Section 2: Intra-operative care
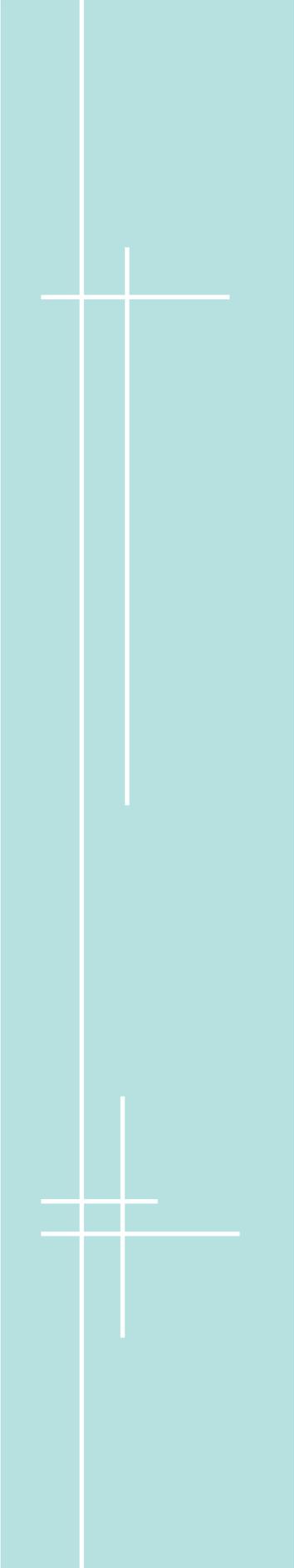Edited by Dr Mike Tremlett

2.1 Adequacy and location of advanced airway management equipment

Dr B McGuire

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Why do this audit?	Difficulty or failure in airway management is a significant factor in much anaesthesia-related morbidity and mortality.[1,2] Rapid access to advanced airway equipment is essential for the provision of safe anaesthesia. There is evidence that knowledge among UK anaesthetists of the location and contents of the 'advanced airway set' is poor.[3]
	NAP4 demonstrated a high failure rate of emergency cannula cricothyrotomy – root causes were not determined, but is likely that in some cases there were problems with availability of appropriate equipment and in the familiarity of such devices amongst clinicians. One quarter of NAP4 events occurred in ICU or the ED and an inadequate provision of equipment appeared to be a factor.[4]
	Excluding routine airway equipment, the advanced airway set should include equipment for the management of both the anticipated and the unanticipated difficult airway.
	Stipulation of the ideal contents of the Advanced Airway (AA) set is difficult as evidence is limited, but certain principles of advanced airway management are generally held in the UK and elsewhere in the world.[5,6]
Best practice: research evidence or authoritative opinion	The Difficult Airway Society has published guidelines for the management of the unanticipated difficult intubation. The general emphasis is on the key principles of good practice and the stepwise approach to managing difficulty.[7] The DAS website also has recommended equipment lists to go with its algorithms, although these lists were compiled in 2005.[8] Essential equipment would include simple airway adjuncts, intubation equipment, supraglottic ventilation devices and an emergency cricothyrotomy oxygenation system.
	The RCoA's 'Guidelines for the provision of anaesthetic services' refer to a need for specialist airway equipment and state 'within each theatre suite, there must be at least one portable storage unit with specialised equipment for managing the difficult airway.' [9]
	The NAP4 Executive Summary recommended that national standardisation of Advanced Airway trolleys should be given consideration and that each hospital should ensure a minimum level of airway equipment for all sites where airway management may be performed.[4] There is now a strong argument for standardised 'airway rescue' carts in all areas within a hospital. It may be preferable for these emergency trolleys to be distinct from the 'advanced airway set' which should include a flexible fibrescope.
Suggested indicators	▷ Existence of a named consultant responsible for the AA set.
	▷ Immediate availability of an AA set in all areas where anaesthesia is administered, which includes a list of contents and an algorithm flowchart of advanced airway management.
	▷ Each cart is laid out in a simple, structured manner with labelled drawers and including airway adjuncts, intubation kit, supraglottic ventilation devices and emergency cricothyrotomy kit (including oxygen delivery).
	▷ There is documentation of regular maintenance and stocking of each AA set.
	▷ % anaesthetists familiar with the location and contents of the AA set.
	▷ % anaesthetists with formal training in use of AA set.
Proposed standard or target for best practice	▷ A named consultant should be responsible for the AA set.
	▷ 100% of areas where anaesthesia is administered should have AA set immediately available (portable).
	▷ 100% AA carts should have a simple layout with labelled drawers, a list of contents and an algorithm flowchart of advanced airway management.
	▷ 100% AA sets should include airway adjuncts, intubation kit, supraglottic ventilation devices and emergency cricothyrotomy kit.
	▷ 100% AA sets should include evidence of regular maintenance.
	▷ 100% of anaesthetists should be familiar with the location and contents of the AA set.
	▷ 100% anaesthetists should have had training in the use of the equipment in the AA set.

