of glucocorticoids and mineralocorticoids. Blood cortisol,
✗ sodium and glucose concentrations are low, while potassium and
✓ ACTH are high. A normal response to exogenous ACTH excludes the
✓ diagnosis of primary adrenocortical failure.

130 You would expect to find sensory changes in the following conditions:

✓ Poliomyelitis and motor neurone disease affect motor not sensory nerves.
✗ Carpal tunnel syndrome affects the entire nerve both motor and
✓ sensory fibres.
✗
✓

131 The metabolic response to major surgery includes:

✗ The stress response includes increased release of catecholamines,
✓ glucocorticoids and ADH. There is therefore water and sodium
✗ retention and blood glucose rises due to the anti-insulin effects of
✓ the steroids and catecholamines.
✓

132 An anaesthetic technique suitable for nasal septoplasty is likely to include the use of:

✓ A throat pack and south-facing RAE tube are usually used (reinforced L.MA
✗ is an alternative) and a nasal vasoconstrictor applied.
✓
✓
✗

133 Hepatitis B infection:

✗ Immunisation against Hepatitis B is mandatory and requires booster
✓ injections every five years. Transmission occurs via blood, seminal
✓ and vaginal secretions. Cirrhosis, chronic active hepatitis or liver
✓ carcinoma may supervene.
✓

134 Radiological evidence of enlargement of the pulmonary artery is a recognised feature of:

✓ Hyperdynamic right ventricular output resulting from left–right shunting
✓ leads to pulmonary hypertension and arterial enlargement. Pulmonary
✓ valve stenosis occurs in Fallot's tetralogy.
✗
✓

135 The following are recognised causes of thrombocytopenia:

✓ SLE leads to thrombocytopenia in 10% of cases. Hypersplenism in cirrhosis
✓ and infectious mononucleosis may cause thrombocytopenia in contrast
✓ to the situation after splenectomy.
✓
✗

136 The carcinoid syndrome is associated with elevated plasma levels of:

✗ Argentaffin cells in carcinoid tumours secrete vasoactive amines, including
✗ histamine, bradykinin and serotonin. Hepatic secondaries result in
✗ carcinoid syndrome.
✗
✓

137 Clinical findings consistent with persistent vomiting for two months include:

✓ Persistent loss of gastric secretions leads to dehydration and
✓ hypochloraemic alkalosis. Alkalosis can result in tetany and
✓ hypokalaemia. Lack of intrinsic factor in gastric secretions
✓ contributes to pernicious anaemia.
✓

138 Ankylosing spondylitis:

✗ The male:female ratio is about 4:1. Iritis occurs in up to 25% of cases. There
✓ is a predilection for the sacroiliac joints as well as the spine.
✓
✓
✓

139 The following may relieve severe pain from osseous metastases of carcinoma of the prostate:

✓ Androgen deprivation, achieved by orchidectomy or radiotherapy, is useful
✗ for local spread or metastatic spread. Stilboestrol is a useful palliative.
✓
✗
✓

140 Subarachnoid haemorrhage:

✓ Commonly occurs from rupture of a congenital aneurysm, possibly
✓ precipitated by physical strain, and causes a sudden large
✓ increase in ICP. It is twice as common in females as in males.
✗ Dehydration does not cause subarachnoid haemorrhage.
✗

141 Patients with acromegaly have a:

✗ Decreased sensitivity to insulin and diabetes mellitus is not uncommon.
✗ Overproduction of growth hormone is from an eosinophilic adenoma.
✓
✗
✓

142 In trigeminal neuralgia:

✗ The trigeminal nerve is the fifth cranial nerve and there is minimal sensory
✓ loss associated with the pain. The majority of cases are controlled with
✓ carbamazepine and glycerol is a neurolytic that can be used to
✗ ablate the Gasserian ganglion approached by the foramen ovale.
✗

143 Criteria for discharging an adult patient from the recovery area of a day-stay surgical unit include:

✓ Under current guidelines the return of cognitive skills, ability to pass urine
✗ and orientation in time and place are not essential prior to discharge from
✓ day-stay surgery units.
✗
✗

144 Applications of the Doppler effect in clinical practice involve measurement of a change in:

✗ ✗ ✓ ✗ ✗

The Doppler effect refers to ultrasonic waves not to electrical conductivity, frequency response of the arterial wall, temperature, or harmonic waves.

145 Gas properties that influence resistance during laminar flow include:

✗ ✓ ✗ ✗ ✗

Resistance during laminar flow depends on viscosity. Critical temperature, density, diffusion rate and molecular weight have no effect.

146 FEV1/FVC ratio measurement is useful in the detection of:

✗ ✗ ✓ ✗ ✗

Restrictive pulmonary lesions are detected from measurements of vital capacity. More complicated tests are required to measure functional residual capacity and elastic recoil of the lung. The FEV_1/FVC ratio is a measurement made on expiration.

147 Potential complications of radial artery cannulation for continuous measurement of arterial blood pressure include:

✓ ✗ ✓ ✗ ✓

Cerebral arterial emboli are caused by internal carotid or vertebral artery cannulation. Sensation of the thenar eminence is supplied by the median nerve. Pulmonary oedema is not associated with radial artery cannulation.

148 In cardiac output measurement by thermodilution:

✓ ✗ ✓ ✗ ✓

The thermistor is accurate to 0.1°C. Measurements are still accurate after 48 hours in situ. Measurements will tend to over-read during inspiration.

149 Carbon dioxide crosses biological membranes 20 times more readily than oxygen because carbon dioxide:

✗ The Reynolds number and molecular weight are not relevant to diffusion of
✓ gases. Carbon dioxide does not have an electric charge and is not
✗ actively transported across biological membranes.
✗
✗

150 Calculation of systemic vascular resistance requires measurement of:

✗ Systemic vascular resistance is calculated from the mean arterial pressure
✗ (some equations deduct the CVP first) divided by cardiac output
✓ Coronary blood flow, pulmonary artery pressure and rate of peripheral
✓ arteriolar flow are irrelevant.
✗

151 Helium:

✓ Helium is stored as a gas in cylinders and does not support combustion.
✗ It does not affect the work of breathing in bronchospasm because
✓ bronchospasm affects the smaller airways where flow is laminar.
✗
✗

152 In the newborn, a decrease in body temperature is accompanied by:

✓ The neonate is unable to shiver and produces heat by non-shivering
✗ thermogenesis, which involves the oxidation of triglycerides
✗ located in brown fat stores. This heat production requires an increase
✗ in basal metabolic rate. Hypothermia will lead to metabolic acidosis.
✗

153 The pneumotachograph:

✓ The pneumotachograph works by measuring pressure change across a
✓ resistance with laminar flow. It has a response time sufficiently rapid
✓ for breath-by-breath monitoring. Changes in gas composition will alter
✓ viscosity and may affect accuracy, as can temperature changes.
✗

154 Intraoperative heat loss due to convection may be minimised by:

✓ Increasing theatre humidity or humidifying inspired gases does not affect
✗ convection losses, only evaporation losses. Heated mattresses do
✗ not prevent convection losses from exposed body cavities. Evaporation
✗ of spirit from the skin is another form of evaporative heat loss.
✗

155 When the statistical P value is reported as being < 0.001:

✓ By convention any P value of less than 0.05 indicates rejection of the null
✗ hypothesis and that the difference between two sample means
✓ is statistically significant. This does not mean that the results are definitely
✗ clinically significant. The P value does not describe the distribution
✗ of the data.

156 In a patient undergoing spinal anaesthesia using hyperbaric bupivacaine for repair of an inguinal hernia, bilateral sensory block up to the level of the umbilicus may be associated with:

✓ The sympathetic block can exceed motor/sensory by two dermatomes
✓ Onset of motor blockade may take significantly longer than sensory block
✗ due to differential myelination of motor and sensory nerves. 10-15%
✓ of patients will experience bradycardia, Other potential side effects
✓ include hesitancy and urinary retention. Pruritis is associated with the use of spinal opioids not LA.

157 Measurement of peak expiratory flow rate:

✓ Peak expiratory flow rate can be calculated from the Vitalograph but this is
✗ not as accurate as the Wright peak flow meter. The Wright peak flow
✗ meter uses the principle of a variable orifice with a constant pressure
✗ drop. Peak expiratory flow rate cannot be measured using a capnograph.
✓

158 Class 1 indications for cardiac pacing include:

✗ Pacing is indicated in patients with third- or second-degree type 2 AV block
✗ irrespective of symptoms.
✗
✓
✓

159 The air in an operating theatre:

✗ The dew point must be at or below room temperature. Infrared analysers are
✗ not sufficiently sensitive to detect volatile agent concentrations in parts
✓ per million. Room air is one of the calibration points for oxygen
✗ analysers. The minimum number of air changes per hour is 20.
✗

160 The end-tidal partial pressure of carbon dioxide:

✓ Nitrous oxide absorbs infrared radiation and this will increase the reading
✓ on a capnograph if an inappropriate wavelength is used. It has the same
✗ molecular weight as carbon dioxide and this can lead to an
✗ overestimate of the measurement of carbon dioxide by mass
✗ spectrometry. Water vapour does not reduce the mass spectrometer reading for carbon dioxide. PEEP does not influence measurement of end-tidal carbon dioxide tension. End-tidal carbon dioxide tension can never exceedthe $PaCO_2$.

161 On the day of major abdominal surgery, a normal adult will have:

✗ 1.5 litres of 5% dextrose only provides 300 kcal whereas the normal calorie
✗ requirement (depending on sex and size) will be approximately
✗ 2000–3000 kcal. Daily potassium requirements are in the range
✓ of 1–2 mmol/kg. Two litres of Hartmann's only contains about 10 mmol
✗ K+. Maximum concentrating ability of normal adult kidneys is up to 1200 mOsm/L. Maintenance fluid requirements in the adult are about 2 ml/kg hr.

162 Likely findings in an elderly dehydrated patient with prolonged intestinal obstruction who is hypotensive, tachypnoeic and confused, breathing air include:

✓ Hypomagnesaemia is associated with gastrointestinal disease due to excess
✓ loss via gut secretions and associated NG drainage. Shocked patients
✓ usually have increased levels of insulin antagonists such as glucagon,
✓ cortisol and adrenaline. This results in hyperglycaemia. A high urea
✓ is a common accompaniment of dehydration.

163 Preoperative preparation of a patient with primary hyperparathyroidism will necessitate the use of:

✓ Primary hyperparathyroidism results in hypercalcaemia which antagonises
✓ ADH and results in sodium and water loss. Giving 0.9% sodium chloride
✗ will replace this loss, dilute Ca++, and also increase urine flow and
✗ Ca++ excretion. It is recommended that urine output be maintained at
✗ 200–300 ml/hr in the adult, and this is best achieved by judicious use of fluids alongside diuretics such as furosemide.

164 Airway characteristics of an adult with acromegaly include:

✗ Patients with acromegaly actually have decreased airway patency and
✓ hypertrophy of the mucosa of the nasopharynx which are
✗ overdeveloped, not underdeveloped. The larynx is frequently
✗ narrowed with subglottic stenosis – a common feature leading to
✓ difficulty of passage of endotracheal tubes.

165 The success of cricoid pressure in preventing aspiration into the lungs during a rapid sequence induction depends upon:

✓ The use of cricoid pressure in preventing aspiration is dependent upon
✓ adequate compression of the oesophagus against a vertebral
✓ body to prevent passive regurgitation. An incomplete cricoid cartilage or
✓ presence of a nasogastric tube will prevent adequate compression of
✗ the oesophagus. Pre-oxygenation has no effect on preventing aspiration.

166 Airway obstruction at the tracheal level may be caused by:

✓ Tracheomalacia, vascular rings, post intubation tracheal stenosis and cystic
✓ hygroma can all cause airway obstruction.
✓
✓
✗

167 Features of pulmonary function after upper abdominal surgery include:

✓ Functional residual capacity is markedly decreased following upper
✗ abdominal surgery, even with effective pain relief. Respiratory rate
✗ is increased and the shift of the majority of ventilation to the apices of
✓ the lungs is due to reduced functional residual capacity with a resulting
✓ decrease in compliance of the alveoli at the lung base.

168 In induced hypothermia:

✓ Hypothermia decreases anaesthetic requirements. Ventricular fibrillation
✗ does not usually occur until core temperature reaches approximately
✗ 28°C. There is a paradoxical increase in urine output (cold diuresis) due
✓ to decreased renal tubular reabsorptive capacity. Oxygen dissociation
✗ curve is shifted to the left in hypothermia.

169 To repair lacerations on the palm of the hand the following nerves must be blocked:

✗ The ulnar and median nerves supply the palm of the hand.
✓
✗
✓
✗

170 Compartment syndrome:

✗ Compartment syndrome can occur in any extremity (both upper and lower),
✗ where there are deep fascial compartments. Absence of sensation to
✓ light touch, paraesthesia and pain on passive muscle movement are
✗ characteristic presenting features. Loss of distal pulses is a very
✓ late clinical sign and thus pulses may still be present long after significant tissue and muscle necrosis has occurred.

171 Fat embolism syndrome:

✓ Hypoxaemia often presents before clinical signs of respiratory distress.
✓ Petechial rashes are a hallmark of FES and may also be seen in the retina.
✓ FES is much more common following long-bone fractures (eg, lower limb).
✗ Although isolated cases of cerebral FES are described with focal
✓ neurological signs, they are uncommon.

172 Nitric oxide:

✓ Nitric oxide is synthesised from arginine in a reaction catalysed by nitric
✗ oxide synthase. Nitric oxide stimulates guanylyl cyclase, which increases
✓ cGMP resulting in a fall in intracellular calcium concentration and
✗ relaxation of bronchial smooth muscle.
✓

173 In patients with compartment syndrome:

✗ ✓ ✓ ✗ ✗

Paralysis is a late sign and splintage should be removed. Low systemic blood pressure, increased tissue pressures and myoglobinuria are features of compartment syndrome.

174 Acupuncture produces:

✗ ✗ ✓ ✗ ✗

Acupuncture affects the CSF concentrations of endorphins, dynorphin and encephalin. It produces an increase in adrenocorticotrophic hormone and a decrease in circulating substance P. It can cause local histamine release.

175 The radial nerve:

✓ ✗ ✓ ✗ ✓

The deltoid muscle is innervated by the axillary nerve (C5, C6). The radial nerve has important cutaneous branches which supply sensation to most of the dorsum of the hand.

176 In the fetal circulation:

✓ ✓ ✗ ✗ ✓

There is one umbilical vein. Approximately 50% of the blood returning to the fetus passes through the fetal liver. The remaining 50% passes through the ductus venosus to the inferior vena cava.

177 Pain in the area of an upper arm tourniquet is mediated via the:

✓ ✗ ✗ ✓ ✗

Cutaneous branches of the circumflex nerve innervate the skin overlying the lower part of the deltoid muscle. The posteromedial aspect of the upper arm is innervated by the intercostobrachial nerve.

178 Angiotensin converting enzyme inhibitors cause:

✓ ✓ ✗ ✓ ✓

ACE inhibitors do not increase total body water.

179 Hepatic blood flow decreases:

✓ Hepatic oxygen extraction is limited by the reduction in hepatic blood flow.
✗
✓
✓
✗

180 The following are true of the use of dibucaine in the detection of abnormal serum cholinesterase:

✓ The dibucaine number is approximately 20 in patients who are homozygous
✓ for the atypical enzyme.
✗
✓
✓

Single best answer – Paper 1

Question 1

A neonate, born at 28 weeks gestation and now six weeks old, develops apnoeic episodes following an inguinal herniotomy performed under general anaesthesia.

Which of the following blood results/vital signs are LEAST likely to be associated with apnoeic spells in this age group?

a blood glucose 1.7 mmol/L
b core temperature 35.2°C
c core temperature 39.5°C
d **haemoglobin 115 g/L**
e serum ionised calcium 0.8 mmol/L

Hyperthermia, hypothermia, hypoglycaemia and hypocalcaemia are all associated with apnoeic episodes in preterm infants Although the haemoglobin is below normal for a neonate, at this level it is unlikely to be associated with apnoea.

Question 2

A 37-year-old man has an uneventful total colectomy performed under GA. Surgery, lasting five hours, was performed in the Lloyd Davies position. One hour postoperatively, with a 0.1% L-bupivacaine thoracic epidural infusion in progress, he has no abdominal pain but does have pain in both calves. There are decreased lower limb movements bilaterally with reduced pinprick sensation in all dermatomes below the knees.

What is the most appropriate initial investigation in this scenario?

a **compartment pressure measurement in both calves**
b Doppler arterial pulse measurement in both legs
c electromyography of leg flexor and extensor muscles
d magnetic resonance imaging of the thoracolumbar spine
e ultrasound scan of deep venous system in both calves

Compartment syndrome is a well described complication following prolonged surgery in the Lloyd Davies position. Breakthrough pain in the calves despite a functioning epidural is an important clue. The neurological findings do not suggest spinal cord compression, so MRI & EMG are not indicated. Bilateral dee-vein thromboses are highly unlikely.

Question 3

A previously fit 54-year-old woman presents to the emergency department with severe sore throat and increasingly noisy breathing for the past 12 hours. She finds it difficult to swallow her saliva and cannot tolerate lying flat. Her tympanic temperature is 39.2°C, pulse rate 110 beats/min, BP 130/85 mmHg and SPO_2 92% on 35% oxygen via face mask. There is marked inspiratory stridor.

What is the most appropriate management plan?

a administer intravenous steroids and antibiotics, nebulised adrenaline and high-flow oxygen by CPAP face mask in a high-dependency area
b after direct examination of the oropharynx, the patient should have blood cultures taken, receive oral antibiotics, high-flow oxygen and be observed in a high dependency area
c the airway should be secured by awake fibreoptic intubation under local anaesthesia, followed by admission to an intensive care unit
d **the airway should be secured by tracheal intubation following direct laryngoscopy under deep inhalational anaesthesia**
e the patient should be transferred, fully monitored, to the operating theatre for immediate tracheostomy under local anaesthesia

The clinical picture is highly suggestive of inflammatory upper airway obstruction, most probably acute epiglottitis. The patient needs to have their airway secured by intubation. Deep inhalational anaesthesia is the safest technique in this scenario. An awake fibreoptic technique may result in acute airway obstruction or laryngeal spasm in this situation.

Question 4

A seven-year-old child weighing 24 kg is having squint correction surgery under general anaesthesia. During the procedure, his heart rate falls abruptly to 45 beats per minute and his blood pressure is 70/40 mmHg.

What is the most appropriate initial action to take?

a **ask the surgeon to release the globe of the eye**
b give atropine 480 µg intravenously
c give ephedrine 6 mg intravenously
d give glycopyrollate 240 µg intravenously
e reduce the inspired concentration of sevoflurane

Severe bradyarrythmias due to the oculocardiac reflex are a potential problem with squint surgery. Releasing traction on the eye is the first action to take, followed by a bolus of an anticholinergic agent to obtund the reflex.

