2 Intraoperative care

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2.1 World Health Organization surgical checklist

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Why do this improvement project?

Within healthcare, errors involving patient safety have often been attributed to inadequate communication or poor teamwork.[1] Since its development, the World Health Organization (WHO) surgical checklist has revolutionised patient safety within the operative setting.[2] However, success of the checklist is critically dependent on participant compliance and engagement in a checklist ethos to reduce adverse events, near misses and mortality rates.

Background

In 2008, the World Health Assembly faced the challenge of improving global healthcare standards. An estimated 234 million operations were being performed globally, with 9.2% resulting in adverse events such as drug- or surgery-related errors.[3] Of these errors, half were identified as preventable.[4] Led by Professor Atul Gawande, the concept of 'Safe Surgery Saves Lives' was conceived. The aim of the project was to achieve a consistently safe surgical journey by ensuring efficient checks, effective communication and a multidisciplinary approach to safety. A 19-point checklist was initially derived and implemented in geographically varied hospitals. The findings of this initial pilot revealed a reduction in major complications by 4% and a reduction in morality of 0.7%.[5] To date, 1790 hospitals over six different continents are actively implementing the WHO surgical checklist.[6]

Best practice

The use of the WHO surgical checklist was mandated for use in the NHS in England and Wales in January 2009. It was strongly commended for use in all hospitals by the Department of Health, Social Services and Public Safety in Northern Ireland and is one of the Patient Safety Essentials in the Scottish Patient Safety Programme – to be used for every patient, every time.[7]

Suggested data to collect

Primary outcomes

- Components of the WHO checklist (sign in, time out, sign out) conducted per patient.
- Compliance in documentation of all components of each checklist.

Secondary outcomes

- Patient safety indicators (eg reduced wrong site surgery, surgical site infections, incidents due to equipment availability and teamwork).
- Members of the team present during each component.
- Time taken to complete each component.
- Safety culture surveys, such as the Manchester Patient Safety Framework.[8]

Quality improvement methodology

Quality improvement will require engagement with all groups of theatre staff involved in the WHO checklist. Take time to understand individual behaviour and beliefs around the WHO checklist. Addressing the barriers to implementation of the checklist is likely to be essential when improving compliance at a given institution. Consider using a behaviour change framework to analyse the barriers to behaviour change in surgical teams to uptake the checklist.

Sharing stories and data about locally identified problems are likely to be powerful drivers (eg instances of wrong site surgery, wrong implant, incorrect block or critical equipment non-availability) to improve compliance by all members of the multidisciplinary team.

Could you highlight best practice and institute some rewards or 'learning from excellence'? Could groups with good WHO checklist compliance and execution be used to teach their peers about good practice (eg surgeons teaching surgeons, scrub nurses teaching scrub nurses)?

You could use measures presented by statistical process control p-charts or run charts to track improvement and effect of interventions. A performance polygon might highlight the elements of the check list where compliance is best and worst.

Mapping

ACSA standard: 1.3.1.3
Basic curriculum competence: POM_BS_11
Advanced curriculum competence: AT_D2_11
GPAS 2020: 2.3.23, 2.5.8, 2.5.17, 3.5.2, 3.5.3, 3.5.4, 3.5.5, 3.5.19, 5.5.40, 5.5.41, 7.2.17, 7.7.4, 8.5.25, 8.7.5, 10.3.3 , 16.5.25, 10.5.8, 18.5.6

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2.2 Conduct of regional anaesthesia

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Why to do this quality improvement project?

- Basic anaesthesia monitoring is an integral component of delivering quality patient care during the perioperative period.
- Adverse events during conduct of anaesthesia are partly attributable to human error.[1]
- Adequate monitoring reduces the risk of incidents by early detection of consequences of errors and by giving early warning signs to the deteriorating condition of patients.[2]
- Standards of monitoring during conduct of regional analgesia with or without sedation should be exactly the same as during general anaesthesia.[1]
- Incorrect placement of a block is a patient-safety incident but has previously been classified as a never event according to the Never Events Policy and Framework published by NHS Improvement.[3]
- In 2011, the Stop Before You Block (SBYB) initiative was introduced by Nottingham University Hospitals NHS Trust and endorsed by the RCoA Safe Anaesthesia Liaison Group and Regional Anaesthesia UK.[4]
- The Healthcare Safety Investigation Branch report Administering a Wrong Site Nerve Block was published in September 2018.[5]

Best practice

The Association of Anaesthetists published recommendations for standards of monitoring during anaesthesia and recovery 2015,[1] which was followed by Regional Anaesthesia UK guidance.[6] Minimum monitoring (electrocardiogram, ECG, pulse oximeter, noninvasive blood pressure) should be in place before commencing regional anaesthesia and should be continued throughout the operative and recovery period.[7,8]

- All patients should have working intravenous access.[9]
- All monitoring equipment should be checked by an anaesthetist in accordance with guidance from the Association of Anaesthetists.
- Audible monitor alarms should be enabled and alarm limits should be set by the anaesthetist.
- Summary of all monitoring and any reasons for carrying out regional anaesthesia without adequate minimum monitoring should be documented in the anaesthetic notes.
- Provision, maintenance, calibration and renewal of equipment are the responsibilities of the institution in which anaesthesia is delivered. Advice regarding procurement and maintenance of monitoring equipment should be taken from the anaesthetic department.
- SBYB should be carried out prior to every single-sided nerve block.
- A STOP moment should take place immediately before inserting the block needle and should involve both the anaesthetist and the anaesthetic assistant.[3]
- The STOP moment should check site and side of block with reference to the surgical site mark.[3]
- Staff should undertake regular training in the SBYB process.
- Suggested data to collect.

Equipment

- Audit of the availability of functioning equipment for minimum monitoring in all areas where regional anaesthesia is practised. Minimum continuous ECG, pulse, oxygen saturations and blood pressure.
- Audit of the use of minimum monitoring during regional anaesthesia. Patients must have appropriate monitoring, including pulse oximeter, noninvasive blood pressure at intervals of five minutes, ECG and end-tidal carbon dioxide monitoring if the patient is sedated.