Suggested data to be collected	As above.
Common reasons for failure to meet standard	▶ Inadequate provision of AA kit (including resource limitation or lack of prioritisation with regards to the purchase of AA equipment). ▶ Poor layout of AA set contributing to confusion during emergent use. ▶ Lack of agreement as to which equipment and techniques represent best practice. ▶ Inadequate documentation accompanying AA sets. ▶ Lack of a leader to take responsibility for the provision, maintenance and education of advanced airway equipment/techniques. ▶ Lack of facilities for training in advanced airways management.
Related audits	6.1 – Anaesthesia in the Accident and Emergency department
CPD and Curriculum mapping	CPD matrix codes: **1C01, 2A01**
References	1 Gannon K. Mortality associated with anaesthesia. A case review study. *Anaesthesia* 1991;**46**:962–966. 2 Domino KB et al. Airway injury during anaesthesia: a closed claims analysis. *Anesthesiology* 1999;**91**:1703–1711. 3 Green L. Can't intubate, can't ventilate! A survey of knowledge and skills in a large teaching hospital. *Eur J Anaesthesiol* 2009;**26**:480–483. 4 NAP4: Major complications of airway management in the UK. Report and findings of the 4th National Audit Project of The Royal College of Anaesthetists. *RCoA*, London March 2011 (http://www.rcoa.ac.uk/nap4). 5 American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Practice Guidelines for the management of the difficult airway. *Anesthesiology* 1993;**78**:597–602. 6 Crosby ET et al. The unanticipated difficult airway with recommendations for management. *Can J Anaesth* 1998;**45**:757–776. 7 Henderson JJ et al. Difficult Airway Society guidelines for the management of the unanticipated difficult intubation. *Anaesthesia* 2004;**59**:675–684. 8 Recommended equipment for management of unanticipated difficult intubation. Difficult Airway Society, 2005 (http://www.das.uk.com/equipmentlistjuly2005.htm). 9 Guidance on the provision of anaesthesia services for intra-operative care. *RCoA*, London 2009 (http://www.rcoa.ac.uk/node/709).
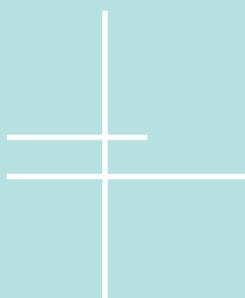
2.2

Anaesthetic record keeping

Dr R Bowers, Dr D Booth

Why do this audit?	The peri-operative period is one of the most closely monitored times of a patient's treatment. The documents 'Good Practice'[1] and 'Recommendations for Standards of Monitoring During Anaesthesia and Recovery'[2] establish the acceptable standards of patient monitoring. The production of a record of relevant peri-operative data is a central role of the anaesthetist, and provides the details of pre-operative assessment, intra-operative management and physiological variables, along with post-operative recovery and discharge.
	The record should provide sufficient data to allow comprehension of a sequence of events, the pertinent factors for decisions made, and instructions for a patient's ongoing management.
	This data can be used to support local audit, for inter-professional communications (such as handover of care), and to inform future plans for anaesthesia.
	A contemporaneous and full record would also be considered more favourably in the event of legal or regulatory proceedings.
Best practice: research evidence or authoritative opinion	'Good Practice' (2006), jointly published by the Royal College of Anaesthetists and the Association for Anaesthetists of Great Britain and Ireland, establishes both the data expected and the requirement for legibility and completeness for anaesthetic charts.[1]
Suggested indicators	Percentage of anaesthetic records containing indicators from 'Good Practice'.[1] The full list is not reproduced here and is easily obtained from the Royal College of Anaesthetists website.
Proposed standard or target for best practice	Best practice would consider both:

1 Data completion

- ▷ 100% record of anaesthetic consent and risks.
- ▷ 100% identification of anaesthetists, patient, surgeons and procedure.
- ▷ 100% completion of pre-operative WHO checklist confirmation.
- ▷ 100% confirmation of anaesthetic equipment check.
- ▷ 100% identification of responsible consultant.
- ▷ 100% record of pre-induction values (where possible).
- ▷ 100% charts state monitoring used.
- ▷ 100% charts meet minimum monitoring standards.
- ▷ 100% charts contain an adequately frequent record of physiological measurements.
- ▷ 100% charts contain post-operative instructions.

2 Legibility

- ▷ 100% charts assessed as legible.
- ▷ 100% charts detail clearly any unanticipated or untoward events and critical incidents.

These targets are by no means complete and serve merely as a list of important points of safety and as an anticipated minimum number of data points. Further indicators from 'Good Practice' and 'Recommendations for Standards of Monitoring During Anaesthesia and Recovery' may be used for completeness, or to emphasise a certain subsection of anaesthetic practice, for instance regional anaesthesia.