Question 5

A 45-year-old woman with a past history of mild asthma and anxiety undergoes left shoulder arthroscopic surgery under interscalene brachial plexus block. Postoperatively she complains of dyspnoea and light headedness. Breath sounds are slightly reduced on the left side of the chest. SpO_2 92% (on air), BP 110/70 mmHg and peak flow 290 L/min. A standard portable chest x-ray appears normal.

What is the most likely cause of her symptoms?

a exacerbation of asthma
b **left phrenic nerve palsy**
c left recurrent laryngeal nerve palsy
d psychogenic dyspnoea
e subarachnoid local anaesthetic injection

The clinical signs and slightly reduced peak flow do not suggest an exacerbation of asthma. Recurrent laryngeal nerve palsy can complicate interscalene blockade but would cause hoarseness rather than dyspnoea. Psychogenic dyspnoea is a possibility but does not account for the low SpO_2. The time scale of symptoms does not fit with subarachnoid injection. Phrenic nerve palsy would account for all her symptoms and signs. NB, an inspiratory CXR is required to demonstrate a raised hemidiaphragm with phrenic nerve palsy.

Question 6

A 72-year-old man is ventilated on the intensive care unit (ICU) four hours following elective coronary artery bypass surgery. His pulse is 110 beats/min, BP 85/45 mmHg, CVP 17 mmHg, urine output 25 ml/hr in the previous two hours and tympanic temperature 37.6°C Heart sounds are difficult to hear but breath sounds are normal. A 12-lead ECG is unchanged from preoperatively.

What is the most likely cause of the patient's current clinical condition?

a developing septic shock
b hypovolaemia
c myocardial ischaemia
d **pericardial tamponade**
e tension pneumothorax

In the context of postoperative cardiac surgery, pericardial tamponade is the most likely explanation of the patient's clinical signs and cardiovascular parameters.

Question 7

A 56-year-old woman who had a total colectomy develops a tachyarrhythmia 12 hours post operatively on the high-dependecny unit (HDU). She has a past history of hypertension treated by bendroflumethiazide but no history of cardiac problems.

Which of the following serum electrolyte abnormalities is the most likely to contribute to the arrhythmia?

a ionised calcium 1.88 mmol/L
b **magnesium 0.38 mmol/L**
c phosphate 0.58 mmol/L
d potassium 3.4 mmol/L
e sodium 129 mmol/L

The patient has significant hypomagnesaemia, probably due to diuretic therapy, and this is the most likely exacerbating factor for the development of an arrhythmia in this case. The serum potassium is only just below the normal range, so unlikely to be the main precipitant.

Question 8

You need to anaesthetise a woman who does not speak English, for a category 3 caesarean section.

What is the best way to take a history and provide information to this patient?

a **a professional telephone translation service**
b the obstetric registrar who has some understanding of the patient's language
c the patient's husband who has a limited command of English
d the patient's 11-year-old daughter who is bilingual
e written translated materials

Family members (especially children) or those with a limited command of the languages required should not be used for medical translation purposes other than in an emergency. We do not know if the patient can read or what she understands if she can. Unless a professional translator is available in person then the telephone help line would be the best option.

Question 9

A 10-month-old apparently well infant presents for religious circumcision under GA. Routine examination reveals a soft systolic murmur; the rest of the examination is normal.

The most appropriate action to take is:

a postpone surgery and obtain an urgent cardiac echocardiogram
b **postpone surgery and refer the child back to the GP**
c proceed with anaesthesia because this is an 'innocent' murmur
d proceed with anaesthesia giving antibiotic cover
e proceed with surgery under local anaesthesia

A cardiac murmur in a child below one year cannot be dismissed as innocent without an echocardiogram. The case is not urgent and the child is well, so it should be referred back to the GP to organise a cardiology outpatient referral.

Question 10

You administer a general anaesthetic to a previously fit young man for arthroscopic repair of a ruptured left anterior cruciate ligament. The thigh tourniquet was inflated to 200 mmHg above the systolic blood pressure for 110 minutes. Postoperatively, he complains of paraesthesia in his left calf and sole of the foot.

Which of the following is the single most likely cause of the paraesthesia?

a compartment syndrome in the thigh
b **compression injury to the sciatic nerve**
c deep venous thrombosis in the calf
d ischaemic injury to the calf muscles
e pressure injury from the edge of the operating table

DVT is unlikely, as is calf muscle ischaemia or compartment syndrome after less than two hours tourniquet time. Paraesthesia in the sciatic nerve distribution is more likely to be due to tourniquet compression than neuropraxia from the operating table.

Question 11

A 40-year-old man is scheduled for an elective craniotomy. You commence intravenous induction with thiopentone but after injecting 100 mgs the patient complains of an intense burning pain in his hand associated with blanching of the fingers.

What is the most important next step to take in managing this situation?

a arrange for a stellate ganglion block to be performed in the affected limb
b insert an IV cannula in the contralateral limb and administer opioid analgesia
c insert an IV cannula in the contralateral limb and administer papaverine
d **leave the IV cannula *in situ* and flush with heparinised saline**
e remove the IV cannula, apply local pressure and elevate the limb

The history is highly suggestive of intra-arterial injection of thiopental. The priority is to dilute the irritant by flushing the vessel with isotonic or heparinised saline.

Question 12

A 75-year-old man is scheduled for a total knee replacement under general anaesthesia supplemented by a femoral nerve block for perioperative analgesia.

What is the most effective way to reduce the likelihood of local anaesthetic toxicity during placement of the block?

a adding a vasoconstrictor to the local anaesthetic
b **injecting the local anaesthetic slowly and aspirating at regular intervals**
c monitoring the patient with ECG, SpO_2 and non-invasive blood pressure measurement
d not exceeding the maximum permissible dose of local anaesthetic
e using a nerve stimulator to guide block placement

Answer B is the correct answer because it is the only option that allows inadvertent intravascular injection to be detected. A and D are more related to toxicity due to absorption, which would occur later. C is about detecting effects of toxicity. E could allow use of lower doses of LA and theoretically should make intravascular injection less likely but is not as reliable as B

Question 13

A 60-year-old man is scheduled for a palmar fasciectomy. He has angina, with several episodes of chest pain each week and says that he is 'allergic to local anaesthetics'. 15 years ago he had a local anaesthetic block at the dentist, following which he developed palpitations and became very anxious for 10-15 minutes.

Which is the most likely explanation for his previous experience at the dentist?

a **adverse reaction to adrenaline absorbed from the local anaesthetic solution**
b anaphylactic reaction to a preservative in the local anaesthetic solution
c episode of angina brought on by the stress of the situation
d systemic toxicity due to accidental intravascular injection of local anaesthetic
e systemic toxicity due to overdose of local anaesthetic

Most patients with 'LA allergy', particularly after dental surgery, are describing the effects of systemic absorption of adrenaline. It is highly unlikely that enough LA would be injected for a dental block to cause an overdose. Allergy to amide LAs (or their preservatives) is very rare and the symptoms here are not suggestive of an allergic reaction. Although intravascular injection of LA is a possibility his symptoms do not indicate systemic toxicity.

Question 14

An otherwise fit 80-year-old man had uneventful resection of a bladder tumour under general anaesthesia. A three-way irrigating urinary catheter is inserted at the end of the procedure. In recovery, he looks pale and has severe abdominal discomfort. His pulse rate is 48 beats/min and blood pressure is 75/30 mmHg. The drained irrigating fluid appears clear.

What is the most appropriate action that would resolve the clinical situation in this patient?

a atropine 0.3 mgs IV bolus
b ephedrine 6 mgs IV bolus
c **flush the 3–way catheter**
d morphine 5 mgs IV bolus
e rapid infusion of 500 ml 0.9% saline

The combination of bradycardia, hypotension, abdominal pain and clear bladder drainage fluid suggests that the patient has bladder clot retention resulting in a vaso-vagal episode. Flushing the catheter is the only action which will resolve this situation.

Question 15

A patient develops anaphylactic shock shortly after induction of general anaesthesia and is treated with intravenous adrenaline and makes an uneventful recovery.

Which is the best explanation of the therapeutic action of adrenaline in the treatment of anaphylaxis?

a causes increased myocardial contractility and bronchodilation
b causes increased myocardial contractility and tachycardia
c **causes peripheral vasoconstriction and decreases mast cell degranulation**
d causes peripheral vasoconstriction and increased myocardial contractility
e causes tachycardia and decreases mast cell degranulation

Decreased mast cell degranulation and peripheral vasoconstriction are the two most important therapeutic actions of adrenaline in the treatment of anaphylaxis.

Question 16

A previously fit 60-year-old woman is oliguric (<0.5 ml/kg/hr) 48 hours after a laparotomy for colonic carcinoma. Laboratory testing of her urine reveals the following:

Specific gravity = 1.020
Sodium 2 mmol/L
Osmolarity 600 mOsm/L

What is the most likely diagnosis?

a acute tubular necrosis
b analgesic nephropathy
c **hypovolaemia**
d renal calculi
e bilateral ureteric injury

Answer C is the correct answer. These urinary indices, with a high specific gravity, low sodium and high osmolarity, are indicative of pre-renal impairment. Hypovolaemia is the only pre-renal cause of the options provided.

Question 17

A 59-year-old man with a caecal carcinoma requiring a right hemicolectomy has been referred for preoperative assessment. Following an episode of crescendo angina three months previously, he had a coronary angioplasty and multiple coronary stent insertion. He is currently well with no further angina and he is taking aspirin and clopidogrel.

What would be the most appropriate management plan for this patient?

a continue both antiplatelet drugs and give a preoperative platelet transfusion
b postpone surgery until he has completed his antiplatelet therapy
c **schedule urgent surgery and continue both antiplatelet drugs perioperatively**
d stop aspirin for seven days preoperatively but continue clopidogrel
e stop clopidogrel for seven days preoperatively but continue aspirin

Delaying surgery, possibly for many months, is not realistic when treating malignant disease. He is at higher risk of a perioperative MI if anti-platelet therapy is stopped (due to stent occlusion) than postoperative bleeding. This can be treated with a platelet transfusion if it occurs rather than giving platelets preoperatively.

Question 18

A 64-year-old man with a BMI of 41 kg/m^2 had a laparotomy for resection of hepatic metastases one hour ago. In the recovery room his SpO_2 is 85% breathing room air, but 98% when supplemental oxygen is delivered by nasal prongs at 2 L/min.

Which is the most likely explanation for his current respiratory status?

a alveolar atelectasis
b **alveolar hypoventilation**
c diffusion hypoxia due to nitrous oxide use
d residual inhalational anaesthesia
e residual neuromuscular blockade

Postoperative hypoxaemia is most commonly caused by alveolar hypoventilation, causing a rise in alveolar carbon dioxide. This results in a decrease in the alveolar partial pressure of oxygen, causing peripheral oxygen desaturation. Significant alveolar atelectasis causes true shunt which is not easily improved by inhaled supplemental oxygen administration. C, D and E are unlikely to be significant factors one hour after surgery.

Question 19

Lumbar chemical sympathectomy has a variety of potential therapeutic indications.

Which condition has the best chance of sustained improvement with this technique?

a complex regional pain syndrome type 1
b hyperhydrosis
c intermittent claudication
d **ischaemic rest pain in the foot**
e venous ulceration around the ankle

Lumbar sympathectomy can make intermittent claudication worse due to shunting of blood from muscle to skin. Venous ulceration responds poorly (but arterial ulceration well). Sympathectomy results for CRPS are inconsistent and often temporary. Hyperhydrosis does respond but the duration of relief is often transient. Ischaemic rest pain will usually reduce following a chemical sympathectomy (but not the pain from dead tissue!).

Question 20

An 18-year-old male patient is admitted to a district hospital with an isolated severe head injury and is promptly intubated, ventilated and sedated. Soon afterwards his SpO_2 is 99% (FiO_2 0.5), $ETCO_2$ 4.5 kPa, BP 200/120 mmHg, pulse 44 beats/min and he has a fixed dilated left pupil.

What is the most appropriate next action to take?

a actively cool the patient to 35°C
b arrange an urgent head CT scan
c arrange transfer to the nearest neurosurgical unit
d **give an intravenous bolus of mannitol 0.5 g/kg**
e insert an arterial line

The patient is showing signs of severely raised ICP with a marked Cushing's response. Although all of the options are useful in the management of this patient, measures to reduce ICP are urgently required if coning is to be prevented.

Question 21

You are called to the emergency department to see a previously well 20-year-old woman who has been admitted following a grand mal fit outside a nightclub. After administration of lorazepam she stops fitting and is now not responsive to commands. Her SpO_2 is 94% on air and blood glucose is 4.5 mmol/L. No other history is available.

What is the next most useful investigation you would perform on this patient?

a arterial blood gases
b blood alcohol level
c drug toxicology screen
d full blood count
e **serum electrolytes**

A grand mal fit in a previously well patient is unlikely to be due to deranged blood gases or acute alcohol intoxication. Although a toxicology screen would be useful it will take some time to perform. An obvious cause of convulsions has been excluded by a normal blood glucose result. Hyponatraemia secondary to ecstasy ingestion should be considered in this clinical scenario and can be quickly excluded by measuring the serum electrolytes.

Question 22

A 78-year-old woman has had severe, lancinating episodes of pain below the right eye for four months which are sometimes triggered by face washing. Carbamazepine in full doses has produced little improvement in her pain. She has a past history of hypertension and transient ischaemic episodes.

What therapeutic intervention should be considered next?

a amitriptyline
b **gabapentin**
c microvascular decompression surgery
d rhizolysis of the trigeminal ganglion
e slow-release oral morphine

After failure of the first-line treatment for trigeminal neuralgia, gabapentin or microvascular decompression would be the options. In view of the patient's co-morbidities a non-operative approach would be more appropriate for this patient.

Question 23

A previously fit 70-year-old man undergoes radical neck dissection for malignant disease. The patient is stable until the surgeon dissects the tumour away from the carotid sheath. Suddenly, the systolic BP falls from 110 mmHg to 60 mmHg, heart rate increases to 110 beats/min, SpO_2 falls to 87% and end-tidal CO_2 concentration falls to 1.9 kPa.

What is the most likely cause for the change in vital signs?

a anaphylactic shock
b carotid sinus manipulation
c myocardial ischaemia
d tension pneumothorax
e **venous air embolism**

Venous air embolism during dissection around the carotid sheath, which contains the internal jugular vein, is the mostly likely cause of the patient's deterioration in this scenario. The patient is likely to be in the head-up position, which will increase the risk of air embolism.

Question 24

A previously fit five-year-old child is distressed and in severe pain in the recovery room following emergency appendicectomy. He is awake and cardiovascularly stable. Intraoperatively, he received fentanyl 3 µg/kg IV, paracetamol 15 mg/kg IV and diclofenac 1 mg/kg PR.

What would be the most appropriate management option now?

a administer Entonox until the child's mother arrives
b commence a nurse-controlled analgesia (NCA) pump using morphine
c dihydrocodeine 1 mg/kg intramuscularly
d dihydrocodeine 1 mg/kg orally
e **morphine 0.1 mg/kg IV bolus**

The child requires intravenous analgesia – commencing an NCA without a loading dose will be ineffective. The intramuscular route is inappropriate for a paediatric patient. Oral medication may not be absorbed due to postoperative ileus.

Question 25

A 26-year-old primigravida (BMI = 47) with a twin pregnancy is in established labour at 38 weeks gestation. She requests an epidural for pain relief, but on inserting the epidural needle at L3 – L4 an accidental dural puncture occurs.

What is the most appropriate action to take?

a abandon the epidural and use inhalational analgesia
b abandon the epidural and use opioid-based analgesia
c **insert the epidural catheter intrathecally and use it for spinal analgesia**
d perform an epidural blood patch to prevent post-dural puncture headache
e resite the epidural at an adjacent spinal interspace

A regional block is needed for labour analgesia and the increased possibility of instrumental/operative delivery in the presence of a multiple pregnancy. A further attempt at inserting an epidural is likely to be difficult in view of the patient's high BMI. An epidural blood patch may be required but not during labour.

Question 26

A 70-year-old woman had a gastrectomy 48 hours ago and she has a thoracic epidural for postoperative analgesia which is functioning well. Warfarin, for atrial fibrillation, was stopped seven days ago and she was converted to low molecular weight heparin. Clotting studies and platelet count are in the normal range. Today she is noted to have a white, cold left leg.

What is the most appropriate initial management?

a **Doppler studies of the arterial supply of the left leg**
b increase the dose of low molecular weight heparin
c organise an urgent MRI scan of the spine
d top up the epidural with her lying on the left side
e ultrasound of the deep veins of the lower limbs

The patient's history of AF and the clinical findings are highly suggestive of an arterial embolus. The clotting studies are normal, which indicates that the heparin dosage is sub-therapeutic, and this has predisposed to the risk of arterial embolism. The priority is to confirm the diagnosis with Doppler studies.

Question 27

A 64-year-old man presents to the emergency department with an exacerbation of COPD.

His arterial blood gases breathing air show the following:

pH	7.30
pO_2	5.5 kPa
pCO_2	7.5 kPa
HCO_3	35 mmol/L
Hb	185 g/L

Which is the most appropriate device to initiate oxygen therapy?

a Hudson mask
b medium concentration mask
c nasal prongs
d non-rebreathing reservoir mask
e **Venturi mask**

The patient's blood gases, with raised bicarbonate and high haemoglobin, indicate that he has long-term severe hypoxaemia and normally retains CO_2. He needs to use a fixed-performance device to ensure that he receives a controlled amount of oxygen as too much oxygen could result in a loss of hypoxic drive and worsening respiratory failure. The Venturi mask is the only fixed-performance device listed.

Question 28

A 35-year-old male suffered a severe isolated traumatic brain injury 10 days ago. There is no neurological recovery or respiratory effort 48 hours after cessation of propofol sedation and neuromuscular blockade with atracurium. The serum sodium concentration is 152 mmol/L, core temperature is 37.5°C; serum glucose concentration is normal. The patient's family know that brain stem death is suspected.

What is the most appropriate action to take now?

a **consult the organ donor register**
b cool the patient to 36.5°C
c perform an EEG
d reduce serum sodium below 152 mmol/L
e undertake brain stem death tests

The patient has a mild degree of hypernatraemia, which is an effect rather than the cause of brain-stem death and would not be responsible for the extreme neuro-disability seen in this patient. Mild hyperthermia is not a contraindication to brain-stem testing. EEG testing is not part of the brain stem death assessment protocol in the UK.

Question 29

A 70-year-old patient with a long history of severe depression and hypertension is admitted as an emergency with severe peritonitis. He is taking bendroflumethiazide, enalapril and phenelzine. During laparotomy, his blood pressure falls to 65/30 mmHg and heart rate rises to 100 beats/min. There is no cardiovascular improvement in response to a fluid bolus which raises the CVP to +10 mmHg.

Which is the most appropriate initial pharmacological intervention?

a ephedrine
b metaraminol
c noradrenaline
d **phenylephrine**
e vasopressin

The patient is taking phenelzine, which is an MAOI antidepressant. Drugs with indirect sympathomimetic action are contraindicated in the presence of MAOIs – this excludes ephedrine and metaraminol. Vasopressin and noradrenaline, although both directly acting vasoactive drugs, would not be considered as first line as they would need to be given as an infusion which would take some time to prepare. A bolus of phenylephrine would be the most appropriate initial response for this severely hypotensive patient.