Documentation

- 100% of records have documented SBYB check and intravenous cannula insertion.
- Audit of documentation in anaesthetic records of monitoring used during regional anaesthesia.

Audit of SBYB practice

- Percentage of anaesthetists who report always performing SBYB.
- Percentage of anaesthetic assistants who report always performing SBYB (standard of 100%). Reasons for non-compliance.
- Percentage of anaesthetists who report performing STOP immediately prior to needle insertion.
- Percentage of anaesthetists who involve anaesthetic assistant in the SBYB process (standard 100%). Reasons for non-compliance.
- Percentage of anaesthetic assistants who have received training in SBYB process and access to continuing training opportunities.

Quality improvement methodology

Prompts and reminders in the pathway may remind anaesthetists and assistants to perform SBYB, but as wrong site blocks continue to occur despite this initiative, a formal STOP moment, involving both anaesthetist and assistant, must be carried out immediately before needle insertion. Think about how you could design a 'hard block' to prevent a block proceeding if the check is not done.

Survey anaesthetists and assistants for their perceived barriers to doing SBYB, which you could display as a Pareto chart. This will give you some initial areas of focus for improvement.

You should pilot any proposed changes to the pathway (paperwork or other prompts) using plan–do–study–act cycles before implementing them as hospital policy.

Mapping

ACSA standards: 1.3.1.5
Curriculum competences: CS_BK_03, IG_BK_02, IG_BS_05, IG_BS_06, RA_IS_01, CS_IS_02, CS_HS_04
CPD matrix codes: 1A03, 2A04, 2G02, 3A07, 3A09
GPAS 2020: 3.2.29, 3.2.30, 3.2.31, 3.2.32, 5.2.35, 6.2.17, 7.2.9

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2.3 Management of the difficult airway

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Why do this quality improvement project?

Complications arising from difficult airways are a leading cause of anaesthetic morbidity and mortality. Improvement in availability of equipment, training, communication and teamwork contribute to improved outcome in difficult airway management.

Background

The Fourth National Audit Project of the RCoA and the Difficult Airway Society (NAP-4): Major Complications of Airway Management in the UK highlighted that while the majority of airway problems happen at induction, a significant proportion occurred during emergence or during transfer to the recovery area.[1] The report highlighted that airway management outside the theatre environment was associated with a higher risk of adverse events. Human factors contributed to airway issues, relating to either the individual or the team in 40% of cases.[1]

Best practice

- The RCoA Guidelines for the Provision of Anaesthetic Services recommends that there should be a full range of equipment relating to the management of the anticipated difficult airway available within the theatre suite.[2]
- The NAP4 report recommended the need for standardised 'airway rescue' carts in all areas within a hospital and the Difficult Airway Society has published guidance on stocking of difficult airway trolleys.[3]
- Simulation training with instruction on human factors has been shown to improve communication within team, reduce task fixation and improve situational awareness and empower team members.

Data to collect

Equipment

There should be a full range of equipment relating to the management of the anticipated difficult airway available where airway management takes place, including at remote sites. This should include nasal endoscopy and ultrasound equipment.

Difficult airway trolleys should be equipped and standardised as per the recommendations of the Difficult Airway Society.[3] The trolley should be stocked in a structured and in a logical manner following the Difficult Airway Society algorithm. Are the difficult airway trolleys standardised across all locations?

Selection of the equipment should be supported by evidence wherever possible and keeping in mind the training needs of all users. Who is the named person so maintenance and replacement of equipment?

All anaesthetists and anaesthetic assistants, including locum, agency and trust grade staff, should have been shown the location and contents of difficult airway trolleys as part of hospital induction.

The equipment should be checked and stocked regularly. Who is issued with the responsibility of checking, stocking and maintenance of all difficult airway trolleys especially in areas with multiple users (eg in accident and emergency, intensive care and radiology suites)?

Follow up of patients with a difficult airway

Is there appropriate handover of potentially difficult airway patients to intensive care and recovery areas? Are patients with difficult airway given adequate information and the Difficult Airway Society airway alert card?

Training and human factors

Training in the use of advanced airway management equipment should be thorough, comprehensive and continual, especially as some of the equipment is used only on rare occasions:

- What is the departmental plan for equipment training?
- Is there appropriate evaluation and training prior to introducing new equipment?
- Do staff have access to adequate time, funding and facilities to undertake and update training?
- How frequent is the training and does it address skill decay?

Quality improvement methodology

Skills and equipment

- Survey all anaesthetists for the barriers to using advanced airway equipment. Do you need to address skills, logistical issues or 'just in time' learning aids for infrequent users?
- Are theatre staff able to identify and locate difficult airway trolleys? Are all anaesthetic assistants familiar with location of equipment needed in managing a difficult airway? Conduct multidisciplinary team 'check and challenge' drills to practise accessing equipment. Can you reduce the time needed to access equipment?

Staffing and training

- There should be regular scenario-based simulation training using equipment identical to that in the clinical environment and incorporating instruction in both technical and non-technical skills. Such training is especially important in high-risk areas, such as obstetrics, intensive care and the emergency department. Regular multidisciplinary rehearsals involving the entire team should focus on developing non-technical skills, improving communication and facilitating teamwork.

Reporting and learning

- Regular team debrief, reporting of critical incidents and near misses, and discussion of cases where plans C and D are needed encourages learning and individual behaviour change. All critical incidents and near misses must be discussed in a constructive manner in joint departmental audits with the surgical team and study days to identify contributing factors and develop practical recommendations for systems changes and improve communication and teamwork.

Mapping

ACSA standards: 2.1.1.11, 1.1.2.2, 1.3.1.5, 2.1.1.1, 2.1.1.5
Curriculum competences: AM BK14, AM BK 16, AM HK01-07
CPD matrix codes: 2A01, 3A01
GPAS 2020: 3.2.14, 3.2.18, 3.2.20, 3.5.18, 5.2.27, 9.2.11, 10.5.19

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2.4 Anaesthetic record keeping

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Why do this quality improvement project?

The anaesthetic record is an essential component of documentation. Accurate and detailed anaesthetic records provide valuable information on preoperative assessment, intraoperative care, response to treatment, and postoperative care instructions.