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Suggested data to be collected	A sample of anaesthetic charts should be assessed from all relevant clinical areas and on several different days of the week. Sample size will depend on levels of clinical activity, but a sufficiently large number should be collected to allow conclusions to be drawn.
Common reasons for failure to meet standard	◗ Insufficient space or lack of prompts on anaesthetic charts. ◗ Multiple short procedures with high turnover of patients. ◗ Lack of appropriate peri-operative pauses to allow safety checks.
Related audits	2.6 – Compliance with the World Health Organization Surgical Safety Checklist
CPD and Curriculum mapping	Training curriculum competence: **IO_BS_O6, CC_D1_03, CC_D11_08**
References	1 Good Practice: A guide for departments of anaesthesia, critical care and pain management. *RCoA and AAGBI*, London 2006 (http://www.rcoa.ac.uk/node/1470). 2 Recommendations for Standards of Monitoring during Anaesthesia and Recovery (4th Edition). *AAGBI*, London 2007 (http://www.aagbi.org/sites/default/files/standardsofmonitoring07.pdf).
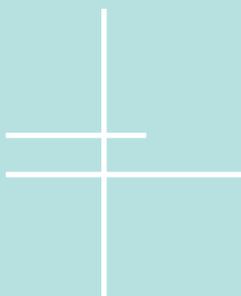
2.3

Check and challenge: Anaphylaxis
Dr M Allan

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Why do this audit?	We should all be able to demonstrate an awareness and competence to manage anaphylaxis/ malignant hyperpyrexia and local anaesthetic toxicity in our workplace. **Methodology** On a given week give a brief clinical vignette to staff in their place of work e.g. theatres, labour ward, MRI suite, etc. The vignette should end stating that they now suspect Anaphylaxis. (A range of other conditions including malignant hyperpyrexia or local anaesthetic toxicity may be tested using a similar format.) The respondent should be asked and timed to: ▯ outline treatment strategy ▯ locate the appropriate guidelines in the anaesthetic room ▯ go to and locate the specific treatment, e.g. Intralipid or Dantrolene (e.g. not just the cupboard or box but the ampule or bag) and return to theatre. (There is no need to bring the drugs back to theatre.)
Best practice: research evidence or authoritative opinion	Multiple publications from the RCoA define the need for a working knowledge of how to manage these emergencies (see CPD and curriculum mapping).[1]
Suggested indicators	▯ % of the department asked. ▯ % whose management correlated with published guidelines. ▯ Time taken to find the guidelines. ▯ Time taken to locate the drugs.
Proposed standard or target for best practice	▯ 100% of the available department asked. ▯ 100% correlate with guidelines. ▯ Less than a minute to locate the guidelines. ▯ Less than a minute to locate the adrenaline. ▯ Less than 3 minutes to locate Intralipid or Dantrolene and return.
Suggested data to be collected	As above.
Common reasons for failure to meet standard	▯ The respondent saying that they do not need to know the location of equipment because other members of staff, e.g. ODAs/anaesthetic nurses do. This is unacceptable. ▯ Core guidelines being in an unusable location, e.g. filed amongst other documents. Transient staff population. ▯ Equipment being moved without informing staff.
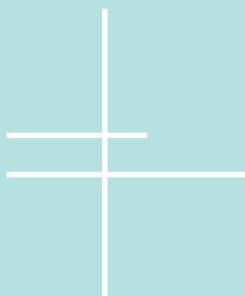
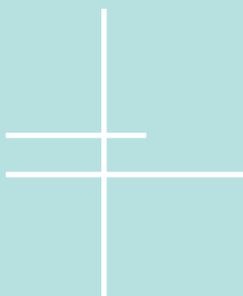|	
Related audits	2.10 – Check and challenge: defibrillation
CPD and Curriculum mapping	CPD matrix code: **1B01, 2A06** Basic curriculum competence: **CI_BK_23** Intermediate curriculum competence: **PR_IK_14**
References	1　Guidance for the provision of anaesthesia services for intra-operative care. *RCoA*, London 2009 (http://www.rcoa.ac.uk/node/709).

2.4

Secure custody of controlled drugs

Dr A Skinner

Why do this audit?

The supply, storage and use of controlled drugs (CDs) is governed by *The Misuse of Drugs Act 1971*, *The Misuse of Drugs Regulations 2001* and *Controlled Drugs (Supervision of Management and Use) Regulations 2006*. The legislation listed above forms part of English law, but minor differences in the devolved nations are unimportant for the purposes of this audit.

Compliance with these regulations reduces the risk of theft or abuse of controlled drugs by staff and others.

Hospitals should ensure compliance with these regulations without preventing timely administration of these drugs when indicated.