Question 30

A 19-year-old man is listed for a cervical lymph node biopsy after a six-week history of generalised lymphadenopathy and intermittent pyrexia. He is breathless on mild exertion and needs to sleep with four pillows.

Which is the most important preoperative investigation that will influence your anaesthetic management?

a **chest X-ray**
b CT scan of the neck
c full blood count
d flow volume loops
e spirometry

The clinical picture indicates a lymphoproliferative malignancy, and orthopnoea suggests significant mediastinal involvement, which has major implications for safe general anaesthesia. A CXR would the most useful investigation to initially assess the extent of mediastinal disease. This is a good example of a question where a candidate may be unsure of the correct response because they are looking for a more complete answer such as asking for a CT chest. However, this is not one of the options, and of the responses available, a chest x-ray is likely to give the most information.

Single best answer – Paper 2

Question 1

You are performing a percutaneous (dilational) tracheostomy on an ITU patient as an aid to weaning from mechanical ventilation. A more junior colleague is assisting with a bronchoscope. On passing the guidewire down the seeker needle cannula it becomes apparent that the cannula and guidewire can no longer be seen within the trachea.

The most appropriate action at this point is to:

a leave cannula and wire *in situ* and call for surgical assistance
b **remove the cannula and wire, abandoning/deferring the procedure**
c remove the cannula and wire and call for surgical assistance
d remove the cannula and wire and repeat attempted access of the airway
e remove the wire and check whether air can be aspirated from the cannula

A percutaneous tracheostomy is an entirely elective procedure in this setting, so successful completion is not urgent. Dangers associated with the procedure include making a false passage and damage to other tissues in the neck. Successful cannulation of the upper trachea close to the midline is an essential initial step, and the success of the procedure hinges upon it. Passage of the cannula and guidewire into a place unknown increases that risk. This risk will be minimised by abandoning/deferring the procedure, returning to conventional oro-tracheal tube ventilation and re-assessing the patient. There is no apparent need for surgical assessment or intervention acutely.

Question 2

In an anaesthesia pre-assessment clinic, you are seeing a patient listed for an elective open aortic abdominal aneurysm repair. The referring team suspect a diagnosis of significant obstructive sleep apnoea and your assessment has included the STOP-BANG questionnaire along with usual history and examination. The results of a sleep study are also available to you.

The finding of greatest overall concern to you is:

a a body mass index (BMI) of 36 kg/m^2
b a history of observed apnoeic episodes in sleep
c an Apnoea-Hypopnoea Index (AHI) of 18
d collar size 17 (neck circumference 43.2 cm)
e **Mallampati score 3**

Though all are recognised risk factors for major surgery, E is the most significant. A Mallampati score of 3 suggests likely difficult airway, problems with intubation, and contribution to a risk of postoperative airway obstruction and/or OSA.

Question 3

A 22-year-old student with Brugada syndrome requires open reduction and fixation of his right humerus. His preoperative electrolytes are within the normal ranges. Anaesthesia is induced with fentanyl, propofol and rocuronium, and his lungs are ventilated in air, oxygen and isoflurane.

After skin incision, his ECG shows ST segment elevation and polymorphic ventricular tachycardia.

The most appropriate action would be:

a administer amiodarone
b administer calcium chloride
c **administer isoprenaline**
d administer quinidine
e stop isoflurane and maintain anaesthesia with propofol

Isoprenaline is the most appropriate treatment as it increases heart rate, reverses ST elevation and suppresses ventricular arrhythmias. Amiodarone is an antiarrhythmic but tends to worsen the Brugada pattern. Quinidine is given prophylactically. Stopping isoflurane is a possibility but is not the best available response. In Brugada syndrome, hypercalcaemia tends to exacerbate the arrhythmia.

Question 4

You have been asked to transfer a sedated and ventilated woman from your local hospital to a neurosurgical centre, which is 50 miles away. At a rate of 12 breaths per minute, the lungs are ventilated with a tidal volume of 500 ml. The fractional inspired oxygen concentration is 60% and the ventilator consumes additional oxygen of 2.4 litres per minute. On average, the paramedic crew drives at 60 miles per hour for this journey.

For this journey, the minimum portable oxygen volume that is most likely to be recommended is:

a 300 litres
b 420 litres
c **600 litres**
d 840 litres
e 900 litres

At an average speed of 60 mph, it would take 50 minutes to travel 50 miles.
Patient's oxygen consumption = 0.5 x 12 x 0.6 = 3.6 litres per minute
Ventilator oxygen consumption = 2.4 litres per minute
Total oxygen consumption = 3.6 + 2.4 = 6.0 litres per minute
Total oxygen consumption in 50 minutes = 6 x 50 =300 litres

You would recommend a minimum of 2 x 300 = 600 litres to account for delays.

Question 5

After a failed attempt at instrumental delivery a 28-year-old nulliparous woman is taken to theatre for a lower segment caesarean section (LSCS). A spinal anaesthetic is easily inserted and the operation begins. The surgeons now ask for uterine relaxation to be given as the baby's head is too far into the pelvis.

What would be the most appropriate first line of action?

a administration of intravenous nebulised salbutamol
b administration of intravenous magnesium infusion
c administration of intravenous terbutaline increments
d **administration of sublingual glyceryl trinitrate (GTN) spray**
e conversion of spinal to a general anaesthetic

Option A, B and C would be useful but would take a longer time to administer than a GTN spray. Option E would be effective but wouldn't be the first line if the baby was stable.

Question 6

A 15-year-old girl presents for evacuation of retained products of conception after a spontaneous miscarriage. She has presented at the surgical unit without a parent and is refusing to let you contact them. She seems to have capacity to understand the nature of the planned procedure and the complications.

What is the most appropriate course of action?

a complete a lack of capacity consent form with the surgeon and anaesthetist
b contact the Court of Protection for the authority to treat the child in their best interests
c **continue with the surgery with the child's consent**
d reschedule the surgery after a parent has consented
e telephone a parent to obtain consent

Children under the age of 16 are not presumed to have capacity to consent to treatment, unless the doctor decides that the child 'has sufficient intelligence and understanding to appreciate fully what is proposed' (ie, 'Gillick competence'). The degree of understanding they will need to show will vary depending upon the nature of the procedure and the severity of the condition being treated. A capable child should understand the treatment and its effects, and the consequence of non-treatment. Capable children should be encouraged to inform their parents about treatment, but the doctor must still respect their right to confidentiality and a refusal to permit disclosure to the parents.

Question 7

A 78-year-old obese woman is having an elective laparoscopic cholecystectomy.

Which of the following is most likely to be responsible for the risk of her developing postoperative cognitive dysfunction (POCD)?

a abdominal surgery
b administration of ondansetron
c BMI >30 kg/m^2
d general anaesthesia
e **previous history of stroke**

Risk factors for developing POCD include increasing age, fewer years of education, postoperative delirium, the use of sedative drugs, depression, previous stroke, postoperative infection and postoperative pulmonary complications.

Question 8

With regards to postoperative nausea and vomiting, the most significant risk factor is:

a gynaecological surgery
b **non-smoking status**
c otological surgery
d use of neostigmine
e use of nitrous oxide

There is insufficient evidence to conclude that neostigmine increases the risk of PONV. Some studies have shown that gynaecological, ophthalmological, otological, and thyroid surgery can each increase the risk of PONV. However, large prospective trials that used multivariable analysis to identify PONV risk factors found no such associations. In general, the type of surgery cannot provide reliable, reproducible, and clinically relevant information for assessing the patient's risk of PONV in adult patients. N_2O increases relative risk by 1.4 (less than previously thought). Non-smoking status, with an OR of 2, roughly doubles the patient's risk of PONV. The specific mechanism underlying smoking's protective effect is unknown. Female gender is associated with the strongest risk factor with an odds ratio of 3.

Question 9

An otherwise fit 47-year-old man has a seemingly uneventful elective anterior cervical discectomy for radiculopathy. Postoperatively, he has new severe weakness in all four limbs, but an urgent MRI does not show evidence of haematoma or cord compression. His heart rate is 85 bpm, blood pressure 110/60 mmHg and oxygen saturation 96% on 2 L/min oxygen.

The most appropriate immediate action is:

a **augment blood pressure with vasopressors**
b commence intravenous dexamethasone 4 mg qds
c insert a lumbar drain for urgent CSF drainage
d refer him urgently for hyperbaric oxygen therapy
e return to theatre for urgent neck exploration

The most likely diagnosis is ischaemic cord injury, and in the first instance this should be treated with augmentation of blood pressure and consideration of a lumbar drain. Spinal cord perfusion is dependent on MAP and CSF pressure, and can be manipulated in a similar way to cerebral perfusion pressure. Given that the MRI did not demonstrate a haematoma or cord compression, a further GA with resultant hypotension has the potential to exacerbate the cord injury. Although hyperbaric oxygen can alleviate the local hypoxia seen in cord injury and reduce neuronal apoptosis, its use cannot be considered mainstream and other measures should be instituted before it is contemplated. There is little evidence of benefit from steroids in acute spinal cord injury.

Question 10

A 68-year-old female patient is admitted to the intensive care unit with sepsis secondary to acute pancreatitis. She requires a central venous catheter for vasopressors and is warned about potential complications including pneumothorax. Despite an uneventful line insertion, the post-procedure x-ray demonstrates a very small pneumothorax that does not require any intervention. The nurse tells you that a duty of candour letter will be required.

The most appropriate response is:

a a duty of candour letter will be required as it is a significant complication
b **a duty of candour letter will not be required as this is not a moderate harm incident and an apology will suffice**
c agree to discuss the matter urgently with the trust's risk manager
d duty of candour does not apply as it is a recognised complication
e duty of candour does not apply as the incident occurred in the context of treating a life-threatening illness

Duty of candour legislation dictates that a letter of apology and an investigation is required when a patient safety incident leads to moderate harm or above. The fact this is a recognised complication that occurred during life-saving treatment is irrelevant,

although the trust risk manager will be able to provide guidance, Duty of candour has been law for some time now, and every healthcare professional should know when it applies. As the pneumothorax does not require any further treatment, this would not be classed as a moderate harm incident and a verbal apology will suffice.

Question 11

A 57-year-old male is admitted for C3/4 anterior cervical decompression for cervical myelopathy. He gives a history of snoring and his BMI is 32.

Which of the following factors is the most significant predictor of difficult facemask ventilation?

a limited jaw protrusion
b mallampati score of 3 or 4
c neck circumference >40 cm
d presence of beard
e **previous neck irradiation**

All have been linked with difficult facemask ventilation, but previous neck radiation was found to be the most significant.

Question 12

A 37-year-old man is admitted with an isolated head injury and a GCS of 12. He is agitated and uncooperative and so is sedated and intubated for a CT scan. The scan shows bifrontal contusions with obliteration of the basal cisterns and compression of the ventricles. Following transfer to ICU he is stable., His HR is 78 beats per minute, MAP 80 mmHg and SaO_2 98%. Pupils are equal and reactive.

What is the most appropriate initial management plan?

a **continue sedation and insertion of an ICP monitor**
b extubate as haemodynamically stable and prior GCS was 12
c increase blood pressure with fluids and vasopressors as ICP will be high
d inform the family that the outcome is likely to be poor
e lighten sedation to allow assessment of his neurological status

He has bifrontal contusions and a 'tight brain' – this is a severe brain injury. In the presence of a severe head injury, sedation and ventilation should be continued for optimum control of ICP. Accurate neurological assessment will not be feasible, and an ICP monitor should be inserted. This will also allow calculation and manipulation of CPP. Normotension should be targeted in the first instance.

Question 13

Local anaesthetic toxicity is a potential complication of regional anaesthesia.

Which of the following is associated with the highest risk of local anaesthetic toxicity?

a a combination of popliteal nerve block and saphenous nerve block for ankle surgery in a 75-year-old male patient
b axillary brachial plexus block augmented with median and ulnar nerve blocks in the forearm in a 40-year-old male patient
c **bilateral transabdominal plane (TAP) blocks in a woman undergoing caesarean section**
d interscalene brachial plexus block for shoulder surgery in a 50-year-old woman
e spinal anaesthesia augmented by adductor canal block for a 65-year-old female patient undergoing a total knee replacement

This question is about the rate of absorption from the site of injection. It is not about inadvertent intravascular injection, the risk of which is minimised by the use of ultrasound. Ultrasound-guided techniques for all the above blocks have developed so that the suggested maximum dose of local anaesthesia is not even reached. The elderly are more sensitive to the effects of local anaesthesia, and doses should be tailored accordingly.

The greatest care has to be taken with TAP blocks as they rely on larger volumes, and the blocks are bilateral into a more vascular area with a subsequent greater local anaesthetic absorption. Furthermore, pregnant women have lower alpha-1-acid glycoprotein (AAG) levels and a dynamic circulation – risk factors for a high, peak-free LA concentration.

Question 14

A 43-year-old man with multiple injuries after a high-energy impact is in the emergency department. His serum lactate on arterial blood gas analysis is 5.5 mmol/L

Serum lactate level is high because:

a it is a marker for anaerobic respiration secondary to hypoxia
b it is a marker for damage to or hypoperfusion of the liver
c **it is an indirect marker of oxygen debt, tissue hypoperfusion and the severity of haemorrhagic shock**
d it is correlated to the degree of tissue damage throughout the body
e it is correlated to the severity of haemorrhagic shock and the associated coagulopathy and hypothermia

The amount of lactate is produced by anaerobic glycolysis and is an indirect marker of the factors in answer C. It is not specific to any particular injury or condition but reflects the amount of time and the severity of the insult inflicted on the patient.

Question 15

A 50-year-old woman has suffered a traumatic brain injury and is presently in the emergency department. She is being ventilated via an endotracheal tube.

Which of the following best describes your rationale for oxygen therapy and ventilation in this patient?

a **high inspired oxygen concentrations are generally used to ensure oxygen delivery to ischaemic areas in or near the injured areas of the brain**
b high inspired oxygen concentrations must not be applied so as to avoid hyperoxic vasoconstriction
c hyperventilation should be used to optimise oxygen delivery and reduce the arterial CO_2 partial pressure
d inspired oxygen concentration should be tailored to ensure oxygen saturations of 93-98%
e the use of optimal PEEP reduces pulmonary shunt and optimises oxygen delivery to the brain

The negative effects of hypoxaemia in patients with traumatic brain injury are well-known. Therefore higher oxygen concentrations are generally used as in A. Extreme hyperoxia is associated with increased mortality. Hyperventilation should be avoided unless there is clear evidence of imminent cerebral herniation, since even a modest level of hypocapnia may extend the primary injury via apoptosis. Excessive positive pressure will compromise venous return and reduce cerebral perfusion and may even compromise cardiac output especially in hypovolaemic patients.

Question 16

A 48-year-old woman with insulin dependent diabetes mellitus presents for day-case excision of Dupuytren's contracture of the ring and little fingers. She is keen to be awake for the operation.

The choice of an axillary nerve block is most influenced by the fact that:

a **it allows for the median and ulnar nerves to be precisely anaesthetised and provides a still and anaesthetised upper limb**
b it avoids phrenic nerve palsy and inadvertent pneumothorax
c it is the least technically difficult of brachial plexus blocks
d it provides analgesia for tourniquet pain
e nerve block of the ulnar and median nerves at the level of the forearm does not provide analgesia for the tourniquet

The axillary nerve block is especially useful for surgery of the hand because the innervating nerves (median, ulnar and radial) are clearly identified and specifically surrounded by local anaesthesia. The axillary nerve block will also provide a limb that is still and without sensation to at least above the elbow, which is valuable when the patient is awake.

Pain from the tourniquet may occur despite a well-functioning axillary nerve block but can be mitigated by local anaesthesia subcutaneously in the axilla. Axillary nerve block is often augmented by distal blocks (here, median and ulnar in the forearm).

Phrenic nerve palsy may occur with supraclavicular nerve block but is often without symptoms. Ultrasound-guidance means that a needle penetration of the pleura should be rare in a supraclavicular nerve block.

Question 17

A 34-year-old man with a BMI 35 presents for surgery for a dental abscess. He suffers from severe reflux and his mouth opening is limited to 1 cm.

The most suitable option for securing the airway at induction is:

a induce anaesthesia with propofol and fentanyl and insert a flexible size 4 LMA
b induce the patient with TIVA and perform an asleep nasal fibreoptic intubation
c perform a rapid sequence induction with propofol and rocuronium and attempt direct laryngoscopy
d **perform an awake nasal fibreoptic intubation, and then anaesthetise the patient once the airway is secure**
e perform an awake oral fibreoptic intubation, and then anaesthetise the patient once the airway is secure

Dental abscesses cause inflammation of the soft tissues which limits mouth opening and rarely improves once the patient is anaesthetised. Given that the patient also has significant reflux, this rules out securing the airway once the patient is anaesthetised. Given the limited mouth opening, and that an oral ETT would cause surgical difficulties, an awake oral FOI is also not suitable.

Question 18

A 29-year-old woman weighing 76 kg presents at 36 weeks for a category 1 lower segment caesarean section (LSCS) due to placental abruption. You suspect she has developed a coagulopathy. A rapid sequence induction is performed with thiopentone and suxamethonium but you are unable to intubate her.

The most appropriate way to manage her airway would be:

a insert an oral airway, keep cricoid pressure on, allow her to breathe spontaneously and proceed with the LSCS
b keep cricoid pressure on, insert a size 4 i-gel (2nd generation supraglottic airway), allow her to breathe spontaneously and proceed with the LSCS
c paralyse with rocuronium, maintain cricoid pressure, insert a size 4 LMA, ventilate her, and proceed with the LSCS
d **paralyse with rocuronium, remove cricoid pressure, insert a size 4 i-gel, ventilate her, and proceed with the LSCS**
e perform bag-mask ventilation, wake her up and perform a spinal anaesthetic

Because of the high risk to both mother and baby, you are unable to wake her up at this stage. Therefore the highest chance of proceeding safely is if she is paralysed, and ventilated on an appropriately sized 2nd generation supraglottic airway with the removal of cricoid. There is a high risk of regurgitation so a first generation laryngeal mask airway (LMA) would be less suitable.

Question 19

A six-week-old infant presents to the emergency department with signs and symptoms suggestive of pyloric stenosis.

The initial treatment should be:

a 4-5 ml/kg 0.45% NaCl with 5% glucose
b **10 ml/kg 0.9% NaCl bolus**
c insert a nasogastric tube
d make arrangements for surgical correction
e ultrasound scan to confirm diagnosis

Infants with pyloric stenosis present with a classical electrolyte disturbance, which needs correcting over 12-24 hours. The initial priority is to correct their dehydration.

Question 20

A six-year-old girl with sickle cell disease who is generally well presents for umbilical hernia repair.

The optimal perioperative management to prevent complications would be to:

a ensure active warming and oxygenation during surgery.
b give IV fluids to prevent dehydration
c transfuse blood to ensure Hb >100 g/L and HbS <30%
d **transfuse blood to ensure Hb >100 g/L and HbS <60%**
e treat as a day case to reduce the risks of hospitalacquired infection

Fewer complications have been shown to occur (including fewer transfusions) in children who are transfused to a Hb of 100 g/L with an HbS <60% for children having low or medium risk surgery.