Background

The anaesthetic record is central to understanding perioperative events and aids communication and handover between colleagues. It is a useful source of information for quality improvement and can assist in the event of medicolegal proceedings.

While there is no recommended anaesthetic record format, in the last 10 years publications from professional organisations have highlighted specific areas, such as basic standards of record keeping, recording of physiological details and recording of consent. This has led to an increase in the required amount of information to be recorded, so paper anaesthetic records may not easily support recommended record keeping and may require frequent redesign.

Electronic records may enhance the quality of documentation, particularly with automatic capture of monitoring and equipment data, but they are not widely used yet in the UK. The quality of record keeping should still be assessed using the same standards as for paper records.

Best practice

The Good Anaesthetist, produced by the RCoA and the Association of Anaesthetists in 2010,[1] sets a standard for all anaesthetic records to be clear, accurate and legible. Records should be made at the same time as the events wherever possible, and should include details on clinical findings, treatment given and any information given to patients. Further detail on what should be recorded has been stated in other publications from these organisations.

Suggested data to collect

Data completion:

- patient name and unique identifier recorded
- anaesthetist name and GMC number
- consultant supervisor recorded for non-consultants
- appropriate anaesthetic equipment check at the start of the list and before each patient
- appropriate monitoring in place from before induction of anaesthesia through to the post-anaesthesia care unit
- consent discussion recorded – risk, benefits, alternatives
- patient agreement to intervention
- recording appropriate physiological data at recommended interval.

Legibility:

- The record should be legible.
- Only recognised abbreviations are used.

These standards should be achieved 100% of the time and should serve as a minimum standard for all anaesthetic records. National Audit Project reports and other guidelines on specific areas of anaesthetic care provide further recommendations of what should be recorded in specific situations.[2–5]

Quality improvement methodology

- Anaesthetic records should be reviewed against the standards above. The number reviewed should ensure that a representative range of anaesthetists, grades and specialties is included. You should also aim to review charts written for elective and emergency procedures: does the chart support good documentation in all circumstances? Is the chart suitable for areas with different requirements, such as obstetrics?
- What are the common components not recorded? You can display these in a Pareto chart. Could charts be redesigned to make recording frequently missed data more reliably?
- Are there any unnecessary data recorded on the charts or recorded in duplicate across medical and nursing charts? Could you streamline the data recording to remove some unnecessary items?

Mapping

ACSA standards: 1.1.1.1, 1.1.3.3, 1.2.2.1, 1.3.1.5, 1.4.5.1, 2.1.1.1, 2.3.1.1, 2.3.1.2, 3.1.1.2
CPD matrix codes: 1F01, 2A03
Curriculum competences: IO_BS_06, CS_BK_01
GPAS 2020: 3.5.6

References

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2.5 Awareness under anaesthesia

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Why do this quality improvement project?

Awareness under anaesthesia can be extremely distressing for the patients, especially when it is associated with recall.[1] Reducing this risk will benefit patients by reducing the risk of long-term psychological impact of this rare but devastating outcome.

Background

As demonstrated by the Fifth National Audit Project of The Royal College of Anaesthetists and the Association of Anaesthetists (NAP5), general anaesthesia can fail, leading to awareness. The exact cause of awareness is often hard to identify but it may be due to failure to deliver an adequate amount of the anaesthetic or to the patient having a higher than usual requirement.[2] Patients who have had accidental awareness also need appropriate follow-up and management, with the aim of reducing the risk of long-term psychological sequelae.

Best practice

NAP5 identified areas of practice that can be improved. A support pack detailing the steps to take when patients have suffered accidental awareness has been developed.[3]

Suggested data to collect

Preoperatively

- Do all patients have the risk of awareness included in their preoperative discussion for general anaesthesia and sedation?
- How are patients with increased risk of awareness identified? This includes:
  - use of neuromuscular blocking drugs
  - obesity
  - known or predicted difficult tracheal intubation
  - where awake extubation methods are planned
  - general anaesthesia for caesarean section
  - rapid sequence induction
  - total intravenous anaesthesia (TIVA) in the presence of neuromuscular blockade
  - emergency surgery especially in the frail or critically ill
  - family history or past history of accidental awareness during general anaesthesia (AAGA).
- How are the patients counselled preoperatively if they are found to be at high risk or have had AAGA in the past? Do they use the guidance phraseology in the NAP-5 handbook?

Intraoperatively

- If the patient is identified as being at high risk, what are the additional steps taken to ensure that the risk is minimised?
  - Are staff trained on the appropriate use of TIVA and related equipment and is enough equipment available for use?
  - Do the logistics of anaesthetic rooms and operating theatres support anaesthesia during patient transfer? Can you reduce the 'gap' during transfer?
  - Do all anaesthetic machines have an end-tidal volatile alarm enabled as standard?
  - Do the World Health Organization safety checks include AAGA-related checks, including a check that surgery is finished before emergence?

Postoperatively

- What is the pathway to early identification of awareness? Awareness is unlikely to be directly reported to anaesthetic practitioners; are there clear lines of escalation for the ward or recovery staff to notify anaesthetists of potential awareness events?
- How are patients followed-up after the event? Is there an established link with psychological services?
- Is the local policy of detailing steps to follow after accidental awareness?
- Is there a responsible person who is nominated to manage and collect data on accidental awareness?
- Are all cases of awareness reported as critical incidents and reviewed?
- Is there a mechanism for learning and sharing after an event?

Quality improvement methodology

- Draw out a process map of the patient journey from the point they are assessed for potential risk of accidental awareness.
  - Are there any gaps in local processes can could lead to harm? Note the steps listed in detail in the NAP-5 handbook. Are there any supporting aids within the clinical environment to remind staff of the key learning points from NAP5?
- AAGA is a rare event and so it is unlikely that clinical staff will reliably commit the actions necessary in response to reported AAGA to memory. Anaesthetic departments should consider appointing a local lead to help staff and patients through the recommended follow-up steps or customising a local 'awareness toolkit' using the NAP5 toolkit to ensure that all relevant steps are followed.