Best practice: research evidence or authoritative opinion

The following best practice points are taken from 'Safer management of controlled drugs: a guide to good practice in secondary care'.[1]

- CDs should be secured in a cupboard meeting statutory requirements, locked other than for issue, return or replenishment.
- Keys to this cupboard should be held by an appropriate staff member other than the person who will administer the drugs. Handing keys over for short absences should be avoided as far as possible and the key holder should be available in a timely way and immediately in recovery and similar areas. Secure arrangements should exist for custody of keys not in use and issue and return of keys.
- A CD register should record doses issued, administered and destroyed against stock levels.
- CD stock should be reconciled against the CD register regularly, at least at shift changes, ideally whenever the keys change hands.
- Drugs should only be issued for the current patient, normally only when the patient is in the anaesthetic room or theatre.
- CDs should only be issued against a signature in the CD register by a practitioner authorised to administer CDs and issued as close as practical to the time of administration.
- CDs should remain under the direct supervision of this signatory until administered or destroyed.
- CD doses recorded on the anaesthetic record or the medicines record should be congruent with the doses recorded in the CD register.
- CD drug ampoules should not be split between different patients.

Suggested indicators

- Appropriate arrangements for witnessed destruction should exist.
- Existence of Standard Operating Procedures (SOPs) for custody, issue and destruction of CDs.
- Availability of SOPs and staff knowledge.
- Adherence to the SOPs.
- Timely availability of CDs for administration to patients as indicated.

Proposed standard or target for best practice

- All units should have SOPs for custody and issue of CDs which should be easily available and all appropriate staff should understand them.
- Adherence to the SOPs.
- Timely availability of CDs for administration to patients as indicated.
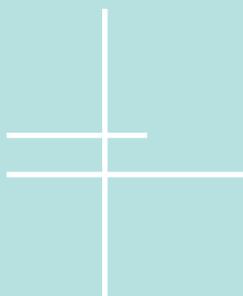
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Suggested data to be collected	◗ Reference set of SOPs.
	◗ Questioning of staff on SOPs.
	◗ Examination from time to time of CD registers, including examination of CD administration records for random named patients.
	◗ 'Check and challenge' at suitable points in an operating list or in the recovery areas to see issued drugs are signed for and suitably supervised by the signatory.
	◗ 'Check and challenge' at suitable points in an operating list or in the recovery areas to see that the key holder is appropriately available to issue CDs for administration.
Common reasons for failure to meet standard	◗ Failure of staff to recognise the personal risk of recreational use or the risk of theft.
	◗ Poor leadership around CD security and toleration of lax practice.
	◗ Informal growth of personal 'shortcut' practices in teams that work together regularly.
	◗ Perceived or real pressure to hasten progress through operating lists.
	◗ Low staffing levels leading to poor arrangements to cover staff breaks.
CPD and Curriculum mapping	Training curriculum competence: **CC_D8_07**
References	1 Safer management of controlled drugs: a guide to good practice in secondary care (England). DH, October 2007 (http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/ documents/digitalasset/dh_079591.pdf).
	2 The safe and secure handling of medicines: a team approach (the revised Duthie report). *Royal Pharmaceutical Society* March 2005 (http://www.rpharms.com/support-pdfs/ safsechandmeds.pdf).

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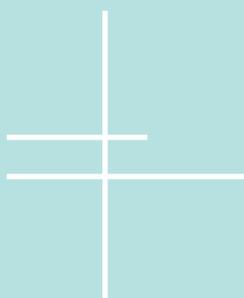
Deaths in hospital

Dr M Allen

Why do this audit?	Death is never the intended outcome from surgery. Whilst the risk of death is often run, surgery should only be undertaken in the hope and expectation of a reasonable chance of survival. It is therefore appropriate to review any case where the outcome is death within a short period of surgery or another significant procedure.
Best practice: research evidence or authoritative opinion	In 1982 a joint venture between surgical and anaesthetic specialties named the Confidential Enquiry into Perioperative Deaths (CEPOD) was initiated, building on an earlier initiative by Lunn and Mushin.[1] This reviewed surgical and anaesthetic practice over one year in three regions. In 1988 the National Confidential Enquiry into Perioperative Deaths (NCEPOD) was established and its first report was published in 1990. Since then numerous reports[2] published by NCEPOD have examined various patient sub-groups and procedures. These reports are widely cited as insightful and useful to identify shortcomings in and opportunities to improve patient care. Although almost all departments take part in these national projects, participation does not mean there is necessarily local ownership or understanding of this highly undesirable outcome. Timely response to specific issues identified is only possible after systemic local examination of these cases. In addition, National Audits may only focus on selective groups of procedures or patient groups (cardiac surgery, maternal deaths for example) and miss local problems. Reliable estimates are difficult to find but it appears that death within 30 days of an operation is the outcome for less than 1% of patients. This means that the actual task of reviewing all deaths is achievable and practical if the cases can be identified and other impediments overcome. NCEPOD makes numerous resources available on its website.[3] The Scottish Audit of Surgical Mortality (SASM) is a similar voluntary National Audit in Scotland with high participation rate.[4] This has been run since 1994.
Suggested indicators	Systematic review of patients dying soon after surgery or other significant procedure should be undertaken. This should be led by an appropriate physician and undertaken in co-operation with surgeons or other clinicians deciding upon and carrying out the procedures.
Proposed standard or target for best practice	◗ Different hospitals will find different approaches practical. ◗ Ideally a robust data set of all patients dying within a specified time after a procedure should be generated and used to review all such patients. Modern information technology (IT) should allow this data to be extracted from the patient information system and theatre management systems. Generally patients dying out of hospital will be marked as deceased on a patient information system within 2–3 months by which time routine processes needing the case record should be concluded. ◗ Failing this, patients dying in hospital after surgery could be found in other ways, for example through the mortuary or bereavement services. ◗ If this is not practical then systematic review of specific high-risk groups should be undertaken by hand searching of records.
Suggested data to be collected	◗ A rapid screening of case records should be undertaken for all deaths discovered. ◗ Deaths which seem to the screening reviewer to merit further scrutiny for any reason should be examined by a larger team including all appropriate specialities and professions. Root cause analysis[5] should be undertaken where significant shortcomings are identified. ◗ Consider use of a structured mortality review as discussed in Section A.9. ◗ Lessons learned should be collated and disseminated.