Question 21

A 63-year-old man presents to the emergency department with syncope. His heart rate is 40 beats/min and blood pressure 80/40 mmHg. He is a known hypertensive with stable ischaemic heart disease and is taking diltiazem, atenolol, simvastatin and aspirin. There has been no response to 6 doses of atropine 500 mcg.

The most appropriate treatment is:

a adrenaline 10 mcg/min
b dopamine 10 mcg/kg/min
c **glucagon 10 mg**
d isoprenaline 5 mcg/min
e theophylline 100 mg

This patient is taking two drugs that cause bradycardia (diltiazem and atenolol) which have a specific treatment (C). Theophylline (100–200 mg by slow IV injection) can be used for bradycardia complicating acute inferior wall myocardial infarction, spinal cord injury or cardiac transplantation. Although he is at risk of ACS, no chest pain or ECG changes are mentioned in the stem to this question. Adrenaline, dopamine and isoprenaline (A,B,D) are all generic treatments of bradycardia but not specific in this scenario.

Question 22

An 84-year-old gentleman develops confusion, nausea and vomiting 48 hours after endovascular aortic vascular repair (EVAR) for a complex aneurysm. He is apyrexial, cardiovascularly stable, with a respiratory rate of 20 breaths per minute. His arterial blood gas on 4 L/min O_2 and his ABG on 4 L O_2 shows:

pH 7.30, pCO_2 4.9 kPa, pO_2 9.0 kPa, HCO_3 19, BE -8.0 and lactate of 1.9 mmol/L.

What is the most likely diagnosis?

a **acute kidney injury (AKI)**
b ischaemic bowel
c post-implantation syndrome
d sepsis
e type 2 endoleak

All of the above can occur as postoperative complications following EVAR of complex aneurysms (eg, upper abdominal aorta involving visceral branches). Type II endoleaks (E) are common but unlikely to cause these symptoms. Both post-implantation syndrome (C) and sepsis (D) are likely to present with a fever. The ABG shows a metabolic acidosis but would likely show a higher lactate with ischaemic bowel (B), and the patient would probably be more cardiovascularly unstable. Acute kidney injury has an incidence of 10-20% following EVAR and has an increased incidence with age >70.

Question 23

A fit and well 70-year-old man having TCI propofol sedation during total knee replacement under spinal anaesthetic starts coughing and becomes restless.

What is the most appropriate course of action?

a ask the surgeon to stop the diathermy to decrease the irritation from plume
b decrease the sedation
c give a small bolus of opiate as an antitussive
d increase the sedation
e **stop the sedation and allow the patient to wake up**

There are case reports of coughing with propofol sedation. Increasing the sedation often led to airway obstruction requiring airway support. Decreasing the sedation is an option , however it may be difficult to find the correct dose. Stopping the sedation allows the patient to wake up and stops the coughing, following which sedation can be restarted at a lower dose and then increased to an appropriate level. Use of opiates as an antitussive can deepen the anaesthetic and cause respiratory depression. Many patients complain about the smell of diathermy during arthroplasties, but propofol sedation is the more likely cause of the coughing.

Question 24

A 71-year-old male patient with chronic stable angina and hypertension is undergoing abdominal aortic aneurysm repair. Prior to the release of aortic cross clamp the blood pressure is 117/74 mmHg, heart rate 68/min, SpO_2 97%. Sixty seconds following the clamp release the parameters are BP 90/40 mmHg, HR 90/min, SpO_2 93% (FiO_2 0.5), $EtCO_2$ 6.2 kPa. The arterial blood gas shows pCO_2 7.0, pH 7.3 BE -5, pO_2 16, lactate 3 mmol/L.

What is the most likely cause of the hypotension?

a acute myocardial infarction
b arterial transducer malfunction
c bleeding from the vascular anastomotic site
d **decreased systemic vascular resistance leading to relative hypovolaemia**
e myocardial depression from toxic metabolites from reperfusion

All of the answers are possibilities. However, the most common reason for hypotension is decreased SVR and central hypovolemia.

Question 25

A five-year-old child weighing 20 kg is brought to the emergency department unresponsive and not breathing. He was recently discharged following an atrial septal defect repair. Following an initial round of CPR, the ECG shows ventricular fibrillation.

The most appropriate immediate response is:

a **defibrillate using an energy of 80 J**
b fast-bleep the cardiac surgeons to assess him
c give 100% oxygen using a supraglottic airway
d intubate with a size 5.5 uncuffed endotracheal tube
e secure intravenous access

Although primary VF occurs in only 3.8-19% of cardiac arrests in children and infants, it is more common following cardiac surgery. Immediate defibrillation at 4 J/kg should be attempted.

Question 26

A 54-year-old man undergoes an uneventful L4/5 microdiscectomy. He smokes 30 cigarettes/day, is recovering from a recent chest infection and takes inhalers for newly diagnosed asthma. You are asked to review him in recovery as his blood pressure is falling despite several fluid challenges. On examination, his BP is 80/40 mmHg, HR 128 bpm and he has cool peripheries. His SaO_2 is 95% on 2 L/min oxygen. His left leg is swollen and the pulses are difficult to palpate.

Which of the following is the most likely cause of his symptoms?

a **major vascular injury**
b myocardial infarction
c pulmonary embolism
d sepsis syndrome
e tension pneumothorax

Vascular injury is an infrequent but recognised complication of minimally invasive spinal surgery. L4/5 is the most common level associated with injury, typically of the iliac vessels. Bleeding tends to be concealed and not recognised at the time of surgery. Patients deteriorate postoperatively with catastrophic, and potentially fatal haemorrhage. A recent fatality has led the coroner and the RCoA to issue a warning about the risk. PE after a DVT is a possible cause, but is unlikely to present with these clinical features. MI and tension pneumothorax are also unlikely with this scenario.

Question 27

A 70-year-old man with community-acquired pneumonia develops delirium seven days after admission to the intensive care unit. He is non-compliant with nursing care.

In addition to daily CAM-ICU assessment (confusion assessment method-ICU score), which strategy is the most effective for managing his delirium?

a dexmedetomidine infusion
b intravenous boluses of lorazepam
c padded gloves and boluses of intravenous haloperidol
d **remove unnecessary invasive lines/catheters**
e sublingual olanzapine

Padded gloves and haloperidol assist the nursing staff but won't improve his delirium. Benzodiazepines, although sedative, are deliriogenic. Olanzapine and dexmedetomidine may be helpful if he is agitated but, again, won't improve his delirium.

Question 28

A 30-year-old primigravida is undergoing an elective caesarean section at 37 weeks for twins under spinal anaesthesia. She has a phenylephrine infusion running at 25 mcg/min. Shortly following skin incision she starts to feel nauseous and dizzy. Her blood pressure has fallen from 110/60 to 84/50 mmHg. Her heart is 55 bpm.

What is the most appropriate treatment?

a **ephedrine bolus of 6 mg**
b glycopyrrolate bolus of 200 mcg
c increase the phenlyephrine infusion to 75 mcg/min
d metaraminol bolus of 0.5 mg
e phenlyephrine bolus of 50 mcg

The aim should be to maintain blood pressure to within 90% of baseline. The patient is already receiving a prophylactic phenylephrine infusion. In patients who are already being treated by alpha agonists, the latest consensus recommends small doses of ephedrine if the patient is bradycardic with a drop in blood pressure to less than 90% of baseline. Glycopyrrolate or atropine may also be used.

Question 29

A 35-year-old male patient presents to the pre-assessment clinic prior to an elective inguinal hernia repair. He gives a history of poorly controlled asthma despite taking regular inhaled corticosteroids. He tells you that he is using his salbutamol inhaler 4-5 times per day. On examination he is apyrexial and his chest is clear. What would you advise the patient and his GP?

a **continue current regime and add in a long-acting inhaled beta agonist**
b increase the dose of inhaled corticosteroid and commence a leukotriene receptor antagonist
c measure peak flows twice daily and reassess in two weeks
d prescribe a one week course of oral prednisolone and amoxicillin
e refer to a chest physician prior to surgery

There is no evidence of a chest infection to justify oral steroids and antibiotics. The BTS/SIGN guidance suggests that for patients taking regular inhaled corticosteroids and beta 2 agonists the next management step is to add in a long-acting beta agonist. His surgery is not urgent, and a referral to a chest physician would not be appropriate before trying other therapies.

Question 30

A previously healthy 21-year-old woman telephones the day surgery unit in the early evening, four hours after discharge following an uneventful knee arthroscopy under general anaesthesia. She reports that she is well but that her husband has unexpectedly had to go to work and she will be alone overnight. What would you advise?

a ask her to return to the ward by taxi for an assessment by the doctor
b inform her that she must return to hospital for an overnight stay
c telephone her husband and explain that he must return home to look after his wife as agreed earlier
d telephone the district nursing service and request a visit at home to assess whether she is fit to remain at home
e **tell her that she can remain at home alone but to telephone the ward if there are any problems**

The patient is seemingly well but has found herself in a difficult position with nobody in the house overnight to look after her. Pragmatically it would be sensible to allow her to stay at home and for her to telephone if there were any difficulties. D would not be correct as you know already that the patient is well and would not be an appropriate use of the district nursing service. Similarly, there is little benefit in calling her husband as presumably he has only changed his plans at the last minute because of the urgency of his work situation. Both A and B, although technically justifiable, would seem disproportionate in a fit young patient who has already been self-caring at home for a number of hours after a short day-case procedure.

SOE examination

SOE 1 – Clinical anaesthesia short cases with linked clinical science questions

Paper 1

Question 1A: Clinical short case 1 – Tracheostomies and their complications
You are called urgently to see a 22-year-old man on the high-dependency unit, who sustained an isolated severe closed traumatic head injury two weeks previously. He underwent a planned percutaneous tracheostomy and has been self-ventilating for three days. The physiotherapists reported difficulty in passing a suction catheter in previous 24 hours and that he has developed increasing difficulty in breathing.

Supporting information
Nil

How would you approach this problem?

The candidate should follow NTSP guidelines:

- call for senior help
- look, listen and feel at the mouth and tracheostomy for 10 seconds following an upper airway opening manoeuvre. You may use Water's circuit to aid assessment, use capnography when available to evaluate if the patient has patent or partially patent airway
- if the patient is breathing apply O_2 to both mouth and tracheostomy (this will require two O_2 supplies, ie, you may have to use O_2 cylinder)
- if the patient is not breathing and no sign of life, call resuscitation team and start CPR
- if the patient is not breathing and there are signs of life continue by assessing tracheostomy patency, remove speaking valve, cap, inner tube, try to re-insert suction catheter (recommendation to use suction catheter and not a Bougie as it may create false passage). If successful and patient is still breathing, tracheostomy is patent or partially obstructed, consider suction, ventilate via tracheostomy if he had weak effort (vigorous attempt should be avoided as it may cause surgical emphysema) and continue ABCDE assessment
- if the above attempt fails to relieve respiratory obstruction, remove tracheostomy tube and make sure that O_2 is applied to both mouth and stoma. If the patient improves continue ABCDE. If he fails to improve after removing tracheostomy maintain emergency oxygenation through oro-nasal route after covering the stoma, or the tracheostomy route (via paediatric face mask), or both

answer continues/...

- if the above attempts fail to improve oxygenation a secondary emergency oxygenation manoeuvre is required. The manoeuvre will depend on the situation, and separate airway teams may be required (one for the oral route and the other for the stoma). Oral route can be used but prepare for difficult intubation or through the stoma using size 6 ETT or smaller tracheostomy tube.

Possible supplementary questions
What airway information might you need before performing a secondary emergency airway manoeuvre?

- was it difficult to intubate and degree of difficulty?
- reason for tracheostomy?
- duration of the problem (recent or repeated obstruction)?
- was it a surgical or percutaneous tracheostomy? (Recent surgical tracheostomy easier to replace while percutaneous tracheostomies are more difficult, as the dilated stoma).

4 What equipment might you need during a secondary emergency oxygenation manoeuvre?
Bedside equipment Emergency equipment:

- humidification equipment
- basic airway equipment – oxygen masks, self-suction with selection of appropriate suction inflating bags, oral and nasal airways
- catheters
- advanced airway management – laryngeal mask
- spare tracheostomy tubes airways and laryngoscopes with appropriate one the same size tubes (arrest trolley or similar) and one tube one size smaller
- capnography
- clean pot for spare inner cannula
- a fibre-optic scope
- sterile water for cleaning the suction tube
- tracheal dilators
- scissors (and stitch cutter if tracheostomy tube bougies are sutured)
- water-soluble lubricating jelly
- sterile dressing pack
- tracheostomy dressings
- tracheostomy tapes
- personal protective equipment (gloves, aprons, eye protection)
- sterile gloves for performing deep suction
- nurse call bell: the patient may be unable to call for help verbally
- communication aids: the patient may not be able to verbalise
- bedside equipment checklist.

answer continues/...

5 What are the indications for a tracheostomy in critical care?

- to assist weaning from artificial ventilation
- to facilitate withdrawal of sedation
- ongoing airway toilet/reduce secretion retention or/and;
  - reduce oropharyngeal/tracheal complications of long-term intubation
  - protect airway in neurological dysfunction
  - longer term: to facilitate ICU discharge and ongoing management/domiciliary.
  - ventilation in patients with chronic conditions (neuromuscular/respiratory problems).

Examiner guidance
Candidate must have:

- awareness of the National Tracheostomy Safety Project guidelines (NTSP) for looking after obstructed tracheostomy
- knowledge to safely manage tracheostomy obstruction due to secretions is important
- pass if they talk sense and have reasonable approach and plan.

Question 1A: Clinical science question 1 – Anatomy

Describe the anatomy relevant to performing a percutaneous tracheostomy starting with the larynx.

- the larynx is an organ of phonation also acting as a valve between upper and lower airway
- innervated by branches of the vagus
- SLN sensation of upper part and motor innervation of cricothyroid (adducts cords)
- RLN sensation of lower larynx and motor to intrinsic muscles
- superiorly, strap muscles and epiglottis attach to hyoid
- thyrohyoid membrane passes caudally to thyroid cartilage
- vocal cords attach anteriorly to the thyroid cartilage and pass posteriorly to the arytenoid cartilage articulating below with the cricoid cartilage. This has the shape of a signet ring with the wider part posteriorly
- the cricothyroid membrane/ligament passes anteriorly between the thyroid and cricoid cartilages
- cricotracheal ligament attaches the cricoid to the 1st tracheal ring. Below the larynx, trachea passes behind the thyroid isthmus backwards and downwards, anterior to the oesophagus to enter the thoracic cavity at the sternal notch
- origins at the lower end of the cricoid cartilage C6, bifurcates into two main bronchi (right and left) at level of T6 in inspiration. (T4/5 in expiration angle of Louis) 11 cm long with 5cm above the sternal notch. Same diameter 2 cm approx. size of patient's index finger. 15-20 C-shaped cartilage joined by fibro-elastic tissue closed posteriorly by trachealis muscle. Lined with ciliated columnar epithelium
- has tracheobronchial lymph nodes deep cardiac plexus and R pulmonary anterior to it.

Ask candidate to draw cross section of neck at C4 and thoracic inlet at T1 to demonstrate relations

- the aortic arch and innominate artery lie anteriorly in the thoracic inlet, where the trachea passes medial to the domes of the pleura
- relationships: In neck
- anterior to trachea: – from superiorly to inferiorly, skin, superficial and deep fascia, thyroid isthmus, edges of sternomastoid, sternohyoid muscles, inferior thyroid veins,SVC and aorta
- posterior to trachea: – oesophagus, recurrent laryngeal nerve
- lateral :- thyroid lobes, inf. thyroid artery(blood supply to trachea), carotid sheath
- In Mediastinum
- posterior Thoracic duct, oesophagus, RLN
- anterior: L common carotid, Brachiocephalic artery and veins, phrenic nerve
- on left: subclavian arteries, L vagus above and aorta below
- on right: Mediastinal pleura, R vagus and azygous vein.

answer continues/...

What are the complications of a percutaneous tracheostomy?

These relate to the procedure itself and anatomically related structures:

- immediate: failure, loss of airway, bleeding, pneumothorax, oesophageal perforation
- early: bleeding, dislodgement, obstruction
- late: erosion into vessels, tracheal dilatation, cuff-related stenosis, granulomata, stenosis related to traumatic insertion, cord/laryngeal dysfunction.

What are the contraindications to bedside tracheostomy?

- *absolute* – local sepsis; tumour; patient refusal
- *relative* – severe coagulopathy/anticoagulation; platelet dysfunction/thrombocytopaenia; blood vessels crossing the surgical field; short fat or immobile neck, unstable C-spine injury, etc.

How might a percutaneous tracheostomy be performed?

- informed consent/assent, monitoring (inc capnography), trained assistant, sterile field
- avoid operator/anaesthetist situations
- reverse Trendelenburg. Increased FiO_2. Bronchoscopic control (pros and cons?)
- below 2nd or 3rd tracheal rings. Palpation/ultrasound. Lidocaine/adrenaline. Incision 1-2cm; blunt dissection. Needle puncture, aspiration of air bubbles; Seldinger wire; dilatation; insertion of device
- avoid damage to vessels/tracheal rings
- confirm position of needle/guidewire/device bronchoscopically. Confirm CO_2 trace
- suction blood/secretions. Secure position. x-ray (Pneumothorax, airway collapse, appropriate positioning above carina, etc).

Examiner guidance

A topic the candidate should recall accurately: should be able to describe the features of the trachea, relations of trachea. with a diagram and attachments of the larynx as well as nerve supply to pass.

(Filler: What techniques are available?)

Open (surgical) tracheostomy versus percutaneous techniques

- percutaneous dilatational with multiple dilators (Seldinger wire/Ciaglia)
- percutaneous dilatational with single dilator (Seldinger wire/Rhino)
- guidewire and dilating forceps (Grigg's forceps)
- other (?PercuTwist).

Question 2A: Clinical short case 2 – Neurofibromatosis

Supporting information
Nil

A 75-year-old man with neurofibromatosis and bullous lung disease presents for resection of a occipital lobe SOL that is causing neurological symptoms.

Describe the features of neurofibromatosis

- autosomal dominant. Type 1 (von Recklinghausen's 1:3000 births. 20,000 patients in UK) chromosome 17, Lisch nodules(iris hamartomas) common intellectual impairment(30–60%) and skeletal abnormality. Café au lait spots
- multiple associated abnormalities (scoliosis(5–10%), phaeochromocytoma, pulmonary fibrosis, cardiomyopathy, renal artery stenosis)
- don't have cataracts or cutaneous swannomas
- type 2 1:40,000 births chromosome 22. Associated with bilateral acoustic neuroma , and cataracts in 60–80% of patients and cutaneous schwannomas
- both have neural tumours (central and peripheral neurofibromas, meningiomas, astrocytomas, gliomas, ependymomas, neuromas).

What symptoms and signs may the patient have presented with?