Mapping

ACSA standards: 1.2.1.4, 1.2.2.2, 3.1.1.1, 4.2.2.2
GPAS 2020: 3.2.32, 3.5.7,3. 5.8, 3.5.24, 3.5.25, 3.5.26, 3.7.2, 9.7.6, 10.9.2
Curriculum competences: Annex G sections G13–G17

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2.6 Perioperative temperature management

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Why do this quality improvement project?

Maintaining normothermia in the perioperative period reduces complications and discomfort for patients.

Background

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]

Inadvertent perioperative hypothermia 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 inadvertent perioperative hypothermia through appropriate perioperative 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.

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

- American Society of Anesthesiologists grades 2–5 (the risk at 5 is greater than at 2)
- preoperative temperature below 36.0 degrees C
- combined regional and general anaesthesia
- intermediate or major surgery
- at risk of cardiac complications
- extremes of age.

Best practice and suggested data to collect

These standards reflect those set out in the National Institute for Health and Care Excellence Clinical Guideline 65, an updated version of which was published in 2016.[8]

Standard	Measures
Preoperative phase	
Except in an emergency, 100% of patients should have a core temperature of 36 degrees C or higher before coming to theatre.	■ Core temperature and time of last reading on ward.
100% of patients should be offered prewarming and those with a temperature of less than 36 degrees C should receive it.	■ Was the patient offered prewarming? ■ Did the patient receive prewarming?
100% of patients should arrive in theatres covered with two blankets or a duvet.	
100% of patients should report being comfortably warm on arrival in the anaesthetic room.	
Intraoperative phase	
100% of patients should have their temperatures measured on arrival in theatre, every 30 minutes throughout the operation and at the end of surgery.	■ Core temperature at operation start. ■ Frequency of temperature measurement intraoperatively. ■ Core temperature at end of operation. ■ Method of temperature measurement.
100% of intravenous infusions greater than 500 ml and all blood products and irrigation fluids should be warmed.	■ Was active fluid warming employed?
Active patient 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.	■ How long after first anaesthetic intervention was active warming commenced? ■ What type(s) of active warming was employed?
Postoperative phase	
100% of patients should arrive in recovery with a temperature of 36 degrees C or higher.	■ Core temperature on arrival in recovery
If core temperature is less than 36 degrees C, active warming should be employed on 100% of patients.	■ Was active warming used in recovery?
100% of patients' core temperatures should be 36 degrees C or higher on discharge to ward.	■ Core temperature on discharge to the ward.

2.6 Perioperative temperature management

Dr C Mark Harper
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Quality improvement methodology

Map out the patient journey from the admission area to leaving recovery. Work backwards from your goal through each step in the patient journey until you reach the admission lounge, to identify the steps that need to be taken to achieve the goal. A driver diagram would help to visualise the factors involved in ensuring patient normothermia; for example:

- the environmental (ward, anaesthetic room, operating theatre or recovery)
- people related (staff education, awareness and time)
- equipment related (blankets, availability of warming devices and consumables).

A key part of any system improvement is stakeholder analysis and involvement. Engaging people at every step of the process is the key skill and will help to deliver change.

Visualising measurement

- Repeated sampling of a small number of patients who might be high risk.
- Percentage of patients normothermic at each stage could be plotted on a statistical process control p-chart.
- A statistical process control u- or t-chart can be used to capture rare events (eg hyperthermia).

Mapping

ACSA standards: 1.3.1.5, 2.1.1.5, 2.1.1.9, 2.1.1.10
GPAS 2020: 1.3.2.2, 3.2.20, 3.2.21, 3.2.30, 5.2.23, 5.2.32, 5.2.42, 10.2.1, 10.2.6, 10.3.4, 16.2.4, 16.2.5, 16.2.6

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Intraoperative care

2.7 TIVA/TCI training for anaesthesia and intensive care trainees

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Why do this quality improvement project?

All anaesthetists must be able to deliver total intravenous anaesthesia by target controlled infusion (TIVA/TCI). This technique has major advantages for many patient groups and is the only safe technique for administering general anaesthesia to patients with malignant hyperthermia. Inhalational anaesthesia is also not possible in all circumstances (e. lack of scavenging, transfer of anaesthetised patients).[1]

The Fifth National Audit Project (NAP5) found that cases of awareness during TIVA were mostly preventable and the most common contributory factor was lack of TIVA education and training. It has been suggested by previous surveys that TIVA teaching and training in the UK and Ireland is not adequate and that many anaesthetists lack the confidence to use TIVA.[1,2]

Background

Training in TIVA/TCI should begin during basic training for all anaesthetic and intensive care trainees and should continue into intermediate and higher training. Trainees should be competent in the use of TIVA/TCI prior to unsupervised practice in this technique, including transfer of patients anaesthetised with an intravenous propofol infusion.[1]

Best practice

The Society for Intravenous Anaesthesia recommends 25 cases (10 consultant-led, 10 with close supervision and 5 solo cases) before basic trainee competence has been achieved.[3]

Suggested data to collect

Standards	Measures
Trainees should be achieving Society for Intravenous Anaesthesia recommended TIVA/TCI case numbers during the course of their core training.	■ Percentage of core trainees who have logged the requisite number of TIVA/TCI cases by the end of this training level.
Trainees should maintain their skills in delivering TIVA/TCI during intermediate and higher training.	■ Percentage of intermediate trainees who have logged a suggested minimum of 10 cases, ideally including 5 solo cases per training year.
Trainees should attend at least one formal TIVA/TCI teaching session per training level.	■ Number of formal TIVA/TCI sessions attended per training level; either as part of the school of anaesthesia's internal teaching programme or other suitable external course or teaching.

Quality improvement methodology

Trainers

- Are there a sufficient number of consultants, specialty doctors or senior trainees competent to teach and supervise core trainees in basic TIVA/TCI anaesthesia?
- Is there a departmental lead for TIVA/TCI? Do trainees have access to suitable trainers during elective theatre sessions? Has this been taken into account during completion of departmental rotas and training carousels?
- Are trainees able to report any deficiencies in TIVA/TCI case numbers and what action is taken to address these. Modified Cappuccini tests specifically relating to TIVA/TCI could be performed.[4]

Teaching

- Is there a teaching programme within the school of anaesthesia which delivers formal TIVA/TCI teaching at all appropriate training levels?
- If trainees are unable to attend their school's internal teaching, are they aware they should attend a suitable external course/study day and is there are robust process for requesting study leave and adequate study budget?