Common reasons for failure to meet standard	▷ This is a complex project and different hospitals will arrive at different solutions.
	▷ Review of all deaths is not the impossibly large task it seems. The numbers are smaller than might be expected and the bulk will require no more scrutiny than an initial screening.
	▷ IT services will be needed if a robust data set is to be generated. Mortuary or bereavement services or other support will be needed if an IT solution is not forthcoming. Support for this project will be needed at high (board) level because of this.
	▷ Availability of notes of deceased patients is often poor.
	▷ Notes may not be available if the coroner is involved.
CPD and Curriculum mapping	CPD matrix code: 1I01
	Training curriculum competence: CI_IK_03
References	1 Lunn JN, Mushin WW. Mortality associated with anaesthesia. *Nuffield Provincial Hospitals Trust*, London 1982.
	2 NCEPOD reports (http://www.ncepod.org.uk/publications.htm).
	3 NCEPOD resources (http://www.ncepod.org.uk/toolkits.htm).
	4 Scottish Audit of Surgical Mortality (SASM) (http://www.sasm.org.uk/index2.htm).
	5 Root cause analysis. *National Patient Safety Agency* (http://www.nrls.npsa.nhs.uk/resources/collections/root-cause-analysis/).

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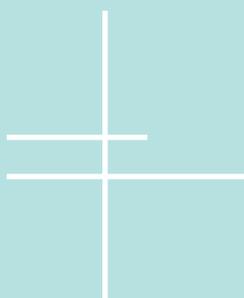
Compliance with the World Health Organization (WHO) Surgical Safety Checklist

Dr J Easby

Why do this audit?

In 2008 the World Health Organization (WHO) launched a global patient safety initiative entitled; 'Safe Surgery Saves Lives'.[1] Surgical teams trialled the use of a safety checklist to reduce the number of surgical deaths across the world. Following this initial study, which demonstrated a 36% reduction in post-operative complications,[2] the NPSA made the checklist a national requirement for hospitals within the UK.[3]

The checklist identifies a set of surgical standards that can be applied in all operating theatres and aids improved communication and leadership. The core document focuses on correct site surgery, haemorrhage, antibiotic prophylaxis, airway management and allergy.[4] The NPSA and the NRLS adapted the document for the UK. The document is divided into three stage checks:

▷ the 'Sign In' before the induction of anaesthesia

▷ 'Time Out' before skin incision

▷ 'Sign Out' before the patient leaves the operating room.[3]

Further checklists for maternity, cataract surgery and radiological procedures have been developed.[3]

Best practice: research evidence or authoritative opinion

Many trusts in conjunction with local clinical governance procedures have developed local checklists. Moreover, trusts have further adapted their checklists over time as national bodies (e.g. DOH/NPSA/NRLS/NICE) and the Royal Colleges have launched campaigns which seek to prioritise patient safety.

These campaigns include: Patient Safety First Campaign;[5] Never Events;[6] Stop Before You Block;[7] The Productive Operating Theatre;[8] Prevention And Treatment Of Surgical Site Infection;[9] Thromboprophylaxsis;[10] and Hypothermia.[11]

Suggested indicators

Audits could include the required NPSA/NRLS checks, or be tailored to suit individual goals, and focus on specific areas, for example NICE guidance.

Organisations are required to:

▷ ensure an executive and a clinical lead are identified to drive the implementation of the surgical safety checklist within the organisation

▷ ensure the checklist is completed for every patient undergoing a surgical procedure (including local anaesthesia)

▷ ensure that the use of the checklist is entered in the clinical notes or electronic record by a registered member of the team.

Each patient checklist should be completed appropriately:

Sign In

▷ % patients should confirm his/her identity and the site, procedure and consent should be checked?

▷ % surgical sites marked prior to the point of anaesthesia?

▷ % anaesthetic machine and medication check complete?

▷ % Any risk factors including; allergy, difficult airway, aspiration or major blood loss should be communicated and appropriate plans put in place?

Time Out

▷ % team members introduced themselves by name and role?

▷ % surgeon, anaesthetist and registered practitioner verbally confirm: patient's name, procedure, site, position and communicate any critical events/concerns?

▷ % care bundles for surgical site infection and thromboprophylaxis undertaken?