- headache
- poor balance
- visual loss (homonymous hemianopsia)
- seizure possible, brain stem compression if large lesion so assess bulbar function and other cranial nerve defects and long-tract signs, and severe N and V.

Possible supplementary questions:
How urgent is the case?

- depends on neurological features, but generally category 3 so can wait 24–36 hours
- it is not an emergency – time for further investigations and management of his medical problems
- generally start on dexamethasone with proton pump gastro protection if there is evidence of cytotoxic oedema and correct electrolytes which may be deranged from poor oral intake/vomiting or as side effect of anticonvulsants
- optimise lung function with physiotherapy, smoking cessation and pharmacological regime as appropriate.

The patient has been optimised, how would you proceed with the induction?
Preoperative:

- explain anaesthetic to patient
- discuss with surgeon positioning – could be Concorde, sitting, park bench or prone and degree of intracranial mass effect
- plan for postoperative HDU/high-care area.

answer continues/...

- induction:
  - full monitoring
  - art line
  - wide bore access
- pre-oxygenation – may take longer in view of lung disease
- induction – remi/propofol/NMBD Thio useful if concerns re fitting
- maintenance – TIVA or volatile + remi
- monitor TO4 before administration muscle relaxant and ensure paralysed prior to intubation
- ETT reinforced
- secure the tube well due to prone position
- avoid tapes which may impede venous return
- limit pressor response with remi/beta-blocker/lignocaine
- positive-pressure ventilation aim low normal $PaCO_2$ 4.5 kPa
- increase RR with low tidal volume to limit pneumothorax risk in this patient
- neck central line useful if surgery likely to be long duration or air embolus high risk.

How would you prone this patient and what are the adverse effects of prone positioning?

Positioning, prone:

- protect eyes, padding
- secure ETT
- six-person team
- patient rolled with arms by side onto arms of people by side
- care to avoid head rotation
- chest and pelvis support
- abdo free
- face down or to side
- avoid pressure areas eyes and facial nerve
- arms care to avoid brachial plexus injury
- care regarding padding of pressure areas.

Adverse effects:

- blindness: several causes posterior ischaemic optic neuritis
- reduced access to airway
- increased airway pressure if abdomen splinted and reduced venous return
- displacement of tubes and lines during proning
- injuries during turning – neck
- brachial plexus injuries
- compression injuries – eyes, facial nerve, sciatic ,ulnar nerve, lateral cutaneous nerve of the thigh.

answer continues/...

How would you maintain anaesthesia for this patient and what are the advantages/disadvantages of your chosen technique?

Maintenance:

TIVA – propofol + remi

- reduces $CMRO_2$ and maintain autoregulation reducing ICP
- easily titrated during different phases of surgery
- rapid smooth emergence
- reduced PONV
- risk of awareness if IV dislodged
- slow waking compared to vapours
- need use BIS.

Volatile + remi

- sevo/Des in oxygen/air
- avoid N20 as it increases ICP and risk/size of pneumothorax
- no effect on autoregulation in the normal clinical range
- animal model suggests useful ischaemic preconditioning with reduced apoptosis in hypoxic injury, via reduced calcium release from intracellular stores.

Either technique:

- pins – increase depth of anaesthesia and analgesia
- vasopressor infusion to maintain MAP phenylephrine or metaraminol
- either neuromuscular blockade or remi to prevent coughing
- normal saline maintenance
- hypertonic saline mannitol to reduce oedema ask concentration and doses
- avoid dextrose containing fluids
- maintain normothermia.

(Filler: How would you manage emergence?)

- if significant oedema or loss of bulbar function, keep asleep and allow recovery in ITU
- otherwise Neuro HDU/high-care area
- maintain anaesthesia until supine and out of pins
- 100% O_2
- antiemesis
- reversal with monitoring via nerve stimulator
- deep emergence best plan to limit cough and hypertensive response, can do airway exchange to I-gel, remifentanil technique, etc.

Question 2A: Clinical science question 2 – Physiology

What compromises cerebral blood flow (CBF) in a patient with a head injury?

Possible supplementary questions:

What are the factors controlling CBF?

Normal CBF 50 ml/100 g/minute. Influenced by:

Cerebral metabolism

- cerebral metabolic rate for oxygen ($CMRO_2$) normally 3.5 ml/100 g/min
- reduced by: hypothermia (at 27°C $CMRO_2$ and CBF halved), anaesthesia
- increased by: pyrexia, seizures.

Carbon dioxide and oxygen

- linear relationship between $PaCO_2$ and CBF between 2.7 kPa (20 mmHg and 10.6 kPa) (80 mmHg). Mediated by pH of ECF surrounding cerebral vasculature
- hyperoxia has little effect, max 10% increase in CBF
- hypoxia PaO_2<6.7 kPa (50mmHg) causes rapidly progressive increase in CBF
- BP causes vasodil, impairing CO_2 responsiveness
- vasodilating agents, eg, Halothane and GTN, sodium nitroprusside steepen the response.

Autoregulation

- CBF constant over the CPP range 50–150mmHg
- achieved by myogenic mechanism inducing vasoconstriction (increased blood pressure), vasodilatation (reduced blood pressure)
- lower limit represents maximal vasodilatation. Below this CBF falls 'pressure passive'
- upper limit represents maximal vasoconstriction. Above this BBB disrupted, oedema and ischaemia
- discuss role of metabolic and tissue theory (? eNOS/nNOS ?ATP dependant K+ channels).

Autonomic nervous system

- generally less well innervated by ANS
- anterior circulation > posterior
- via superior cervical ganglion for SNS
- via sphenopalatine and otic ganglia for PNS
- sensory fibres from the trigeminal ganglion
- thought that tone of ANS may determine set point for homeostatic mechanisms
- sympathetic contributes to vasoconstriction, protects brain in hypotension
- parasympathetic contributes to vasodilatation, maximal in post ischaemic reperfusion and hypotension.

Blood viscosity

- balance between reduced haematocrit improving blood flow and oxygen carrying capacity, 30% optimal.

answer continues/...

What compromises cerebral blood flow (CBF) in a patient with a head injury?

- reduced MAP, increased ICP or both
- CPP = MAP – ICP (or MAP – CVP, if CVP > ICP)
- MAP should be measured at level of tragus.

What strategies do you use to maintain CBF?
Improve cerebral perfusion pressure (CPP) by maintaining MAP:

- first 72 hr, loss of autoregulation, CBF directly dependent on MAP
- hyperaemic phase (20–30% patients), increases ICP
- vasoactive phase (10%), reduced CBF, hypometabolism, loss autoregulation, therefore measure ICP and maintain CPP at 60–70 mmHg.

Control of ICP:
Surgery

- Evacuate haematomas, decompressive craniotomy, drainage of CSF.

Medication

- sedation
- mannitol (0.5–1 g/kg)
- hypertonic saline (eg, 200 ml 3%, prevent/manage hyponatraemia)
- control/prevent seizures
- control pyrexia
- hypothermia debatable
- PaO_2 around 13 kPa, $PaCO_2$ 4.5–5 kPa
- hyperventilation not recommended (unless for temporary, emergency control of dangerously raised ICP prior to surgery).

Mechanical

- prevent straining, high intrathoracic pressure, venous obstruction.

Examiner guidance

To pass candidate must:

- demonstrate knowledge of this core topic and be able to discuss all points and give an accurate account of the relevant physiology
- understand the relevance and application to anaesthetic management.

Question 1B: Clinical short case 3 – Phaeochromocytoma

Supporting information
Nil

What is a phaeochromocytoma?

- tumour of chromaffin tissue, 90% in adrenal medulla
- associated with multiple endocrine neoplasia (MEN) type 2, neurofibromatosis
- von Hippel-Lindau
- m-iodobenzylguanidine (MIBG) radioisotope study. MIBG = an iodinated analogue of norepinephrine actively taken up by tissues involved in catecholamine synthesis – specificity and sensitivity of 90%. Also idenifies extradrenal sites of catecholamine synthesis (~25% of phaeo's are extra-adrenal)
- diagnosis confirmed with 24-hr urinary met-Adr, nor-met-Adr
- localised with CT or MRI.

Management

Preoperative investigations

- ECHO for asymptomatic cardiomyopathy
- drug of choice? Do not beta-block first. Phenoxybenzamine still first **drug of choice** Non-selective irreversible a-adrenergic antagonist – permanently alkylates a-receptors – preventing clinical response to catecholamine release. Selective a1-receptor antagonists – prazosin, doxazosin – described but intraoperative control of BP not as good. **Dose Phenoxybenzamine/ duration?** Starting dose 10 mg and increased, depending on BP control, postural hypotension and nasal stuffiness, to 60–200 mg daily; commonly started ~14 days before surgery and continued until 1–2 days preoperatively
- aims – good blood-pressure control, treatment of significant dysrhythmias, blood volume repletion, and amelioration of any end-organ damage. Criteria often quoted are: (i) BP consistently < 160/90 (ii) postural hypotension not < 80/45 mmHg (iii) absence of ST-T changes in ECG for 7 days (iv) no more than one PVC every 5 min; and (v) nasal congestion
- aim to stabilise BP <140/90, HR <100/min, symptoms reduced
- may get reflex tachycardia requiring beta blockade, drowsiness, dizziness, blocked nose
- use of beta-blockers (not as initial therap: risk of hypertensive crisis). May be added later
- for control of tachydysrhythmias)
- some centres use calcium antagonists usually nicardapine 20–60 mg/day in divided doses started a minimum of 5 days pre-op.

Anaesthesia

- premedication – anxiolytic premed, DVT prophylaxis, stop beta blockers evening before surgery
- monitoring: ECG (CM5), IABP, CVP, CO measurement, SpO_2, $EtCO_2$, urine output, core temperature

answer continues/...

- laparotomy: GA plus epidural, laparoscopy GA alone
- consider avoidinge desflurane, ketamine (sympathetic stimulation), atracurium, morphine (histamine), droperidol (dopamine antagonist), metoclopramide, ephedrine and cocaine (inhibit catecholamine reuptake). Central line for vasoactive infusions (prepared)
- role of Mg infusion as presurgical prophylaxis (inhibits catecholamine release, causes arteriolar dilatation, antidysrhythmic effects). 5g further bolus 2g as required.

Possible supplementary questions:
Which other drugs may be required to control response to fluctuating catecholamine release?

- competitive antagonist of peripheral a1- and a2- receptors(3:1)
- very useful where patient has bradycardia from beta blockers or remifentanil, also useful for catecholamine excess (phaeo), MAOI interactions, cocaine
- 1-2 mg IV bolus, up to 20 mg, onset of action is 1–2 minutes, duration of 10–30 minutes reduces pulmonary artery pressures
- SNP to control hypertension, NA for hypotension, ADR to maintain CO, beta-blockers to control tachycardia
- careful maintenance of temp as patient vasodilated
- final ligation of the tumour's venous supply associated with sudden drop in plasma catecholamine concentrations – may precipitate rapid refractory hypotension
- exacerbated by down-regulation of a-receptors, persistence of preoperative adrenergic-receptor blockade, relative hypovolaemia and catecholamine-induced cardiomyopathy. Treat with fluids as directed by CVP, ODM, SVV measurements fluids. Vasopressors are required – angiotensin may be more useful than a-agonists due to a-receptor down-regulation
- may need significant fluid volumes after removal of tumour.

Post op:

- HDU, BP stability, blood glucose control, hypoglycaemia common (increased insulin secretion or decrease in lipolysis)
- steroid replacement if bilateral adrenalectomy.

Question 1B: Clinical science question 3 – Pharmacology

What are the common indications for the use of calcium-channel blocking drugs and which drugs are used?

Possible supplementary questions:

What are the anaesthetic implications of calcium-channel blockers? Describe the basic pharmacology of calcium-channel blocking drugs?

Scientific principles to be explored

- understand the basic pharmacology of this group of drugs.

Clinical applications of the scientific principles

- calcium-channel blockers in anaesthetic practice.

Question

General uses:

Treatment of angina: eg, diltiazem, amlodipine, verapamil

- as the primary treatment
- as adjunct to beta-blockers or in patients in whom they are contraindicated (eg, brittle asthmatics, etc)
- angina caused by coronary vasospasm

Treatment of hypertension:

- chronically, eg, amlodipine, nicardipine, lacidipine (dihydropyridines)
- acutely: nifedipine
- antiarrhythmic: verapamil, diltiazem
- vasospasm following SAH: nimodipine
- preterm labour eg, nifedipine, nicardipine
- Raynaud's disease eg, diltiazem, nifedipine.

Pharmacology of calcium-channel blockers

- three major groups
  - dihydropyridines, eg, nifedipine, amlodipine, nicardipine, nimodipine
  - phenylalkylamines, eg, verapamil
  - benzothiazepines, eg, diliazem
- each group binds to a specific site on a-subunit on the L-type calcium channel inhibit the slow inward Ca current in smooth muscle and cardiac cells the reduced intracellular Ca causes vasodilatation in vascular smooth muscle
- negative inotropic, chronotropic and dromotropic (slow conduction velocity)
- properties of the heart
- absorption is nearly complete after oral administration
- bioavailability is reduced because of first-pass hepatic metabolism
- there is significant binding of all channel blockers to plasma proteins (70-99%)

answer continues/...

- therapeutic effects are evident within 30-60 min after oral dose; peak effects within
- 15 min i.v.
- they differ in their predilection for various sites of action, with disparate and varied therapeutic effects.

Acute use in anaesthetic practice
Management of SVT and AF

- verapamil slows conduction in pacemaker tissue >↓ AV conduction and ↑ refractory
- period of AV tissue
- risk of heart block if patient recently given beta-blockers
- 5–10 mg over 3 minutes with ECG monitoring.

Anaesthetic implications: interactions of calcium-channel blockers with anaesthesia

- verapamil and beta-blockers carry risk of AV block
- volatile anaesthetics – risk of exaggerated hypotension, MAC depressant properties
- digoxin – inhibits Cytochrome P450 with potential to increase digoxin levels (↑ risk of AV block)
- non-depolarising NMBA – verapamil and nifedipine have potential to increase block
- reduction of lower oesophageal sphincter tone
- sudden withdrawal may be associated with an exacerbation of angina.

(Filler: Management of cerebral vasospasm following SAH)

- cerebral vasospasm occurs 4-14 days post SAH in ~ 40-70% patients
- results in progressive focal neurological deficit and even death (10-20%)
- signs and symptoms: fever, neck stiffness, confusion, hemiplegia, altered consciousness
- triple-H therapy (Hypertension, Hypervolaemia, Haemodilution) is controversial – no longer used – replaced by hypertension (secured aneurysm –aim for SBP of 160–180mmHg; unsecured aneurysm 140–160mmHg) and euvolaemia
- nimodipine: given via central catheter, progressively increasing dose if BP acceptable, or orally (4 hrly – high first-pass metabolism) for 21 days. May reduce poor outcome due to vasospasm
- after SAH by 40%.

Question 2B: Clinical short case 4

You have been asked to anaesthetise a 7 year old child with autistic spectrum disorder for an elective MRI.

Supporting information
Nil

Examiner guidance
A successful candidate should have a reasonable knowledge on autistic spectrum disorder and a flexible approach to anaesthetic management.

What is autistic spectrum disorder?

- A lifelong developmental disability
- Characterised by functional impairment in social communication, social interaction and social imagination. Restricted interest and repetitive behaviours and for some touch, visual, taste or sound hypersensitivity.
- Difficulty coping with new experiences
- May have low, normal or high intelligence
- Males are 4-9 times more affected.
- Incidence 1 in 50-100 children.

Possible supplementary questions:

1 What are the issues with children who have autistic spectrum disorder?

- Difficulty in communication
- May dislike being touched or examined
- Routine of hospital-based care can be an issue, may have had repeated admissions
- May not tolerate premedication & LA cream
- Can have temper tantrums, distress may be demonstrated by disruptive behaviour
- Sound of other crying children is distressing
- Can be disruptive and agitated.
- Lack of knowledge or understanding of the issues by the staff involved

2 How would you manage this child for MRI?

- Flexible, holistic approach with advanced notification for all involved
- Flexible admission process and individualised care (possible checklist of needs/ likes/dislikes)
- Much can be done pre-admission via phone and Primary Care like weight/height
- First or only one on list, clear plan for day, minimise disruption to routine
- Are there language and communication issues? Warn before touching.
- Clear explanations avoiding metaphors or imagery
- Use of computer/ipad may help if familiar to them
- Avoid anything that triggers challenging behaviour like clothes change. Admit and recover in a single quiet room. (find triggers from parents/carers/notes/nurses)
- Premedication with either clonidine/midazolam/ketamine/ Dexmedetomidine masked with sugary drinks
- Look at previous anaesthetic charts/admissions as to what might work. LA cream

answer continues/...

Anaesthetic technique

- Gas/iv induction- drug doses for a 7 year old child, Depends on plan and discussions with child
- Airway: SAD is appropriate, short procedure.
- Temperature control
- Post-operative – rapid smooth recovery, quiet recovery area with familiar staff if possible with parents/carers as soon as possible. Remove IV cannula as soon as safe. Minimise disruption to routine day and discharge as soon as safe to do so

Describe other precautions you should take while a patient is having an MRI scan?

- ensure safety check for patient prior to entering MRI scanner
- ensure safety check for staff
- ear protection for patient
- transfer onto a non-ferrous trolley before entering MRI scanner
- ensure MR-compatible ventilator/anaesthetic machine, or locate in control room
- required infusions should be infused via long extensions, passed through the waveguide (brass-lined hole in wall) to a pump in MRI control room
- use MRI conditional or safe infusion pumps
- pilot balloon of ETT may contain ferromagnetic material, so needs to be secured and placed away from site of scan if possible
- ensure monitoring is visible/slave monitor
- MRI-safe equipment should be clearly identifiable.

Question 2B: Clinical science question 4– Clinical measurement

Supporting information
Nil

What are the problems facing the anaesthetist in the MRI scanner?

- isolation from main theatre, patient in magnet, difficult to observe and monitor
- noise in scanner – up to 95 db, all patients need earplugs, even when anaesthetised (risk cochlear damage)
- variable RF magnetic field causes heating tissues, Burns from monitoring if wires coiled, must avoid closed loops, eg, patients with crossed legs have been burnt, and any metal in clothing
- time-variable magnetic field can cause muscle contraction and induced nerve conduction, some patients find unpleasant so request sedation/GA.
- helium escape need 1000 L liquid helium to keep a superconducting magnet cool: if there is sudden shut down or spontaneous leak the helium will vapourise as it is vented. If the quench pipe malfunctions the oxygen level in scanner will plummet, so need monitoring system and door override to allow.