Equipment

- Is there sufficient equipment for the safe delivery of TIVA/TCI anaesthesia (TCI pumps and processed electroencephalogram monitoring) available within the anaesthetic department to allow for the provision of training.

Mapping

ACSA standards: 1.3.1.5, 2.5.3.1, 2.5.3.2, 2.5.6.1, 4.1.2.1

Curriculum competences: CI_BK_30, PC_BK_52, PR_BK_22;23;24;28, CS_IK_04, EN_IK_02, NA_IK_04;05, PC_IK_20, POM_IS_22, PR_IS_01;03, CD_HK_11, CK_HS_05, POM_HS_11

CPD matrix code: 1E06

GPAS 2020: 3.4.1, 3.4.3, 3.4.5

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2.8 Practical use of total intravenous anaesthesia and target-controlled infusions

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Why do this quality improvement project?

The Royal College of Anaesthetists and Association of Anaesthetists Fifth National Audit Project (NAP5) found that failure to deliver the intended dose of a drug was one of the major contributory factors behind accidental awareness under general anaesthesia during total intravenous anaesthesia (TIVA). Meticulous attention to practical aspects of TIVA practice is essential to avoid over- and underdosing of drugs and attendant complications.[1,2]

Background

TIVA was used for 6.6% of cases nationally according to the NAP5 activity survey in 2014.[1] While the current prevalence of TIVA in the UK is not known, it is likely to have risen following increasing awareness of the environmental impact of volatile anaesthetic agents and the possible effect of TIVA in reducing cancer reoccurrence.[3,4]

Best practice

Joint guidelines from the Association of Anaesthetists and the Society for Intravenous Anaesthesia for the safe practice of TIVA were published in 2018.[2]

Standard	Suggested data to collect
A target-controlled infusion (TCI) pump should be used for maintenance during TIVA.	■ Documentation of use of TCI on anaesthetic charts for TIVA cases. ■ Number of TCI pumps available and incident reports of times when pumps unavailable.
A standardised concentration of propofol and dilution of remifentanil should be used for all TIVA cases.	■ Stock check of available propofol concentrations and/or review of concentrations of drugs on anaesthetic charts for TIVA cases.
Specific designed infusion sets should be used to deliver TIVA.	■ Survey of anaesthetists/operating department practitioners regarding which infusion sets should be used for TIVA. ■ Incident reports of times when sets unavailable.
TCI pumps should be programmed after the syringe containing the drug has been inserted to avoid 'wrong drug wrong pump' error.	■ Review of incident reports for the frequency of 'wrong drug wrong pump' error.
The patient's intravenous access (peripheral cannula or central venous catheter) should be visible wherever practical.	■ Review of anaesthetic charts for documentation of IV access visibility and/or survey of anaesthetists to measure the frequency of, and barriers to, IV access visibility.
Processed EEG (pEEG) monitoring should be used whenever neuromuscular blocking drugs (NMBD) are used during TIVA.	■ Review of anaesthetic charts for documentation of use of a processed electroencephalogram (pEEG).
The same standards of practice and monitoring is maintained when TIVA is used outside of the operating theatre.	■ Use of TCI pumps and pEEG monitoring documented on anaesthetic charts and transfer documentation.

Quality improvement methodology

Checklist

Is there a departmental checklist to promote safe TIVA/TCI practice? An example checklist is:[5]

- Dedicated TCI pumps, programmed with correct:
  - drugs
  - dilution
  - demographics
  - models.
- Is TCI infusion set and intravenous access:
  - designed for the task
  - patent and flushed
  - secure
  - visible
  - to be resited after induction?
- Are neuromuscular blocking drugs to be used?
  - Attach pEEG to the patient.

Department

- Is there a departmental lead for TIVA/TCI anaesthesia?
- Is there clearly defined accessible local policy regarding which TCI pumps, models, drug dilutions, infusion sets and pEEG device are to be used during TIVA/TCI?
- Is there cooperation with the surgical team and theatre staff to promote the visibility of intravenous access?
- What is the continuing training for use of TIVA?

Mapping

ACSA standards: 1.1.1.4, 1.1.2.1, 1.3.1.3, 1.3.1.5, 2.1.1.1, 2.2.1.1, 2.3.1.1, 4.1.2.1, 4.2.1.1

Curriculum competences: CI_BK_30, PC_BK_52, PR_BK_22;23;24;28, CS_IK_04, EN_IK_02, NA_IK_04;05, PC_IK_20, POM_IS_22, PR_IS_01;03, CD_HK_11, CK_HS_05, POM_HS_11

CPD matrix code: 1I03, 3A06

GPAS 2020: 2.18, 2.32, 2.39

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2.9 Intraoperative blood management strategies

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Why do this quality improvement project?

Perioperative anaemia and allogenic blood transfusion are both preventable surgical risks and have been shown to be independent risk factors for poor postoperative outcomes, including morbidity and mortality.[1] Quality improvement in transfusion practice can therefore help to improve patient outcomes and safety.

Background

Anaesthetists play an important role in ensuring appropriate and safe transfusion of blood, blood components and their alternatives. The Association of Anaesthetists has produced updated guidelines on the use of these products.[2] These guidelines incorporate the concept of 'patient blood management', a multidisciplinary and evidence-based approach to optimising blood transfusion.[3] It aims to reduce the use of blood transfusion by focusing on three areas perioperatively: detection and management of anaemia, minimisation of bleeding and blood loss, and management of and improvement of tolerance of anaemia. The National Comparative Audit of Blood Transfusion in elective surgery is a collaborative UK-wide audit that has provided benchmark standards for the implementation of patient blood management.[4]

Best practice

The National Institute for Health and Care Excellence (NICE) Quality Standard 138 (2016)[5] is based on the NICE blood transfusion guideline published in 2015.[6] It lists a set of specific, concise and measurable standards that can be used to support quality improvement.