Sign Out

▷ % the name of the procedure been recorded?

▷ % confirmed that instruments, swabs and sharps counts are complete (or not applicable)?

▷ % specimens been labelled appropriately?

▷ % any equipment problems been identified that need to be addressed?

▷ % key concerns for recovery and management of this patient are noted?

Proposed standard or target for best practice	**Sign In** D 100% of patients should confirm their identity and the site, procedure and consent should be checked. D 100% surgical sites marked prior to the point of anaesthesia (where deemed appropriate). D 100% anaesthetic machine and medication check complete. D 100% risk factors including; allergy, difficult airway, aspiration or major blood loss should be communicated and appropriate plans put in place. **Time Out** D 100% team members introduced themselves by name and role. D 100% surgeon, anaesthetist and registered practitioner verbally confirm: patient's name, procedure, site, position and communicate any critical events/concerns. D 100% care bundles for surgical site infection and thromboprophylaxis undertaken. **Sign Out** D 100% the name of the procedure been recorded. D 100% confirm that instruments, swabs and sharps counts are complete (or not applicable). D 100% specimens been labelled appropriately. D 100% any equipment problems been identified that need to be addressed. D 100% key concerns for recovery and management of this patient are noted.
Suggested data to be collected	As above
Common reasons for failure to meet standard	D Time pressures. D Misinformation and failure of staff to embrace the project. D Lack of leadership driving the project. D Treating the checklist as a 'tick box' exercise. D Poor clinical governance communication.
CPD and Curriculum mapping	CPD matrix codes: No direct links Training curriculum competence: **CC_D8_O3**
References	1 Safe surgery saves lives. *World Health Organisation* (http://www.who.int/patientsafety/safesurgery/en/). 2 Haynes A et al. A surgical safety checklist to reduce morbidity and mortality in a global population. *N Eng J Med* 2009;**360(5)**:491–499. 3 WHO Surgical Safety Checklist – adapted for UK practice. National Reporting and Learning System (http://www.nrls.npsa.nhs.uk/resources/clinical-specialty/surgery/?entryid45=59860). 4 The surgical safety checklist. *World Health Organisation* (http://www.who.int/patientsafety/safesurgery/tools_resources/SSSL_Checklist_finalJun08.pdf). 5 Patient Safety First Campaign (http://www.institute.nhs.uk/images//documents/SaferCare/Perioperative-1.1_17Sept08.pdf). 6 Never events (http://www.nrls.npsa.nhs.uk/resources/collections/never-events/). 7 Stop Before You Block (http://www.rcoa.ac.uk/node/1470). 8 The Productive Operating Theatre. NHS Institute for Innovation and Improvement (http://www.institute.nhs.uk/quality_and_value/productivity_series/the_productive_operating_theatre.html). 9 Prevention and treatment of surgical site infection. NICE Clinical Guideline 74. *NICE*, October 2008 (http://www.nice.org.uk/CG74). 10 Nice: Thromboprophlaxsis: (http://www.nice.org.uk/guidance/qualitystandards/vteprevention/vteprophylaxis.jsp). 11 Perioperative hypothermia (inadvertent): the management of inadvertent perioperative hypothermia in adults. NICE Clinical Guideline 29. *NICE,*London 2008 (http://www.nice.org.uk/CG065).

2.7

Peri-operative temperature management

Dr M Harper

Why do this audit?

Temperature monitoring is essential during induction and maintenance of anaesthesia and should be available during recovery from surgery.[1] Both hypothermia and hyperthermia (including malignant hyperthermia) can complicate anaesthesia.[2,3]

There are a number of reviews of the adverse effects of inadvertent peri-operative hypothermia (IPH) in the literature. Research has shown that IPH can lead to morbidity including prolonged recovery and hospital stay,[4] increased blood loss and transfusion and an increased incidence of pressure sores,[5] wound infections[6] and morbid cardiac events.[7] Reducing the incidence of IPH through appropriate peri-operative care can reduce the incidence of these complications.

In hyperthermia the margin between temperatures for normal cellular processes and cell damage from high temperature is very small compared with hypothermia. Hyperthermia can be corrected by cooling.

This audit reflects the recommendations of the NICE guideline 'Perioperative hypothermia (inadvertent): the management of inadvertent perioperative hypothermia in adults'.[8]

Best practice: research evidence or authoritative opinion

It has been shown that when mildly hypothermic volunteers shiver post-anaesthesia, they can regain heat with simple passive re-warming.[9] However, the anaesthetised patient is unable to shiver and it is unpleasant for the patient in recovery where it can increase oxygen demand and worsen pain. This makes the provision of active warming essential in at-risk patients peri-operatively.

Patients are at higher risk of hypothermia and its consequences if any two of the following apply:

◊ ASA grade 2–5 (the risk at 5 is greater than the risk at 2)
◊ pre-operative temperature below 36.0°C
◊ combined regional and general anaesthesia
◊ intermediate or major surgery
◊ at risk of cardiac complications
◊ extremes of age.