Possible supplementary questions:

1 What precautions should be taken to prevent burns caused by monitoring equipment used in an MRI scanner?

- padding should be placed between cables and the patient's skin
- avoidance of loops in cables
- fibreoptic probe connections for pulse oximeter
- use of high-impedance, braided, short ECG leads
- use of MRI-safe ECG electrodes in a narrow triangle on patient's chest
- use of non-ferromagnetic monitoring, eg, skin-temperature strips
- check all insulation around cables is intact

2 What adaptions are there in the monitoring used?

- all monitoring should be in control room (Association of Anaesthetists guidelines, most is telemetric
- ECG – Monitor V5, V6 as furthest from aortic flow induced voltages causing artefacts, ST segment and T waves, resembles pericarditis or hyperkalaemia. High-impedance graphite electrodes and short braided leads or telemetry to prevent induced current. Electrodes close together to minimise impedance
- LCD display not affected by magnet. Cardiac motion artefact reduced by ECG gating
- risk of burns from heating effect on cables. Ensure no contact and that ECG electrodes are correctly applied
- pulse oximetry – burns with standard pulse oximeters. So fibreoptic cables used, signal is distorted, filtered to improve signal

answer continues/...

- capnography – in line sampler overheats, use side-stream, but delays of up to 20 sec because of long sample tube
- blood pressure
- indirect methods available using nylon connectors
- direct possible but transducer needs to be close to patient to avoid long lines and damping.

Anaesthetic equipment

- non-MR-compatible kept outside scanning room, or outside 50-G line, but long tubes etc risk disconnection
- MR compatible with piped gases in scanner (no ferromagnetic material, usually aluminium)
- all gas cylinders must be MR-compatible
- MR-compatible laryngoscopes, ET tubes, LMAs, ventilators, infusion pumps, suction, patient trolleys available

What are the principles of operation?

- no ionising radiation
- uses interaction between a static magnetic field and the field that arises from atoms
- patient placed within a strong magnetic field (0.5 – 3.0 Tesla, 1T = 104 Gauss, earth's field = 0.5 Gauss)
- some atoms with odd numbers of protons (eg, hydrogen) have an asymmetrical net spin which results in atoms aligning either almost parallel or almost opposed to an external magnetic field
- in addition they exhibit precession ('wobble' about their axis of spin) in the magnetic field at a frequency proportional to the field strength
- application of pulses of radiofrequency energy (microwaves) at the frequency of the atoms precession (64 Mhz for H2) causes protons to 'flip' from lower parallel to higher antiparallel state
- RF switched off, protons 'flip' back and release radiowave energy. Detected by a series of close-fitting antennae or coils within a faraday cage to allow the small signal to be received uncorrupted
- images are generated by perturbing the static field with small dynamic gradient fields which allows spatial localisation by altering the precession frequency contrast between tissues results from differences in hydrogen nuclei density between tissues
- physical and chemical differences in the tissues producing 2 distinct relaxation patterns with time constants T1and T2
- in T1 fat is bright and water dark and vice versa for T2. T2 is used to identify tissue oedema and T1 white matter–grey matter contrast
- contrast (gadolinium) –alters relaxation rates hydrogen nuclei

answer continues/...

Paper 2

Question 1A: Clinical short case 2 – Maternal obesity

Supporting information
Nil

You are asked to see a woman expecting her first baby in the antenatal anaesthetic clinic. She has a BMI of 53, but no other medical problems. She is currently 34 weeks pregnant.

Part 1

What are the risks of maternal obesity in pregnancy?

Maternal:

- increased risk of perinatal death, thromboembolism, gestational diabetes, pre-eclampsia,(risk doubles with every additional 5 BMI points) postpartum haemorrhage, wound infections, requirement for assisted vaginal delivery, caesarean section, decreased rate of breast feeding.

Fetal:

- miscarriage and still birth, preterm birth, fetal distress, meconium aspiration, low Apgar score, admission to NICU (macrosomia, neural tube defects).

What anatomical and pathophysiological factors are relevant to the anaesthetist and why?

Airway:

- increased incidence of failed/difficult intubation (1 in 3, reduced apnoea time, large breast tissue, airway dimensions).

Respiratory:

- reduced FRC/VQ mismatch/hypoxia > non-obese, OSA, pulmonary hypertension, cor pulmonale.

CVS:

- hypertension, IHD, CCF, less able to cope with CVS changes in pregnancy/ labour. Exacerbated aortocaval compression.

GI:

- hiatus hernia, increased risk of aspiration.

Practical:

- equipment, staff training, more difficult vascular access, regional techniques, increased dural puncture rate, monitoring (IABP), pressure care, DVT prophylaxis.

What would you discuss with this lady in the antenatal anaesthetic clinic?

- identify and discuss risk factors associated with obesity, recent case law suggests that all risks should be discussed or offered for discussion. Candidates should appreciate that this needs to be done tactfully and with compassion
- explain the issues around difficult vascular access, regional anaesthesia and risks of general anaesthesia
- advise early epidural – why? Difficult insertion, made easier in still patient, higher failure rate, resite rate rises with increasing BMI, reduce requirement for a GA for operative delivery.

answer continues/...

Part 2

She presents to the delivery unit at 39 weeks in active labour. She has been self-administering therapeutic low-molecular heparin for a deep-vein thrombosis. Her previous injection was 8 hours ago. What pharmacological analgesic options are available to her during her labour?

- inhalational: Entonox
- opioid: Pethidine, morphine, fentanyl, remifentanil. (Can explore advantages and disadvantages of different opioids)
- epidural analgesia is not an option owing to <24hours since therapeutic LMWH injection.

What are the possible side effects of a remifentanil PCA in labour?

Drowsiness, itch, nausea and dizziness, transient lowered oxygen saturation levels requiring the administration of additional oxygen via nasal specs (1 in 10), respiratory depression.

What precautions should be taken when using a remifentanil PCA in labour?

A pulse oximeter (oxygen saturation), dedicated remifentanil PCA pump set to deliver 1 ml (40 mcg) bolus over 15 seconds with a 2 min lockout, Midwife one-to-one care, specific observation chart, including saturation and sedation score and respiratory rate.

What are the risk factors for respiratory depression in patients receiving remifentanil PCAS?

- lack of familiarity with the technique
- drug dose error/constitution error
- inadequate monitoring (recent reports of respiratory arrest in patients with intrauterine death, and desire to not implement intrusive mornitoring)
- concomitant or recent administration of other opioids.

(Filler: If you wanted to introduce a remifentanil PCA service, how would you go about it and what barriers might you encounter?)

Examiner guidance

Do not spend too long on Part 1, make sure that Part 2 is covered. Sensible approach to pharmacological management in labour required with a knowledge of the issues related to remifentanil PCAs to pass.

Question 1A: Clinical science question 1 – Anatomy of epidural space and differences with obesity

What approaches can be used to access the epidural space?
Describe the anatomy of the epidural space at L3/4
Boundaries:

- lateral – pedicles and the intervertebral foraminae-
- anterior – posterior longitudinal ligament, vertebral bodies and discs
- posterior – Ligamentum flavum, facet joints and laminae.

Contents:

- loose areolar connective tissue, scar tissue if previous back injury/surgery/ epidural
- fat, in proportion to rest of body
- dural sac containing CSF and cauda equina
- spinal nerve roots as they exit the dural sac and pass through the intervertebral foramina; dorsal root ganglia in lateral recesses
- arteries and an extensive plexus of veins. The veins are valveless and continuous above with the intracranial veins and below with the pelvic veins. They are distended by coughing or raised intrabdominal pressure.

Describe the anatomy of the sacral canal?

- the sacrum is a triangular bone that articulates superiorly with L5, inferiorly with coccyx, and laterally with ilia
- dorsal roof comprises fused laminae of 5 sacral vertebrae
- in the midline is the median crest with the intermediate sacral crest with a row of 4 tubercles laterally representing the articular processes
- the S5 are remnants only and form the cornua
- in over 90% population the arch of S5 fails to fuse in the midline leaving a triangular gap
- sacral hiatus at S5 is covered by the sacrococcygeal membrane allowing access to epidural space
- along the lateral border are anterior and posterior foramina through which sacral nerve roots pass.

Contents of sacral canal:

- dura superiorly
- connective tissue, fat and lymphatics
- sacral nerves
- filum terminale
- rich venous plexus.

answer continues/...

Clinical differences:

- adults dura ends at S2, newborn dura ends at S4, by age 2 similar to adults
- increased risk of intrathecal injection in children age 2 and less
- underdeveloped ANS in children results in reduced sympathetic blockade and hypotension
- cf adults
- epidural fat loose and wide meshed with less fibrous tissue in children resulting in greater spread of local anaesthetic on ml/kg basis
- spread of LA solution in adults influenced by volume, speed of injection and posture
- relationship between spread of LA in children best with age and less so with height and weight, high blocks easier to achieve in children by increasing volume of LA, not in adults (sacral canal capacity >30 ml).

What are the challenges of siting an epidural for labour analgesia in a morbidly obese patient?

Anatomy:

- increased subcutaneous fat makes identification of landmarks difficult
- unable to adopt ideal position for insertion, ie, flexed spine
- cephalad spread more likely? secondary to increased intra-abdominal pressure.

Epidural failure more common:

- failure to site epidural may be >33% of parturients
- resite rate increases linearly with BMI
- increased incidence of dural puncture (4% vs 0.5-2.5%)
- the previously cited lower incidence PDPH in event of dural tap is now disputed.

(Filler: What techniques can you employ to achieve correct epidural catheter placement in an obese patient?)

Staff: senior and experienced anaesthetist

Position: more likely to succeed in sitting position as landmarks more easily identified

Equipment: longer needles need to be available

Epidural depth equation: predicts how far from skin to space based on height and weight.

Ultrasound:

- NICE guidance (IPG249) in 2008 does not replace standard technique
- may be used 'realtime' to guide needle place in view of experts
- can be used to ensure space below level cord termination is used for CSE.

Guidance to examiners

Candidate should be able to describe both anatomical areas in detail and the anatomical reasons why caudal injection is more efficacious in children.

Question 2A: Short case 2 – Intensive care unit aquired weakness (ICUAW

A 76-year-old lady has been ventilated for one week on the ICU following an episode of severe pneumonia and septic shock. She is now improving but is slow to wean from the ventilator and appears profoundly weak.

What do you think is the cause of this patient's weakness?

Supporting information
Nil

What do you think is the cause of this patient's weakness?

- the patient is likely to have Intensive Care Unit Aquired Weakness (ICUAW) or critical Illness polyneuromyopathy
- it is a 'clinically detected weakness in critically ill patients in whom there is no plausible aetiology other than critical illness'
- usually then subdivided into critical illness polyneuropathy (CIP) and critical illness myopathy (CIM) or critical illness neuromyopathy (CINM)
- CIM may be divided histologically into cachectic, thick-filament and necrotising myopathies
- when studied in detail there is considerable overlap.

Is it common?
Yes – 43–49% of all adults in a general ICU for more than one week, and probably higher in patients with sepsis.

What are the risk factors for its development?

- risk factors = severe systemic inflammation, septic shock, multi-organ failure, prolonged mechanical ventilation/bed rest, poor glycaemic control, longer duration of illness
- associated drugs – corticosteroids, neuromuscular blocking drugs (particularly CIM), aminoglycosides
- possibly: female, age, severity of illness on admission, renal therapy, parenteral nutrition, vasopressors.

How is it diagnosed?
Clinical diagnosis – presence of:

1 weakness after the onset of critical illness

2 generalised weakness including the proximal and distal muscles, symmetrical and flaccid (cranial nerves usually preserved) flaccid quadriplegia, hyporeflexia, muscular atrophy
- deep pain produces grimacing with little limb movement
- diaphragmatic involvement common.

3 Other causes of weakness have been excluded.

answer continues/...

4 AND one of the following:

- low Medical Research Council muscle power score (0–5), 12 muscles are tested, a cut-off score of 48 is supportive of diagnosis
- dependence on mechanical ventilation
- sensory function is difficult to assess, but is often abnormal in CIP
- autonomic function is normal
- only needs investigating if there is diagnostic uncertainty. Then consider neurological investigation (motor and sensory action potentials, electromyography), and possibly muscle and nerve biopsy, creatine phosphokinase(CPK).

What clinical problems does it cause?

- difficult weaning from mechanical ventilation
- increased ICU + hospital stay
- increased mortality (45% die within their hospital admission)
- in survivors, persistent severe disability occurs in about 30%, full recovery occurs in 68%
- possible hyperkalaemic cardiac arrest following suxamethonium.

What can be done to reduce the incidence of this condition?

- address risk factors if possible, care with NM blockers, steroids, aminoglycosides
- intensive insulin therapy has been shown to reduce the prevalence but NICE-SUGAR study no longer recommends this
- sedation holds should be done daily if possible for all ICU patients. Allowing the patient to emerge and move limbs, as well as reducing total amounts of sedation given will help
- enteral nutrition, early mobilisation.

(Fillers: What do you understand by ICU Care Bundles? Such as VAP, CVP, PVC bundles...)

Question 2A – Clinical science question 2 – Physiology

What are the causes of muscle weakness in ITU?

Causes of muscle weakness:

- electrolyte abnormalities: hypokalaemia, hypo-/hypermagnesaemia, hypophosphataemia, abnormalities of calcium
- cachectic myopathy – severe systemic illness, diffuse muscle loss, catabolic or starvation
- drugs: corticosteroids, prolonged action of NMB drugs in liver and renal failure
- disease states: myasthenia gravis, Guillain-Barré syndrome, peripheral neuropathy, cervical cord pathology, endocrine disorders (Addison's, Cushing's)
- critical illness polyneuropathy and myopathy (CIP & CIM)
- damage to anterior horn cells in spinal cord – ischaemia from cardiac arrest, aortic surgery.

Features of Critical Illness Neuropathy (CIP & CIM)

- axonal degeneration of predominantly motor fibres
- muscle wasting
- demyelination during hypercatabolic states as adipose tissue sourced for glucose
- may be relative preservation of limb girdle power relative to movement of distal joints
- may (rare but documented) be residual effects in survivors 4-5 years after discharge.

Diagnosis – Electromyography, muscle biopsy

What is the physiological basis of electromyography (EMG)?

- electrodes used to initiate an action potential in a peripheral nerve.
- action potential arrives at the NMJ, depolarises nerve terminal releasing ACh
- ACh binds to the alpha subunit on the postjunctional receptors, allowing influx of sodium
- depolarisation of the end-plate, activates further sodium channels allowing depolarisation away from end-plates to both ends of muscle fibre at 3-5m/sec, 5–7 msec to spread through 5cm muscle
- the muscle action potential via the T-tubule system depolarises the membrane, releasing calcium, excitation-contraction coupling
- EMG is the sum of the action potentials of the adjacent fibres in a muscle
- recorded by placing one electrode over the mid part of the muscle and other at the end of muscle
- the action potential is recorded as it travels down the muscle typical values are 10mV in hand muscles
- abnormal spontaneous activity in muscles
- repetitive stimulation gives normal response, ie, no defect in neuromuscular transmission
- diaphragm involved in up to 70% cases
- CIP shows normal nerve conduction velocity, slight increase in latency but decreased sensory nerve and motor nerve action potentials

answer continues/...

- CIM – definitive diagnosis requires examination of muscle by biopsy although muscle abnormality will show up in electrophysiologic testing. Low or normal compound action potentials. Sensory nerve APs may be normal if just myopathy.

Direct Muscle Stimulation

- Direct muscle stimulation (DMS) in conjunction with standard testing (NCS/EMG) is a method to distinguish CIP from CIM in non-cooperative patients without performing a muscle biopsy. To perform this test, stimulating and recording electrodes are both placed into the muscle. In CIM, the action potential is reduced in both the standard study and in DMS. In CIP however, the standard study will show low amplitude action potential while DMS will be normal. This is due to the fact that stimulation does not go through a damaged motor nerve.

Muscle biopsy, 3 patterns seen:

- acute necrotising myopathy (myonecrosis)
- thick-filament myopathy (loss of thick myosin filaments), and non-necrotising, cachectic, myopathy (type-2 fibre atrophy).

Examiner guidance

Difficult topic, but candidate should know physiological basis of EMG and be able to deduce likely changes on examination in critical illness weakness to pass.

Question 1B: Clinical short case 3 – General duties: Day surgery

A young female presents for day-case laparoscopic sterilisation. She has had a previous anaesthetic (breast augmentation) and was nauseous and sick repeatedly after the previous surgery. She asks you, will she be sick after this operation? What would you say?

Supporting information
Nil

What would say?

- sympathetic to problem
- explain real risk of happening again (high-risk patient)
- describe a range of things can do to try and stop it occurring.

Commonest cause of dissatisfaction in patients.

Is PONV still a significant problem?

- yes (30% all patients, depending on surgery). Commonest cause conversion day cases to overnight stay).

What are the risks associated with PONV?

- wound dehiscence
- dehydration/electrolyte imbalance
- psychological effects
- aspiration
- delayed nutrition.

Which patients are particularly at risk?

- patient factors
- apfel factors: female, previous history of PONV or motion sickness, non-smokers,anticipated use of postoperative opioids. Greater than 2 factors = high risk (60% incidence PONV). Less than 1 factor – 10-20%, more than 4 – 80%
- surgery related factors
- raised risks with ENT, squint surgery, laparoscopic gynae surgery, breast augmentation
- increasing duration of surgery.

Clinically, how would you try and stop PONV in this young lady?

- represents high risk (greater than 2 patient risk factors)
- prophylaxis more appropriate than treatment once PONV occurs
- two treatment approaches:
  - use of multiple antiemetics (all equally effective (except etoclopramide),demonstrate additive effects)
  - avoidance of emetogenic factors (avoidance of nitrous oxide, propofol rather than inhalational agents, long-acting opiates) +- hydration.

Specifics?

- preoperative antacids/metoclopramide
- give dexamethasone + 5HT3 antagonists and/or cyclizine intraoperatively
- TIVA with propofol-based anaesthetic.

answer continues/...

How effective are the various strategies?

Antiemetics:

Single individual antiemetics reduce risk by approx 20-40%

Risk reduction (cyclizine 0.6, Dex 0.55, Ondansetron 0.6, droperidol 0.65, metoclopramide 0.8, prochlorperazine 0.7). Don't want to use antiemetics which are too sedating as day case.

Second antiemetics are additive not synergistic. If pt low- or high-risk, reduction still only 25%.

Interventions reduce relative risk to a similar extent, so greatest absolute risk reduction in patients at highest risk of PONV. Single intervention in patient at 80% risk reduces risk to 59% (NNT 5 to prevent N&V in one patient): patient baseline risk 10% reduces risk 3% (NNT 40).

- antiemetics similarly effective – logical to use safest ± least expensive first
- multiple antiemetics with different mechanisms of action (triple therap – ondansetron, dexamethasone and cyclizine). Absolute risk reduction by second and third intervention less than first. A 70% reduction in relative risk is the best that can be expected. 'Rescue' treatments are ineffective when same drug has already been used prophylactically
- avoidance of all the factors in first section. Reasonable first-line dexamethasone and total intravenous anaesthesia as these cannot be used once PONV has begun
- avoidance of factors
  - avoidance of nitrous = variable results (? ? statistical but not clinically significant)
  - avoiding long-acting opiates with good oral analgesia and local anaesthesia (infiltration/pouch of Douglas LA), tubal injection of LA
  - overall for this lady, strategy probably reduces risk for patient population like this lady from 60%+ to about 30% (Results for populations not individuals)
  - TIVA based with propofol reduces by 50% in some studies.

Examiner guidance

A successful candidate will be aware that PONV remains a significant problem and will be able to describe how would manage this high-risk patient and risk stratify to wider population.