Suggested data to collect	Measure
Detection and treatment of preoperative anaemia (Association recommendations 1 and 2).	■ Proportion of patients preoperatively screened, treated and followed up for anaemia.
Iron supplementation for patients with iron deficiency anaemia (NICE quality statement 1).	■ Proportion of patients with iron deficiency anaemia who receive iron supplementation.
Patients who may need or have had a blood transfusion are given verbal and written information (Association recommendation 3; NICE quality statement 4).	■ Proportion of patients meeting criteria who are given appropriate information.
Reassessment after red blood cell transfusions (Association recommendation 4; NICE quality statement 3).	■ Proportion of patients transfused with single units, with haemoglobin checked before and after each unit.
Patients having surgery who are expected to have moderate blood loss are given tranexamic acid (Association recommendation 5; NICE quality statement 2).	■ Proportion of patients who had moderate blood loss given tranexamic acid intraoperatively.
Availability of a massive transfusion protocol (Association recommendation 7).	■ Proportion of anaesthetists aware of and able to identify local massive transfusion protocol.
Patients who continue to bleed are actively monitored by point of care and/or regular laboratory tests (Association recommendation 10).	■ Proportion of patients who are bleeding tested appropriately intra- and postoperatively.

Quality improvement methodology

Iron supplementation

Draw out a process map of the time between booking a patient for surgery to the day of surgery:

- Are there ways this pathway could be made simpler or quicker?
- When is haemoglobin first checked?
- How is information fed back to the patient and their general practitioner?
- If it is required, who prescribes the iron supplementation, and is there enough time between the prescription and surgery to complete an appropriate course?
- Which parts of the process are least reliable and how often does surgery get cancelled as a result?

Use of tranexamic acid

- Who determines the estimated blood loss at the briefing and is this documented?
- Is the use of tranexamic acid considered/suggested by the surgeons?
- Look at cases which fail the required standard and determine whether there are any common features (eg types of surgeries, types of patients, groups of surgeons or anaesthetists). This information could be displayed in a Pareto chart. Is further education on recent guidelines needed?

Reassessment after red cell transfusions

Make a process map of ordering blood for a patient undergoing surgery with a risk of blood loss:

- Is blood transfused in single units?
- Is haemoglobin checked between units transfused and, if it is, how is it checked?
- Does the availability of near-patient testing (as compared with laboratory results) alter the proportion of patients tested between units?

Mapping

ACSA standards: 2.2.2.1, 2.2.2.2
Curriculum competences: GU HK 02, GU HS 04, POM HK 12
CPD matrix codes: 1I05, 2A05, 3I00
GPAS 2020: 3.2.5,3.2.6, 3.2.11, 3.2.13, 3.2.14, 3.2.22, 3.2.23, 3.4.4, 3.5.18, 3.5.19

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2.10 Think kidneys

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Why do this improvement project?

All hospital patients are at risk of acute kidney injury. A significant number of episodes of surgery-associated acute kidney injury and associated deaths are potentially preventable, which would improve patient safety and a reduce healthcare costs.[1]

Background

Renal function is sensitive to hypotension and hypovolaemia and is a feature of severe illness, leading to increased mortality and morbidity including the development of chronic kidney disease requiring haemodialysis. Patients undergoing intraperitoneal emergency surgery in the presence of hypovolaemia and sepsis are especially vulnerable.[2] Surgery-associated injuries account for 30–40% of in-hospital episodes of acute kidney injury but they are often under-recognised and badly managed.[3]

Outcomes may be influenced by:

- fluid and haemodynamic optimisation
- the use of nephrotoxins and renally metabolised and cleared drugs perioperatively
- anaesthetic care such as ventilatory management and perioperative glycaemic control.[4]

All surgical patients should therefore be risk assessed preoperatively and measures taken to inform risk reduction. If acute kidney injury is present, it should be detected and managed appropriately, together with education and support of patient and carers, and the early involvement of senior clinicians.

Best practice

The 2009 the National Confidential Enquiry into Patient Outcome and Death (NCEPOD) analysed care of patients dying with acute kidney injury and produced recommendations around admission and assessment of those with or at risk of acute kidney injury as well as subsequent referral and support.[5] Think Kidneys is a national programme designed to prevent acute kidney injury and improve care in accordance with National Institute of Health and Care Excellence quality standards.[6] The Guidelines for the Provision of Anaesthetic Services highlight the identification of high-risk surgical patients based on objective assessment including renal function and early consultation with nephrologists when acute kidney injury is present.[7]

A modified toolkit based on that has been developed by NCEPOD, but with specific emphasis on key perioperative issues, can be used.

Suggested data to collect

Risk assessment

- Has the risk of acute kidney injury been documented and discussed in those having emergency intraperitoneal surgery?

Recognition

- Has a comparison of preoperative renal function been made with baseline results or estimated glomerular filtration rate documented in chronic kidney disease?

Perioperative management

- Perioperative fluid therapy:
  - Has fluid balance been documented?
  - Has glucose control been implemented where appropriate?
  - Has anaemia been corrected?
- Have nephrotoxins been stopped in patients at risk of acute kidney injury as well as kidney-sparing diuretics and metformin?
- Management of blood pressure, electrolytes and pain relief:
  - Is there a plan for postoperative follow-up?

Referral and support

- Was the patient referred to a nephrologist or critical care physician appropriately (eg renal transplant/stage 3 acute kidney injury)?

Quality improvement methodology

- Drawing out a process map of patients journey from preassessment to theatre can highlight areas where you could screen for risk factors for acute kidney injury or institute preventative steps.
- A stakeholder group can be formed to look at the process map and identify local problems and potential solutions. Patient involvement is helpful to design patient information and education on kidney disease and acute kidney injury prevention.
- The most common contributory areas to perceived failures of care should be displayed in a Pareto chart, to focus improvements in the right area.
- Balancing measures (eg the number of blood transfusions or incidence of hypoglycaemia) should be used to ensure that there are no adverse effects from implemented changes.