Care should be taken to ensure that patients are adequately covered on the ward and during transfer to the operating theatres. Unless surgery is life or limb saving, patients should be actively warmed to a temperature 36.0°C or above before being anaesthetised. Otherwise, active warming should be initiated in the anaesthetic room for all procedures where the total operative time (from first anaesthetic intervention to arrival in recovery) is greater than 30 minutes. For total operative times less than 30 minutes, only higher risk patients should be actively warmed. All intravenous infusions of greater than 500 ml (and all blood products and irrigation fluids) should be warmed.

Body temperature is as vital a clinical sign as the pulse or blood pressure and should be recorded in the hour prior to the patient coming to theatre. It should be measured throughout the operation and in recovery until such time as it reaches 36.0°C. It should be recorded at the same frequency as other vital sign measurements for the first 24 post-operative hours.

NICE have recently published a guideline on the management of IPH which details appropriate peri-operative thermal management.[8] Although it recommends the use of forced-air warming, there is some preliminary evidence that other forms of active warming may be equally effective[10,11] and that combining two methods can improve outcome.[12] In fact NICE have now produced an additional new technology guidance on the use of the Inditherm warming mattress.[13]

The ultimate aim is for all patients to have a core temperature of 36.0 °C or above on arrival in the recovery room.

Suggested indicators

◊ Frequency of temperature measurement.
◊ Temperature < 36.0°C at any time.
◊ Use of body and fluid warming techniques.

Proposed standard or target for best practice

Pre-operative phase

◊ 100% patients should have received written information regarding IPH pre-operatively.
◊ 100% patients should have had their risk of IPH and its consequences assessed and documented pre-operatively.
◊ 100% patients should have their temperature recorded in the hour prior to their arrival in theatres.

D 100% patients should have a sheet and two blankets or a duvet for their transfer to theatres and be comfortably warm throughout.

D 100% patients not scheduled for emergency surgery should have a temperature of 36.0°C or above before the start of anaesthesia.

Intra-operative phase

D 100% of 'at-risk' patients should have active warming from the first anaesthetic intervention unless febrile.

D 100% ambient theatre temperature at or above 21°C whilst active warming is being established.

D 100% intravenous infusions greater than 500 ml and all blood products and irrigation fluids should be warmed.

D 100% patients should have their temperature recorded every half-hour during anaesthesia.

Post-operative phase

D **Key outcome: All patients admitted to recovery should have core body temperature of 36.0°C or above.**

D 100% patients should have their temperature recorded every 15 minutes in recovery until they are ready for discharge to the ward.

D 100% patients should have their temperature recorded on the ward at same frequency as other vital signs.

D 100% patients should not be discharged from recovery until their temperature is above 36.0°C.

D 100% patients whose temperature drops below 36.0°C in recovery or on the ward should receive active warming until this is rectified.

Suggested data to be collected	Refer to NICE Clinical Guideline 65.[8] (see audit data collection form available on the RCoA website)
Common reasons for failure to meet standard	Failure to follow NICE guidelines in terms of warming patients. This stems in particular from patients not receiving warming from the first anaesthetic intervention to the start of surgery and failure to monitor patients' temperatures in the peri-operative period.
CPD and Curriculum mapping	Training curriculum: **PB_IK_36**

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2.8

Awareness and general anaesthesia

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Why do this audit?	Patient factual recall of during surgery under general anaesthesia is rare, occurring in 0.15% or less of cases.[1] It may be unpleasant and psychologically damaging, particularly if associated with sensation of pain during surgery.[2] It can be also financially costly. In the UK, awareness accounts for 0.7% of claims made to the NHS Litigation Authority with a mean settlement of £32,680 incurred.[3] In the USA the respective figures from the American Society of Anesthesiologists Closed Claims Project are 2% of claims with a median of $71,500 for compensation payments.[4] Cases of brief awake paralysis may occur especially with drug substitution at the start of surgery. This situation is not included in this audit but please refer to audit 12.13: Complications and critical incident reporting.
Best practice: research evidence or authoritative opinion	Using the isolated forearm technique, response to command during surgery varies from 0% in patients anaesthetised with a volatile anaesthetic agent up to 22% having propofol-alfentanil TIVA (total intravenous anaesthesia).[5] This responsiveness is usually not remembered. As the isolated forearm technique is not used routinely, we depend on the patient remembering a period of intra-operative consciousness in order to gauge the incidence. Intra-operative awareness with recall (hereafter 'Awareness') during general anaesthesia has been found with an incidence of 0.1–0.2% in large population-based studies. Risk factors include:[1,2,6,7] ◗ Patient factors – paediatric, increased anaesthetic requirement (e.g. drug interaction, alcoholism), patients requiring intentionally light anaesthesia (e.g. major trauma, ASA 4 and 5, obstetric), history of awareness, difficult intubation ◗ Type of surgery – e.g. cardiac surgery ◗ Inadequate anaesthetic delivery – no volatile anaesthetic, vapouriser or TIVA pump malfunction, intravenous cannula problem during TIVA, lack of expired anaesthetic agent monitoring ◗ Neuromuscular blockade. The usefulness of depth of anaesthesia monitoring is debated. Bispectral index monitoring reduced awareness in high risk patients by 82%.[8] In contrast, awareness occurred with the same frequency when a depth of anaesthesia monitored group was compared to one with protocol-driven anaesthesia administration using end tidal anaesthetic agent monitoring at 0.7 MAC.[7]
Suggested indicators	◗ % of patients with recall of being conscious during surgery. ◗ % of patients with recall of disturbing dreams.
Proposed standard or target for best practice	Awareness should occur: ◗ < 0.2% during general surgery ◗ < 0.4% at caesarean section ◗ <1% during cardiac surgery ◗ <1% during paediatric surgery.