(Filler: If asked to write one, what would be in your departmental policy for reducing rates of PONV?

- risk stratification based on risk factors
- treatment based on risk/cost effectiveness
- multimodal approach with use of multiple approaches in high-risk groups.)

(Filler: How would you audit the effectiveness of policy?

- multiple issues audit design
- how measure nausea (yes/no, Likert scales, interference with activity at home, more than 24 hrs?))

Question 1B: Pharmacology of PONV

Guidance to examiners
All core knowledge should give accurate and complete account of neurophysiology and mechanism of action and precautions/side effects of five classes of drug to pass

Neurophysiology:
Afferent limbs of vomiting reflex include

- GI tract – mechano- and chemoreceptors via the vagus nerve to the nucleus tractus solitarius in the brain stem, involving cholinergic, 5-HT3, dopamine and neurokinin-1(NK1) receptors
- ipecacuanha can be used in poisoning to directly stimulate these receptors
- Chemoreceptor Trigger Zone. Situated close to the area postrema in the floor of the fourth ventricle, outside the blood–brain barrier. Responsible for detecting toxins in blood and CSF (5HT3) also the nausea associated with sleep deprivation
- vestibular system – especially motion sickness (H1 and H2)
- CVS – afferents mainly from the baroreceptors
- higher centres – sights, sounds, smells, unpleasant thoughts
- pharyngeal afferents
- auricular branch of the vagus nerve
- visceral pain.

Vomiting centre

- Not an anatomical entity, several nuclei in the brain stem (eg, nucleus tractus solitarius, dorsal vagal nuclei, reticular formation and respiratory neural networks) responsible for the coordination of the efferent limb of the vomiting reflex
- Receives input from the afferent limbs of the reflex.

How does each class of anti-emetics act to reduce nausea and vomiting? What are their side effects?
Drugs:

- metoclopramide: dopamine antagonist, also acts directly on GI tract so may be superior in gastroduodenal, hepatic and biliary disease to phenothiazines. Has some efficacy at 10 mg, at higher doses has an anti-5HT3 effect, but side effects generally unacceptable. Side effects – extrapyramidal reactions particularly oculogyric crisis, tardive dyskinesia especially in young females: agitation. Neuroleptic malignant syndrome. After IV injection, hypotension, sinus and supraventricular tachycardia. MHRA guidelines on use in view of serious neurological side effects

answer continues/...

- phenothiazines (antidopaminergic): promethazine, prochlorperazine (side effects – extrapyramidal reactions (acute dystonia), sedation if large dose. Mainly in chronic use – jaundice, skin sensitisation and haematological abnormalities). Cause of neuroleptic malignant syndrome. Many other effects through anticholinergic, anti-noradrenergic (a1 and a2) and antihistamine actions
- butyrophenones (dopamine antagonists). Droperidol and Haloperidol. Side effects – extrapyramidal reactions, apprehension, restlessness, nightmares. MHRA guidance on avoidance of cardiac toxicity (conductance disturbance) contraindicated with other drugs prolong QT interval or inhibit CYP 3A4.
- Domperidone useful in Parkinson's disease to reduce nausea from dopinergic drugs:
- anticholinergics: hyoscine (scopolamine), atropine. Cyclizine is anticholinergic but also an antagonist at H1 receptor. No extrapyramidal side effects but predominantly anticholinergics side effects – sedation, dry mouth, urinary retention, blurred vision, restlessness and hallucinations
- 5-HT3 receptor antagonists: ondansetron, granisetron, dolasetron. Side effects – mild headache, sensation of warmth/flushing, visual disturbance, occasional cardiac arrhythmias, and – with chronic use- constipation
- cannabinoids. Nabilone useful with chemotherapy. Side effects – dysphoria and hallucinations
- dexamethasone: mechanism uncertain suggested mechanisms are reduced release of arachidonic acid, reduced turnover of 5HT or decreased permeability of the blood, brain, barrier (BBB). Side effects – rectal/perineal warmth if given awake. Impaired glucose tolerance and risk of hyperglycaemia and associated wound healing and thrombotic issues, psychotic/delusional reactions
- neurokinin-1 receptor antagonist – aprepitant, fosaprepitant specifically licensed for use with cisplatin chemotherapy.

Question 1A: Clinical short case 1 – Pre-eclampsia

A 32-year-old primigravida of 36 weeks gestation has been in labour for 6 hours. No epidural is in place. The obstetricians have decided that she should undergo caesarean section because of a 'non-reassuring CTG'.

She has hypertension and ankle swelling, and has been started on a hydralazine infusion.

BP 150/102, HR 126, RR 24 bpm and T 37.2°C What problems will we need to consider?

Supporting information
Nil

What problems will we need to consider?

- problems common to any LSCS
- choice of technique, urgency of intervention, maternal preferences
- problems of raised BP?

Does this patient have pre-eclampsia?

- if after 20 weeks gestation
- mild hypertension >140/90
- moderate hypertension >150/100
- severe hypertension >160/110
- significant proteinuria if the urinary protein: creatinine ratio (PCR) >30 mg/mmol or a validated 24-hour urine collection result shows greater than 300 mg protein.

= YES = moderate pre-eclampsia in this case. If no proteinuria just moderate PIH.

NB: severe pre-eclampsia must also be symptomatic and/or have biochemical or haematological derangement (eg, HELLP).

Does this patient require additional drugs before having the LSCS?

- yes, in view of both raised pulse (at least in part secondary to hydralazine) and BP (risk of cerebral bleed and pulmonary oedema)
- consider Labetolol 10 mg boluses, followed by an infusion 100-200 mg/hr
- nifedipine 5-10 mg could be considered but will make tachycardia worse
- magnesium sulphate = according to local protocol but usually reserved for severe pre-eclampsia
- reduces the incidence of pre-eclampsia going on to eclampsia (fits) by 50%
- but only 1–2% of pre-eclamptics in UK go on to eclampsia. (Magpie study 2002)
- Mg regime = 4 g magnesium sulphate IV over 5–15 mins. Then 1g/hr. Continue for maximum of 24 hrs
- sodium citrate + Ranitidine.

answer continues/...

How are you going to anaesthetise this pt for LSCS?

- options? Discuss adv/disadv of each GA vs spinal vs epidural
- check coagulation status before regional block: Regional:
  - adv. = Believed to be safer and better for unborn child. Avoids risks of GA, partner can be present
  - disadv. = Risk of hypotension (some studies show it is less with pre-eclampsia). Likely to have reduced circulating volume in vasoconstricted system. Balance against risks pulmonary oedema. More sensitive to vasopressors.

Spinal analgesia shown to be safe in moderate to severe pre-eclampsia. Slow epidural top-ups no longer considered necessary.

- General:
  - adv. = rapid, effective
  - disadv. = difficult/failed intubation.

Labile pressor response to intubation (reduced by opioids, magnesium or beta-blockers)

Interaction of Mg with non-depolarising muscle relaxants (failure to reverse at end of op).

Assuming platelet count 60 PT 15.3 sec APPT 36 seconds.

Which mode of anaesthesia would you choose?

- GA as insufficient time to correct clotting
- discuss technique in potentially difficult airway with laryngeal oedema and how pressor response is to be avoided
- drugs STP v propofol
- rocuronium v suxmethonium.

(Filler: TEG in pre-eclampsia)

Examiner guidance

Pass candidate if can recognise and define pre-eclampsia, and demonstrates safe and sensible approach to anaesthetic options for LSCS care.

Question 1A: Clinical science question 1 – Clinical measurement

What factors should you consider when selecting a breathing system for a particular patient?

Factors to be considered

- size of patient – T-piece suggested, <~5 kg, why?
- E=emergency situation on the ward, giving 100% oxygen by hand – Mapleson C circuit
- economy of gas flow with expensive volatile agents, reduce pollution – circle system
- specialised circuit for CPAP etc in critical care
- circuit to be used for SV or IPPV or ease of switching between SV and IPPV
- long circuit needed, eg, for patient in MR suite
- ease of scavenging – easier for Lack/Bain than Magill/Mapleson A.

Could you describe in detail the pathway taken by gas in a circle breathing system

Start with gas which has just been expired during **spontaneous ventilation**

Y-connector – expiratory limb tubing – expiratory one-way valve-reservoir bag with spill valve-CO_2 absorber-fresh gas added-inspiratory valve-inspiratory tubing-Y-connector.

- fresh gas enters after absorber to prevent absorber drying, but gas not humidified
- reservoir bag and spill valve before absorber (inefficient to clean gas being voided)
- simple system for IPPV is bag/bellows in bottle but new machines more complicated.

Disadvantages

- complex design with multiple connections
- unidirectional valves may malfunction [check the candidate knows the problem resulting]
- slow response time at low fresh gas flow
- need for volatile-agent monitoring
- breakdown of anaesthetic agents by soda-lime, eg sevoflurane (is this important?)
- consumes absorber, may need changing intra-op
- carbon monoxide accumulation (? significance)
- multiple user inputs required to be used efficiently.

How is the problem of carbon monoxide production avoided

- related to agent (worst with desflurane), broken down by KOH in soda-lime
- related to type of absorber (worst with baralyme), its temperature and dessication
- modern soda-lime has no KOH, dessication-resistant.

answer continues/...

How would you suspect carbon monoxide poisoning

- pulse oximeter not helpful
- no reliable signs in anaesthetised patients beyond perhaps cardiac signs cellular
- hypoxia
- gas analyser may show erroneous volatile agent due to production of trifluoromethane
- analysis of arterial blood sample by co-oximeter to show COHb
- CO ~ 5-10% may be found in smokers, higher results in poisoning
- neurological damage due presumably to cellular hypoxia.

Advantages of circle breathing system

- economy of fresh gas and volatile agent [how would you calculate cost savings?]
- maximum savings at very low flows for long procedures [what is lowest flow possible?]
- conserve heat and moisture in inhaled gases
- reduced theatre pollution – working efficiency, long-term problems of anaesthetic agents
  - reduced environmental pollution – nitrous oxide is a primary greenhouse gas and depletes ozone – H-CFCs, and to a lesser extent desflurane and sevoflurane (no chlorine atom), cause destruction of ozone layer.

Examiner guidance

The circle breathing system is commonly used, and candidates are expected to have good knowledge of its use and limitations but be aware of the uses of other circuits to pass.

SOE 2 – Clinical long case with stand-alone short cases

Long case 1

GUIDANCE FOR EXAMINERS

1 haematology results show lowered Hb and raised wbc
2 biochemistry results show raised glucose levels
3 arterial blood gas analysis shows a metabolic acidosis
4 chest x-ray shows bilateral fractured ribs, surgical emphysema and a R chest drain.

a Preoperative assessment

- discuss results then proceed to ATLS assessment
- airway: How to assess? Speaking. C-spine in collar and blocks. How should C- spine be cleared? clinical history and exam, however she has distracting injuries. Need precautions until conscious and stable or radiology review by MSK radiology. What is likelihood of C-spine injury? (5-10% in presence of sig head injury)
- breathing: Tachypnoeic – causes – pain, pneumothorax, acidosis, hypovolaemia, flail segment. Anion gap (Na + K - HCO_3 + Cl) = 33 (N = 8–16)
- circulation: Assessment? Colour, cap refill, vital signs, this is probably Class III shock – (estimated blood loss at least 1.5–2 litres). Actions? Control bleeding points, check binder. Bilateral upper limb vascular access. Activate massive haemorrhage protocol (see resuscitation below). Bloods for coagulation, including fibrinogen. POC testing if available. Tranexamic acid if not already given. Regimen: CRASH2 protocol: 1 g bolus (10 minutes) further 1 g over 8 hours
- life-threatening injuries – needs prompt surgery. What is surgical priority? Haemorrhage control (damage limitation)
- disability – AVPU – is Alert (what are others – Verbal stimulus response, Painful stimulus response or Unresponsive)
- exposure – other injuries, hypothermia
- what other information needed – AMPLE (allergies, medication, past medical history, last intake, events leading up to injury)
- what is the Lethal Triad? Hypothermia, Coagulopathy, Acidosis.

b Resuscitation and anaesthesia

- analgesia – Issues? Effective analgesia worsens hypotension in hypovolaemia, effect on abdominal signs? analgesia and resuscitation simultaneous
- intubate in ED vs. theatres. Timing – in theatre probably best with surgeon scrubbed and ready ? further volume replacement required. ?remove collar, apply MILS (probably safe if no neck pain and prov. CT normal). Laryngoscopy: what are priorities? Avoid hypoxia and aspiration, minimise C-spine manipulation, reduce pressor response. Videolaryngoscopy helpful. If DL consider minimal glottic view and bougie. RSI – discuss drug choices and why. NG tube useful

- fluid resuscitation (Initial Fluids)? Crystalloid, O negative or Type Specific, FFP or Octaplas. Bloods for coag, including fibrinogen. POC testing if available, crystalloid v colloid (why have starches been withdrawn?). Think platelets (stored at room temp – 5-day shelf life not always immediately available consider transport time from Regional Transfusion Centre). Monitoring adequacy of resuscitation – ?CVP, urine output, ABG's and Lactate. ?LiDCO rapid, NICOM "Cheetah". Transfusion triggers? Near-patient testing – HemoCue, Thromboelastometry. Keep fibrinogen >2 – Cryoprecipitate 1 pooled unit contains cryo from 5 donors
- fluid and body warming important. Risks of hypothermia (already COLD) ,What is the Lethal Triad? Hypothermia, Coagulopathy, Acidosis. MI in high-risk patients, increased blood loss, increased surgical wound infection, decreased oxygen delivery, altered drug kinetics)
- tell candidate operative findings liver tear and small bowel mesentery tear – both successfully repaired and abdomen closed. Orthopaedic surgeons advise nailing of femur with deferred pelvic # fixation. Should you proceed with femoral procedure? [Needs senior discussion with ICU/ortho, affected by acidosis, temp, coagulation, open injury? # Displacement?]
- postoperative care: ITU/HDU.

Long case 2

GUIDANCE FOR EXAMINERS

To pass, candidates should: demonstrate awareness of uncertainty; recall that patients should normally be assumed to have capacity; recall clinical features of raised ICP; describe main elements of intraoperative care, including management of CPP.

a Preoperative assessment

- has his chest infection resolved? (?temp, ↑WCC & steroids)
- delay surgery and treat? Candidate should appreciate the uncertainty here. Seek advice from respiratory physician. Involve patient if capacity. If delay, what treatment? (Stop smoking, patches, cautious physio, review antibiotics)
- do you think this man has raised ICP? (Possible)
- what are the features of raised ICP? – headache, vomiting, confusion. Papilloedema, hypertension, and bradycardia (not in this case)
- consent and mental capacity – does this man have capacity to consent for surgery? (yes, probably, capacity should normally be assumed). How can you tell? Why might capacity be impaired? (ICP, dexamethasone, direct tumour effect, confusion 2ndry to infection). If he lacked capacity could you still proceed? (yes, in best interests, but needs appropriate record, including witnessing explanation). Made more difficult here due to complexity over treatment of chest and possible delay.

b Management

- **discussion of ICP and anaesthetic management** – normal values? (7-15mmHg)
- what is Monro-Kellie? How affect compliance curve and CPP?
- **key principles for craniotomy?** control of ICP and CPP. Need to keep BP up, at least until the dura is open (but excessive hypertension may↑vasogenic oedema). Application of head frame pins may cause BP↑ – therefore give adequate fentanyl/remifentanil
- **where is this tumour on scan? What is significance of tumour location to anaesthesia?**
- may need park bench, prone (sitting now rare) with attendant risks inc. VAE, blood loss, reflex responses to surgery, if brainstem likelihood of postop problems, eg bulbar function
- **maintenance** – inhalational versus TIVA infusion technique – (? better CPP with propofol infusion, but either technique acceptable)
- **mild hypothermia?** – pros and cons
- **catheter? (mannitol v infection/stricture)**
- **steroid management?** IV fluids – saline traditional (dextrose and ischaemic brain, Hartmann's and possible hypotonicity, but Hartmann's favoured by some)
- **monitoring**, A-line. Some use CVP if VAE risk. Role of BIS? Currently BIS/Narcotrend/E-Entropy all on UK market and recommended by AAGBI 2015 guidance during TIVA and 'can be used' acc. to NICE [DG6]
- **antibiotics?** This is clean surgery but issue may be chest-microbiology advice
- **Postoperative care**: Neuro ITU/HDU.

Long case 3

GUIDANCE FOR EXAMINERS

To pass, candidate should provide several of main points without further prompting.

- Bloods: Mild anaemia (normocytic, hypochromic)
- ECG: Normal
- Principles of anaesthetic management for free flap
- Management of critical incident-anaphylaxis

a Preoperative assessment

What do you consider to be the important considerations? Young working woman with cancer diagnosis (anxiety, depression) possibly rendered infertile by this (previous TOP). Complex psychosocial problem potentially:

- borderline weight may reflect poor diet or malabsorption (Crohn's) – advice: dietician, gastroenterology?
- blood picture may reflect GI bleeding (Fe deficient), nutrition or B12 (terminal ileum) deficiency. Transfusion may affect cancer recurrence risk. Nitrous oxide and B12
- lengthy op. Insidious blood loss
- normothermia difficult to maintain: Entire torso exposed. Necessity to turn patient: Supine–lateral–supine. Arms often abducted. Pressure area care and nerve damage.

What type of flap is LD? Pedicled Flap is raised and tunnelled thro the axilla.

What other types of breast reconstruction are there?

Implant-based; free flap using excess abdominal tissue (TRAM/DIEP).

What difference does flap type make to anaesthesia?