Mapping

ACSA standards: 1.2.1.1, 1.2.1.4, 1.2.1.5, 1.2.1.5, 1.1.3.1, 1.3.2.1, 1.4.3.2
Curriculum competences: POM_HK_10/11/12, POM_HS_14/15, POM_HK_15. Annex F: 3.4, 4.4, 4.7
CPD matrix codes: 2C04, 2A05
GPAS 2020: 5.5.29

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2.11 Management of elective abdominal aortic aneurysm surgery

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Why do this quality improvement project?

Elective abdominal aortic aneurysm (AAA) repair is complex high-risk surgery. In-hospital postoperative mortality is 3.2% after open repair and 0.7% after endovascular aneurysm repair.[1] Patient outcomes after elective AAA repair have dramatically improved over the past 10 years, following the introduction of the Vascular Society of Great Britain and Ireland AAA Quality Improvement Framework. However, there remains some variation between hospitals and the latest audit of standards identified a number of key areas requiring improvement.

Background

As most AAAs do not produce symptoms and rupture has a 75% mortality, the national screening programme aims to detect and treat high risk aneurysms to reduce mortality. According to the National Vascular Registry, just over 4,000 elective AAA repairs took place in 2018. The proportion of cases performed by open repair (38%) and endovascular repair (68%) remained similar to the previous two years.[2] Best practice in perioperative care includes the use of evidence-based care bundles and effective multidisciplinary working.

Best practice

- Vascular Anaesthesia Society of Great Britain and Ireland guidance on AAA repair.
- RCoA vascular accreditation standards.[3]

Suggested data to collect

Standards	Measures
All patients with an aneurysm greater than 5.5 cm on screening should undergo standard preoperative risk assessment.	■ Percentage of AAA repairs who had an elective AAA Safe for Intervention Checklist.[4]
All patients should undergo computed tomography angiography (CTA) for assessment as an integral part of AAA care pathway.	■ Percentage of patients undergoing CTA.
All patients should be seen by an anaesthetist with interest in vascular anaesthesia prior to listing for surgery.	■ Percentage of patients seen by a specialist vascular anaesthetist. ■ What local arrangements are in place to comply with this standard?
All patients should undergo functional testing prior to surgery (eg complete physical examination, multiple-gated acquisition scan, magnetic resonance imaging).	■ Percentage of patients undergoing functional testing.
Patients should be assessed for surgery through a multidisciplinary team process involving surgeon and radiologist and an anaesthetist with interest in vascular anaesthesia.	■ Is there an multidisciplinary team process and is it supported by a coordinator? ■ Which clinicians are present at multidisciplinary team? ■ Percentage of patients who underwent AAA repair who have been discussed in a multidisciplinary team setting.

A shared decision-making process with patients to discuss the risks and benefits of scheduled or elective major vascular surgery should be recorded.	■ What percentage of patients have this level of discussion recorded? ■ What is the provision of patient information available? ■ Percentage of patients offered a AAA treatment leaflet describing both surgical and anaesthetic risks involved.
Anaesthesia for all patients undergoing AAA surgery should be provided by or directly supervised by a vascular anaesthetist.	■ Percentage of patients anaesthetised by specialist vascular anaesthetist.
Postoperative care.	■ Where did the patient go immediately postoperatively (level 1/2/3)? ■ Was their postoperative location planned?

Quality improvement methodology

- The National Quality Improvement Programme for AAA details a number of quality improvement approaches.[1] The Programme recommends the use of plan–do–study–act cycles and sharing best practice across units using the Collaborative Breakthrough Series model.[5]
- There is a wealth of data captured in the National Vascular Registry; is this information fed back regularly to clinical teams and discussed at departmental meetings?
- Draw a process map of the elective AAA pathway and compare it to best-practice pathways mapped by the National Quality Improvement Programme for AAA. Where can you improve your pathway to make it more reliable and efficient?
- Do you capture patient feedback along the pathway and how is it used?

Mapping

ACSA standards: 1.1.3.1, 1.1.3.3, 3.2.2.3

GPAS 2020: 2.5.19, 2.5.20, 2.5.21, 2.5.22, 2.5.23, 2.5.24, 3.2.5,3.2.6, 3.2.11, 3.2.13, 3.2.14, 3.2.22, 3.2.23, 3.4.4, 3.5.18, 3.5.19, 15.1.2, 15.1.7, 15.3.1, 15.3.2, 15.4.2, 15.4.5, 15.5.4, 15.9.1, 15.2.11, 15.2.12

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2.12 Intraoperative patient handover

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Why do this quality improvement project?

Intraoperative handover of anaesthetic care is a common event and failures in communication may lead to morbidity and mortality. This project highlights the key areas where improvements can be made to ensure continuity of care and patient safety.

Background

In recent years there have been a number of initiatives directed at improving transfer of information during transition of care. Although the intraoperative period is critical, there have been relatively few studies on transfer of information in the theatre environment. Several studies have highlighted an increase in both morbidity and mortality associated with intraoperative handovers.[1–3] Poor communication is recognised as contributing to adverse events in healthcare, with communication during handovers being a specific area of concern.[4] However, intraoperative handover remains an informal process with little structure.[5]

Best practice

The Association of Anaesthetists' standards of monitoring during anaesthesia and recovery.[6]

The Association of Anaesthetists' immediate post-anaesthesia recovery guidelines.[7]

Suggested data to collect

- Is there a formal intraoperative handover process?
- Is there are checklist that is used for intraoperative handover:
  - measured with anaesthetic documentation audits
  - measured with questionnaires of recovery or critical care staff
  - survey of staff practice?
- Have there been any critical incidents or near misses related to intraoperative handover that have affect patient care?
- Have any recurring communication gaps been highlighted already?
- Is there formal training on information transfer to minimise errors?
- What are the views of different anaesthetic grades of the handover process?