Suggested data to be collected	◗ Recommended audit frequency: continuous data collection as part of a quality assurance programme.[9]
	◗ Incidence of awareness, incidence of dreaming.
	◗ For cases of definite or probable awareness, the following should be documented.
	  ◆ Time since last case of awareness in the anaesthetic service.
	  ◆ ASA of patient and specific pre-existing patient conditions that may have influenced depth of anaesthesia, type of surgery, induction agent and dose, grade and difficulty of intubation, type of anaesthetic agent (inhalational or intravenous) and use of N_2O, use of muscle relaxant and other drugs (opioids, benzodiazepines).
	  ◆ Use of end tidal anaesthetic agent monitoring and correctly set audible alarm (if not used, details of breathing system, fresh gas flow and vapouriser settings).
	  ◆ Use of a depth of anaesthesia monitor.
	  ◆ Evidence of follow up.[9]

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Common reasons for failure to meet standard	▷ Perception of the need for a 'light' anaesthetic – patient factors or intra-operative anaesthetic problems; concomitant use of neuromuscular blockade. ▷ TIVA equipment or administration problem.[6] ▷ Type of surgery. ▷ Lack of appropriate end tidal anaesthetic agent monitoring – non-compliance with AAGBI monitoring standards.
Related audits	12.13 – Complications and critical incident reporting.
CPD and Curriculum mapping	CPD matrix codes: **1I01, 1I05** Training curriculum competence: **PC_IK_22**
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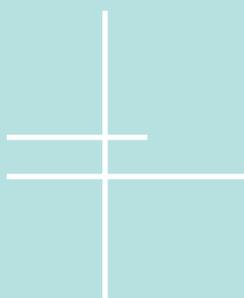
2.9

Check and challenge: Defibrillation

Dr I Whitehead

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Why do this audit?	All anaesthetists are expected to undertake specific training in resuscitation.[1]
	Regular updating of resuscitation knowledge is required; this may be by completing a resuscitation course, or by in-house teaching.
	Consultant anaesthetists rarely attend cardiac arrest unless they have a critical care role; Anaesthetic trainees are often on resuscitation teams.
	Knowledge of the location and contents of the 'resuscitation trolley' in the theatre environment is important.
Best practice: research evidence or authoritative opinion	Experts working under the guidance of the International Liaison Committee on Resuscitation (ILCOR) have recently reviewed the science surrounding resuscitation.[2]
	Standards for the clinical practice and training in CPR were published in 2004 by the Royal College of Anaesthetists, Royal College of Physicians of London, Intensive Care Society, Resuscitation Council (UK).[3] This document indicates that staff should undergo regular resuscitation training to a level appropriate for their expected clinical responsibilities and should be updated annually.
Suggested indicators	▷ Knowledge of current RC(UK) ALS guidelines.[4]
	▷ Knowledge of location of resuscitation trolley.
	▷ Familiarity with defibrillator on resuscitation trolley and how to use it.
	▷ Date of last ALS update.
Proposed standard or target for best practice	▷ 100% of anaesthetists should know the current ALS guidelines.[4]
	▷ 100% of anaesthetists should know the location of the resuscitation trolleys in the theatre suite.
	▷ 100% of anaesthetists should be familiar with the layout and contents of the resuscitation trolley.
	▷ 100% of anaesthetists should know how to operate the defibrillator.
	▷ 100% anaesthetists should have had an ALS update within the last 12 months.
Suggested data to be collected	▷ As above.
	▷ Reason for failure to attend annual resuscitation training.
Common reasons for failure to meet standard	▷ Inadequate time/facilities for training.
	▷ Resuscitation training not deemed a priority.
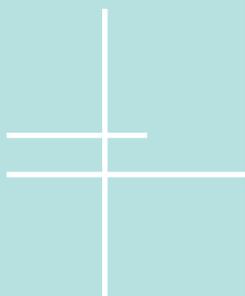
Related audits	7.1 – Resuscitation training for anaesthetists
	7.3 – Equipment checks
CPD and Curriculum mapping	CPD matrix codes: **1B01-04, 2A06, 2B05, 2B07, 3I00**
	Training curriculum competence: **RC_BK_17, RC_BS_01–08**

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