- surgical duration, all issues of free flaps (temp, cardiac output, MAP, recovery issues + postop destination, inotropes). Monitoring for LDR? If it was a free flap? a-line, CVC (inotropes), urinary catheter, flow monitor, eg, ODM
- **Points to discuss at briefing?** valid G & S. Antibiotic prophylaxis. Implant placed under LD flap. Most common infective source? Patients own skin. Staph epidermidis – co-amoxiclav or if penicillin allergic teicoplanin/gentamicin. Thromboembolic prophylaxis – most oncoplastic breast surgeons avoid LMWH – risk of haematoma formation. TEDS Intermittent pneumatic compression used
- **What is SLNB?** used for axillary staging in early breast cancer. Advantage? Avoids the morbidity of axillary dissection – lymphoedema. Radioisotope injection pre-op (99Technetium labelled Human Albumin). Sentinel node = node with the highest level of radioactivity closest to the tumour. Gamma probe used to find this node. Injection of Patent Blue (or other) dye at onset open surgery to stain node. Is there any risk to the fetus from the radioisotope if the surgeon, anaesthetist or patient were pregnant? No!

b Intraoperative care

- **broadly describe your anaesthetic**
  Pre-med? Intubate? Yes in view of duration. Avoid N2O if B12/folate concerns. Large bore IV cannula/a-line in contralateral arm. Temp probe, Bair Hugger, fluid warming, pressure areas, compression boots and TEDs, urinary catheter, cardiac output monitor. Some would use CV line
- **co-amoxiclav is administered, Patent Blue dye is injected by the surgeon: you notice isolated hypotension BP 50/30. Differential diagnosis?**
  Too much anaesthetic, pump failure, sepsis, anaphylaxis (drugs, antibiotics, Patent Blue, latex)
- **management**:
  ABC, Increase $Fi0_2$, Trendelenburg (head down), fluid bolus 20 ml/kg crystalloid, reduce anaesthetic if appropriate, a agonist
- **hypotension not responsive to above measures and 5 mg metaraminol**. Most likely diagnosis anaphylaxis (incidence with Patent Blue?-1 in 1000). Treatment? Adrenaline 0.5 mg i.m. or 50 mcg increments IV (0.5 ml 1 in 10,000). Risks of IV epinephrine v i.m.? Coronary ischaemia/arrhythmias. Send ABG/tryptase (inform lab sample needs to be spun down and serum frozen). Hydrocortisone 200 mg, chlorpheniramine 10 mg. Organise CV catheter. Consider inotropes – epinephrine probably first choice. How do you make it up? Give bolus 50 mcg (0.5 ml 1:10,000) make up 5 mg in 50 mls – start at 5–10 ml/hr – titrate to response. Liaise with surgeon – surgery has commenced and is for cancer if patient can be stabilised consider less extensive surgery, eg. SLNB, skin sparing mastectomy plus implant only with delayed reconstruction
- **what is anaphylaxis?** IgE mediated type B hypersensitivity reaction to an antigen resulting in histamine and serotonin release from mast cells and basophils
- **manifestations**: cardiovascular collapse (88%), erythema (45%), bronchospasm (36%), angio-oedema(24%), rash (13%), urticaria (if conscious)(8.5%)
- **rx of bronchospasm**: salbutamol 250µg IV or 2.5 mg by nebuliser. Aminophylline 250 mg by slow intravenous injection (max 5 mg/kg). If immediate Rx fails: epinephrine IV boluses (10 µg = 0.1 ml of 1 in 10,000) ketamine (2 mg/kg IV), magnesium (2 g by slow IV)
- **mechanisms of adrenaline in anaphylaxis?** Vasoconstriction a1 (coronary and cerebral perfusion pressure), bronchodilatation (B2), mast-cell stabilisation
- **the patient's condition stabilises and after discussion with the team you decide to proceed. At the end of surgery the patient's face is slightly swollen –these are the ABG** (Show candidate). $Fi0_2$ = 50%, pH:7.4, PCO_2: 5.6, pO_2 25.1, BE 1.0, lactate: 1.5 mmol/l
- **would you extubate?** – yes, if there is a leak around the tube. On extubation the patient complains of her face feeling swollen, and her chest feels tight
- **management?** Sit up, humidified 0_2, adrenaline nebuliser 5 mg, close monitoring in HDU
- **post op**: Arrange skin testing at local immunology centre. Ask candidate to interpret allergy results and show tryptase and skin test results (see overleaf).

Serum tryptase

Result	Value	Units	Ref. Range (ng/ml)	Result Comment
2 hours	20.5	ng/ml	2–14	
4 hours	14.5	ng/ml	2–14	
24 hours	2.1	ng/ml	2–14	

Results of skin prick testing	
Saline (negative control)	Negative
Histamine (positive control)	7 mm wheal
Midazolam	Negative
Propofol	Negative
Fentanyl	Negative
Remifentanil	Negative
Atracurium (1:10)	Negative
Rocuronium	Negative
Vecuronium	Negative
Augmentin	Negative
Patent Blue dye	5 mm wheal, 10 mm flare, itch
Results of intradermal testing	
Atracurium (1:1000)	6 mm wheal, 20 mm flare, itch
Rocuronium (1:200)	3 mm wheal
Vecuronium (1:10)	Negative

ABG on completion of surgery (FiO_2 = 50%)

pH	7.40
pCO_2	5.6 kPa
pO_2	25.1 kPa
BE	1 mmol/l
Lactate	1.5mmol/l
Hb	102 g/l
Patient temperature	36.5ºC

Stand-alone clinical short cases

Paper 1

Paper 1: Short case 1 – GGU

A 68-year-old male patient has an incarcerated inguinal hernia requiring exploration. They have ankylosing spondylitis with associated cervical kyphosis. Their FEV_1 is 1.35 and most recent and relevant clinical observations are: RR=23/min; HR=112/min (regular), BP=97/54 and temp= 38.5°C. Their mouth opening is 2cm and their only medications are paracetamol and ibuprofen PRN.

Supporting information
Nil

Opening question:

Can you summarise the epidemiology and pathogenesis of ankylosing spondylitis?

- peak onset at 20–30 years (1% males, 0.5% females)
- ethnicity: usually white
- environmental factors (unidentified bacterial or viral agents), susceptibility genes (HLA–B27) and auto-immune response
- ankylosing spondylitis is characterised by sacroilitis, peripheral arthropathy, enthesopathy (pathological changes at the sites of insertion of ligaments and tendons), and the absence of rheumatoid factor.

Subsequent questions:

What will you focus on in your preoperative assessment?

- incarcerated inguinal hernia and potential for sepsis and therefore urgent surgery
- difficult positioning and difficult venous access
- coagulopathy ruling out regional anaesthesia
- potential for difficult airway (patient)
- possibility of sepsis.

What is the current definition of sepsis, and when managing potential sepsis what is meant by the phrase 'septic-six'?

- initial diagnosis of sepsis made via Quick SOFA (Sequential Organ Failure Assessment) or qSOFA ≥2 (RR>22/min; Altered Mental State, SBP<100mmHg)
- sepsis six: administer oxygen (titrate to SaO_2≥94%), take blood cultures, administer empiric antibiotics (E. coli is likely organism), serum lactate and FBC, intravenous fluid, urinary catheter.

answer continues/...

What perioperative problems does ankylosing spondylitis pose?

- difficult airway: fixed neck deformity, limited jaw opening (TMJ involvement.) Need for AFOI
- respiratory: restrictive lung disease
- cardiovascular: conduction defects, associated valvular heart disease, poor venous access
- novel agents: anti-TNFa drugs: immunosuppression, infection, delayed wound healing
- poor nutritional state.

Outline how you would perform an AFOI.

- Candidates must give a description of safe conduct withlocal anaesthetic and/or remifentanil.

Curriculum Mapping: AM_IK_01; AM_IK_02; GU_IK_12

References: www.das.uk.com *Anaesthesia* 2009; **64**:540

Paper 1 question 2 – Perioperative medicine

Scenario:
You are asked to review a 62-year-old male patient for an urgent femoral endarterectomy. They have a PMH of HT and schizophrenia with associated depressive illness. Their medications include amlodipine, lisinopril, terbutaline inhaler, salbutamol inhaler, olanzapine and citalopram. They continue to smoke between 40 and 50 cigarettes per day.

Supporting information
Artefact N

Opening question:

Can you describe the major implication of general anaesthesia in this patient?

- smoking:
  - increased risk of perioperative morbidity and mortality (dose dependent)
  - cardiovascular: 3– 4-fold increase in ischaemic heart disease, sympathomimetic effects of nicotine (arrhythmias), carboxyhaemoglobin (adverse myocardial oxygen delivery and increased oxygen demand), atheroma (altered lipid profile and plaque formation), increased risk of subarachnoid haemorrhage (dose dependent)
  - respiratory: COPD, lung cancer, bronchoconstriction, increased mucous production and viscosity with sputum retention and risk of hospital-acquired pneumonia, adverse perioperative incidents (cough, breath holding, laryngospasm)
  - GI tract: lower barrier pressure and risk of GORD, peptic ulcer disease, reduced incidence of PONV
- other systems: immunosuppression, poorer wound healing and increased rate of infection
- schizophrenia:
  - lack of capacity
  - agitation and increased incidence of postoperative cognitive dysfunction
  - poor compliance with medication and smoking cessation programmes
  - drug interactions: **Neuroleptics** (extra-pyramidal side effects) noting antiemetic usage; dystonia; akathisia (restlessness); Parkinsonism. **Atypical antipsychotics** such as olanzapine (extra-pyramidal side effects; central D2, H1, a1, 5HT2, Ach (muscarinic) blockade).

Subsequent questions:

Can you describe what is meant by informed consent with respect to surgical procedures?

- every human of adult years and sound mind has a right to determine what is done with their own body. A surgeon who performs an operation without consent commits an assault
- consent should usually be a process and not a single event, beginning well before the day of surgery. Indeed, consent taken on the day of surgery can be regarded as placing pressure on a patient to proceed and may be invalid

answer continues/...

- consent should usually be taken by a surgeon competent to perform the operation, or specifically trained to take consent for the proposed procedure.

What do you understand by the term capacity?

- the ability to make a decision based on being able to understand information, retain that information, weigh up that information and then offer an opinion on what is being offered
- legislation:
  - England and Wales: Mental capacity Act 2005
  - Scotland: Adults with Incapacity Act 2000
  - Northern Ireland: Mental Capacity Act (NI) 2016.

What is a Best-Interests Process?

- a decision made in the best interests of a patient (no one else's) without capacity
- it must consider past and present wishes, feelings, values and beliefs of the patient
- as far as is practicable and appropriate, others engaged in caring for the patient or interested in their welfare must be consulted
- a 'balance sheet' approach should then be applied, weighing the likely advantages of a treatment against the likely disadvantages.

Curriculum mapping: VS_IK_03; DI_IK_08

References: Anesth and Analgesia 2005; **101**:1867–1872 *BJA Education* 2019; **9**:1-6

Paper 2

Question 3 – Morbid obesity and laparotomy

A 45-year-old female patient on a surgical ward admitted as an emergency has a NEWS of 12, including temp= 38.9°C. They've had abdominal pain for 4-5 days and are noted to be cellulitic in their left iliac fossa. The surgical team want to perform explorative surgery. They weigh 243 kg with a BMI of 58.2 and have been unable to fit into a CT scanner. The patient has hypertension (Ramipril 10 mg OD) and type 2 diabetes (gliclazide 80 mg BD).

Supporting Information:
Nil

What are your concerns about the patient's size?

- patient is morbidly obese
- potential for difficult airway, increased incidence of reflux, OSA, difficult venous access, multi-organ involvement, altered pharmacodynamics and pharmacokinetics, difficult regional anaesthesia, patient movement and positioning.

How will you investigate and manage the diabetes over the perioperative period?

- RBG and HbA1C (<70 mmol/mol)
- assess for complications of diabetes: HT, nephropathy, neuropathy, retinopathy, PVD.

What postoperative complications can occur?

- labile blood pressure. Hypertension may cause haematoma, myocardial ischaemia, cerebral hyperperfusion syndrome, haemorrhagic stroke. Hypotension may cause ischaemic stroke
- CVA (incidence 2%) usually from clot or micro-emboli
- MI (0.5%)
- death (incidence 1%) all causes (usually cardiovascular)
- bleeding, neck haematoma and potential airway obstruction
- nerve damage: recurrent laryngeal nerve manifesting in hoarseness/voice changes (incidence 4%.) Superior laryngeal, glossopharyngeal, hypoglossal. Majority of cases resolve within 4-5 weeks of surgery, ie, neuropraxia
- restenosis (incidence 2-4%).

The patient is undergoing an emergency laparotomy. What are the key themes to the NELA audit?

- early senior input
- prompt administration of antibiotics
- assessment and appreciation of risk
- provision of appropriate perioperative resource, ie, radiological, access to operating theatres, critical care for postoperative management
- 24/7 services
- clinical governance, audit and improvement.

Curriculum mapping: AM_IK_02; GU_IK_03 & 08

References: www.nela.org.uk Perioperative management of the obese surgical patient *AAGBI* 2015

(Filler: Diagnosis of obstructive sleep apnoea (STOP-BANG))

Paper 2 Question 4 – Metastatic Ovarian Cancer

A 38-year-old female patient has metastatic ovarian cancer and is undergoing palliative chemotherapy. She requires a general anaesthetic for insertion of a ureteric stent due to locally invasive tumour in her left ureter, close to the cysto-ureteric junction. Outline your preoperative assessment and likely anaesthetic implications.

Supporting Information: Nil

Opening question:

What likely implications are there for your perioperative management with respect to metastatic ovarian cancer?

- Metastases:
  - local spread (pelvis, omentum, para-aortic lymph nodes) and invasion/compression of adjacent structures, eg, ureter (see question), iliac veins (and risk of thromboembolism)
  - lungs (respiratory problems), bone (pathological fractures and patient positioning), AKI, brain (seizures, raised intracranial pressure, cognitive impairment and potential for reduced capacity and uncertainty re informed consent), liver (coagulopathy, ascites: reduced barrier pressure (reflux) and impaired respiratory mechanics)
  - consider draining ascites preoperatively.
- Nutritional state:
  - likely malnourished state (ascites contributing to the overall weight giving a falsely high BMI) with reduced muscle mass
  - patient positioning and likelihood of pressure injuries: nerves and skin (ureteric stent insertion will require lithotomy position)
  - immunosuppression: risk of infection and poor wound healing
  - anaemia and thrombocytopenia.
- Chemotherapy:
  - immunosuppression
  - poor venous access
  - systemic involvement: RS (pulmonary fibrosis and oxygen toxicity especially if bleomycin used), CVS (myocardial suppression), GI (mouth sores, abdominal pain, diarrhoea, abnormal LFTs), Nervous system (neuropathy, pain), AKI
  - other: bleeding, dry skin.
- Anaesthesia: (regional difficult: height of block, possibility of coagulopathy and sepsis)
  - airway management: likely to require intubation and ventilation (risk of reflux, respiratory mechanics, position of tumour)
  - drug interactions and metabolism (reduced protein binding, reduced elimination, particularly noting opiates and muscle relaxants).
- Postoperative management: pain control: prolonged effects of opiates with possible accumulation and effect on respiratory function and conscious level.

Curriculum Mapping: GU_IK_02 References: *BJA Ed* 2014; **2**:52-56

(Filler: What other practical considerations may be necessary in postoperative period?

- may have young family so area of nursing may need to be reviewed
- poor prognosis: consideration of Treatment Escalation Plan and DNACPR.)

Paper 3

Paper 3 Question 5 – Upper limb regional anaesthesia and Never Events

A 78-year-old male patient with COPD (FEV_1= 0.61) is scheduled to undergo an arthrodesis of their left wrist for degeneration of their carpal bones.

Supporting Information:
Nil

Opening question:
What regional anaesthetic options are available for wrist arthrodesis?

- any form of brachial plexus block, but if limited to wrist the axillary block is probably the safest.

Subsequent questions:
How do you minimise the likelihood of 'wrong-sided block'?

- WHO sign-in
- visualise marking and ask patient to confirm site of surgery
- check/re-check consent form
- be aware of distractions: excess number of personnel present, teaching
- STOP BEFORE YOU BLOCK: any member of the team can demand for procedure to stop and make a further check.

What situations can lead to a wrong-sided block?

- covering of marking with sheets (particularly lower-limb blocks)
- distractions (see above)
- excessive workload on the operating list
- inexperienced personnel, unfamiliar with the patient.

What are the implications of a wrong-sided block for a patient?

- increased risk of complications (especially local anaesthetic toxicity)
- increased length of stay and delayed discharge
- conversion to GA (problematic if FEV_1=0.61)
- psychological impact.

Wrong-sided block is listed as a Never Event. Can you define a Never Event and provide examples?

- an adverse event that is serious, largely preventable and of concern to healthcare providers and public alike for the purpose of accountability
- **surgical**: wrong-site surgery/wrong implant or prosthesis/retained foreign object post-procedure
- **medication**: mis-selection of a strong potassium solution/administration of medication by the wrong route/overdose of insulin due to abbreviations or incorrect device/overdose of methotrexate for non-cancer treatment/mis-selection of high strength midazolam during conscious sedation/incorrect route of drug administration
- **mental health**: failure to install functional collapsible shower or curtain rails (minimising threat of hanging

answer continues/...

- **general**: falls from poorly restricted windows/chest or neck entrapment in bed rails/transfusion or transplantation of ABO-incompatible blood components or organs/misplaced naso- or orogastric tubes/scalding of patients/unintentional connection of a patient requiring oxygen to an air flowmeter/undetected oesophageal intubation (temporarily suspended from Never Events list in 2018).

What are sentinel events?

Any unanticipated or unusual event in a medical setting which results in death or serious physical injury to patients, specifically including limb loss or gross motor function.

Curriculum Mapping: RA_IK_02; RA_IK_03

References: *Anaesthesia* 2011; **66**: 58-62 *Anaesthesia* 2016; **17**:17-30 *JR Soc Med* 2016; **109**:190-199 bit.ly/39V0rF9

(Filler: Pitfalls/inequities of Never Events:

Concept originated in part from insurance-based healthcare so motivation for their implementation may not be completely altruistic. Can be construed as being excessively punitive. Some may not necessarily be wholly preventable, eg, PPH after elective LSCS)

Paper 3 Question 6 – ICM Pancreatitis

You are called to see 58-year-old female patient with gallstone pancreatitis who has collapsed on the surgical ward. She has been in hospital for 10 days and is scheduled to undergo a staging CT scan of her abdomen. Her NEWS score is 12. RR=36/min; temp. 38.10°C; HR = 138/min and regular; BP=94/52; agitated but tolerating 15 L/min of oxygen. Resuscitative attempts include high-flow oxygen, 2000 ml of IV Hartmann's solution and 4.5 g bolus of tazocin.

Supporting Information:
Nil

Opening question:
Can you outline the salient features of this case that give cause for concern and are there any additional investigations that you would perform?

- significantly abnormal NEWS suggestive of complications of severe acute pancreatitis that may fit with haemorrhage or sepsis
- interpretation of blood results: metabolic acidaemia, relative anaemia and possible haemorrhage, raised inflammatory markers and possible sepsis, likely biliary obstruction
- group and save in case of haemorrhage, chest x-ray (10-days in hospital: at risk of atelectasis and/or hospital-acquired pneumonia).

Subsequent questions:
If this is severe acute pancreatitis, what are the likely causes of deterioration?

- haemorrhage: erosion of blood vessel of ruptured pseudo-aneurysm (usually splenic artery or gastro-duodenal artery)
- sepsis; necrosis, abscess, infected ascites, pseudocyst, hospital-acquired pneumonia, visceral perforation/fistula formation.

Outline your management in order to ensure that the patient is transferred safely to CT:

- very unlikely the patient will be able to lie flat and maintain airway in CT scanner, therefore RSI will be required and invasive cardiovascular monitoring recommended, NG tube
- drugs: maintenance of anaesthesia, infusion pumps, emergency drugs
- risk of radio-contrast induced AKI
- ensure portable ventilator and monitors: know transfer time, volume of oxygen in cylinder (equated to atmospheric pressure), patient's minute volume and volume of oxygen required to drive ventilator
- remote environment: full AAGBI monitoring, senior support, skilled assistance, should have been made aware of environment at trust induction
- timely liaison with radiology in order to minimise delays in accessing CT scan.

Curriculum Mapping: Annexe F_1.1; 2.8; 3.1 DI_IK_03

References: *ICS* 2011. Guidelines for the transfer of critically ill patients *BJA Ed* 2018; **8**:63-68

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