Quality improvement methodology

The SBAR (situation, background, assessment and recommendation) tool could be used to structure the handover:[8]

Situation	Background	Assessment	Recommendations
Patient details	Medical history	Anaesthetic technique	Physiological targets
Operation progress	Anaesthetic history	Airway grade	Analgesia plan
	Allergies	Venous access	Fluid plan
		Monitoring	Antiemesis plan
		Intraoperative course	Patient destination

The Anaesthetic Component World Health Organization checklist, as modified in the Fifth National Audit Project report could be used:[9]

Airway	■ Is the airway management plan clear? ■ Is the airway secure?

Breathing	■ Is the circuit intact and connected? ■ Is the correct gas mix on? ■ Is there adequate lung ventilation? ■ Is it suitably monitored?
Circulation	■ Is venous access appropriate and secure? ■ Is the circulation suitably monitored?
Fluid balance	■ Estimated blood loss? ■ Special concerns (eg Jehovah's Witness, allergies, abnormal blood results)
Drugs	■ Is there adequate anaesthetic agent? ■ Is it suitably monitored? ■ Are emergency, reserve and other drugs available? ■ Is blood available?
Effective team	■ Are suitably trained staff present and identified? ■ Any special concerns not covered above? ■ Has the management plan been communicated?

- Data and improvement ideas could be collected via observation of handover interactions.
- Stakeholder and problem-driven approaches where identified handover issues or communication gaps are used as drivers to change current practice (eg drug errors, never- or near-miss events).
- A structured handover tool could be developed for use and tested using simulation.
- The use of any developed tool should be consistent throughout the perioperative period. This will require involvement of allied health professionals for implementation.
- Anaesthetic charts could be modified locally to ensure that key information areas for handover are easily identifiable and formally documented.

Mapping

ACSA standards: 1.1.1.5, 4.1.0.5

Basic curriculum competences: IO_BS_06; IO_BS_08, POM_BS_11, POM_BS_21

CPD matrix codes: 1E06, 1I03

GPAS 2020: 2.5.37, 3.5.19, 3.5.22, 3.5.23, 4.1.5, 4.5.54, 5.5.56-5.5.60, 8.1.7, 8.1.8, 8.5.26, 16.3.16, 18.1.2

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2.13 Management of death in the operating theatre

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Why do this quality improvement project?

Death in the operating theatre is rare. In addition to the devastating impact on family members of the deceased, staff may feel a sense of personal responsibility for the events and the outcome, whether the event was a direct consequence of their actions or not. This can affect family life and the treatment of subsequent patients and can have long-term physical, emotional and psychosocial symptoms.[1,2] It is therefore crucial to ensure that as well as analysing deaths for lessons to improve the system, we care for the relatives and staff involved to prevent long-term psychological sequelae.

Background

Although death or other catastrophe is a rare outcome, most anaesthetists will be involved in such events during their career.[3] Any member of the theatre team may be affected by an event in theatre which leads to the harm of a patient, regardless of whether an adverse outcome was anticipated or not. There is some evidence that death during high-risk cases, where death may be expected, can have a greater impact on the staff involved than unexpected deaths in low risk cases.[4]

There is an increased emphasis on openness after incidents and a 'just culture' not focused on blame but on understanding the system factors involved in adverse outcomes. Whether or not the death is due to an error, there should be an open attitude to learning and support for all involved and full disclosure of events to relatives.

Best practice

Immediate measures

- A senior member of staff not involved in the incident should take leadership of the further management of the situation.
- Contemporaneous records of the event must be kept and all involved staff must provide their statements at the time.
- An accurate and contemporaneous record of the anaesthetic, operation and event must be kept. These must be timed, dated and signed. Electronically stored monitoring records must be printed and filed in the notes.
- The clinical commitment of staff must be reviewed immediately by the most senior anaesthetist available, preferably the clinical director, with the expectation that the team will not continue with their routine duties.
- If the incident involves a trainee, the supervising consultant anaesthetist should immediately make arrangements to relieve the trainee of their clinical commitments. The educational supervisor should also be notified.
- In the case of an unexplained anaesthesia-related death, all equipment and drugs should be kept for investigation. An accurate record should be made of all the checks undertaken including time and date of inspection. Clinical engineering and pharmacy should be informed as appropriate as soon as possible after an incident.
- A critical incident form should be completed electronically immediately after the event.

Communication with patients and relatives

- Senior members of the surgical, anaesthetic and nursing team responsible for the patient should be responsible for breaking bad news using a team approach.[5]
- The content of all discussions should be noted in the patient's record and should follow the General Medical Council's duty of candour guidance.[6]

Effective staff support systems

- The team should discuss the need for a short initial debrief to clarify information and next steps and to identify any team members who may require extra support. This should be facilitated by a senior staff member not directly involved in the incident.
- A senior colleague or mentor should be assigned as continuing support for the team. They should aim to check in with all members of staff involved within a week of the incident.
- Team discussion is useful in identifying and assisting staff adversely affected by an intraoperative death. All members of the team should feel able to speak freely without blame or judgement.
- The case should be discussed at departmental clinical governance or morning meeting within three months of the event or within three months of the outcome of the coroner's referral, if applicable.

Suggested data to collect

There should be a departmental policy for a death in the operating theatre, linking to hospital duty of candour, staff welfare and Association of Anaesthetists' wellbeing guidance.[1]

As part of the analysis of all intraoperative deaths, there should be an audit to ensure that 100% of above steps have been taken.

Quality improvement methodology

- Teams should test the effectiveness of the above measures using simulations and a 'check and challenge' rehearsal for various staff members.
- The aids for use in the event of an intraoperative death should be easy to access and easy to follow for those unfamiliar with the local policy. As the policy will be actioned infrequently, it is not likely that many features will be committed to memory, and so should use human factors solutions such as checklists.
- Those formulating a local policy should undertake a stakeholder analysis to ensure that they involve all relevant stakeholder in the design of resources to use in the event of a death on the table. Have you included your staff support services or shared the learning from other teams who may deal with deaths and so have an existing policy, for example for the emergency department?

Mapping

ACSA standards: 1.1.1.6, 4.2.1.3
GPAS 2020: 3.5.15, 3.5.16, 5.5.45

References

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4. Goldstone AR et al. Should surgeons take a break after an intraoperative death? Survey and outcome evaluation. BMJ 2004;328:0-c.
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