6 Anaesthesia and sedation outside theatre

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6.1 Anaesthesia in the accident and emergency department

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Why do this quality improvement project?

Providing anaesthetic services in the emergency department can be very challenging, given the remoteness from the theatre suite, the nature of the problem for which anaesthesia is needed and the unfamiliar environment. However, standards of care must be maintained. Teamwork and communication are particularly important in the emergency department, where anaesthetists may work with a number of different teams, including the emergency department team, paramedics and a variety of specialists, on critically ill and injured patients.

Background

In the emergency department, rapid sequence induction of anaesthesia with intubation is often required immediately in severely ill or injured patients. The Fourth National Audit Project of the Royal College of Anaesthetists and the Difficult Airway Society (NAP4) highlighted several concerns.[1] Most of the events reported in the emergency department were complications of rapid sequence induction. The most common cause appeared to be poor judgement, but poor planning, inadequate provision of skilled staff and equipment, delayed recognition of events and lack of or misinterpretation of capnography were all considered to be important.[1]

The anaesthetist attending the emergency department must be competent to manage a difficult intubation in a timely and effective manner.[2–5] Use of an emergency induction checklist is indicated. Major haemorrhage may also need to be managed, and appropriate equipment and checklists should be available. Anaesthetic services may also be required to help with the provision of analgesia for painful conditions and anaesthesia or sedation for minor ambulatory surgery such as suturing of lacerations, incision and drainage of abscesses and manipulation of fractures and dislocations.[6,7] Standards of anaesthetic care and safety in the emergency department must be the same as those provided in theatre suites. Anaesthetists are also frequently involved in transferring patients to theatre or critical care in the same hospital or to other hospitals. National guidelines for patient transfer should be followed.[8,9]

Best practice

Previous NCEPOD reports, Association of Anaesthetists guidelines and the Royal College of Surgeons report The High-Risk General Surgical Patient have considered that too many decisions in emergency situations are being made by junior trainees.[10] The need for accountability in providing direct or indirect supervision has been recognised.

Suggested data to collect

Standards	Measures
Where sedation is provided by an anaesthetist there is a policy for the provision of this service including all subspecialty areas.	■ 100% presence of a policy surrounding the provision of safe sedation practice.
Nominated consultant anaesthetist responsible for anaesthetic services in the emergency department with links to the hospital's governance programme.	■ 100% presence of a dedicated emergency consultant on anaesthetic rota.
Regular team practice for rapid sequence induction and major trauma management, using case scenarios and simulation with debriefing and discussion, at least every two months.	■ At least 95% compliance with regular team practice and drills using scenarios.

Checklists of what should be available, together with visible algorithms for difficult airway, anaesthetic emergencies and major haemorrhage management in the resuscitation room. A dose calculation chart, formula or other algorithm to establish appropriate doses in children.	■ Percentage presence of checklists for visual aid in the emergency department.
Airway and ventilator equipment availability.	■ At least 95% compliance with checklist.
Presence of capnography during intubation and ventilation including on transfer of patient.	■ Percentage compliance with presence of capnography equipment in the emergency department.
The anaesthetic trauma team members should be of specialty trainee year 3 or above to manage rapid sequence induction and haemorrhage control in major trauma patients, and should attend within five minutes of being called, more than 90% of the time.	■ Percentage compliance with the requirement.
Trainee anaesthetist should be able to obtain senior advice within 3 minutes or direct practical assistance from a senior colleague within 20 minutes, whenever needed.	■ Percentage compliance with the requirement.
For 100% of emergency department rapid sequence induction procedures a trained assistant should be present.	■ Percentage compliance with the requirement measured by the dedicated allocation of trained assistant for the emergency department.
Accurate real-time data is recorded to allow discerning review of emergency department rapid sequence induction and major trauma resuscitation.	■ Percentage compliance needs to be achieved with documentation to comply with legal requirements.
Many of these patients will require interhospital transfer to the regional trauma centre or the operating theatre; this is not without risk.	■ Percentage compliance with local and national guidelines for transfer, together with provision of equipment for safe transfer.

6.1 Anaesthesia in the accident and emergency department

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Quality improvement methodology

- Using data collected, see where standards regularly fall short and focus quality improvement work on these areas.
- Form a multidisciplinary stakeholder group to look at the processes which, if improved, will have the most influence on patient outcomes.
- Perform regular multidisciplinary systematic review of critical incidents and near misses, and work as a multidisciplinary team to develop solutions.
- Use sequential plan-do-study-act cycles to make incremental changes to the system. This method allows regular review and feedback and therefore builds learning from ideas that work in each cycle.
- Joint teaching and training is an effective way of sharing examples of good practice and also opening conversations about potential problems and their solution (use of simulation improves team working, communication and decision making and can be effective in changing behaviour).

Mapping

ACSA standards: 1.1.2.2, 1.5.14, 2.1.1.1, 2.2.1.3, 2.2.1.4, 2.4.1.3, 2.5.6.2

GPAS 2020: 5.2.12, 5.4.5, 5.5.38, 5.5.46, 7.3.9, 7.3.10, 7.3.11, 7.2.18, 7.3.32, 7.4.4

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Anaesthesia and sedation outside theatre

6.2 Remote site anaesthesia

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Why do this quality improvement project?

As the number of diagnostic and therapeutic procedures performed outside the theatre environment increases, anaesthetists are becoming more involved in providing remote-site anaesthesia and sedation. Developing safe practice guidelines will allow high-quality patient care to be delivered wherever the location.

Background

The RCoA defines a remote site as being away from the main theatre suite and anaesthetic department where help may not be readily available. Potential risks in the remote site include unfamiliarity with the isolated environment, the equipment, team and assistance available, and the procedure being carried out. Additionally, problems with communication pose further challenges in calling for senior help in a timely manner.

Best practice

The same standards of monitoring should be provided as if the patient is in the main operating theatres,[1] as stated in the RCoA guidance Anaesthetic Services in Remote Sites and Guidelines for the Provision of Anaesthesia Services in the Non-theatre Environment.[2,3]

Suggested data to collect

Standard met versus not met

Standards	Measures
A clinical lead for anaesthesia in the non-theatre environment should be appointed.	■ Presence of a clinical lead for remote site anaesthesia. Evidence of involvement in developing the service, training and revalidation of staff, maintaining safety standards and carrying out audit.
All institutions where sedation is practised should have a sedation committee, with a nominated lead for sedation.	■ Presence of a sedation committee and sedation lead.
Full resuscitation facilities should be available in all remote sites providing anaesthetic services including a defibrillator, suction, oxygen, airway devices and a means of providing ventilation.	■ % of remote sites around the Trust with the above equipment immediately available.
All remote sites providing anaesthetic services have standardised equipment. Where standardisation is not possible, all staff should be provided with regular formalised anaesthetic equipment training sessions.	■ % of remote sites with standardised equipment. There is a record of individual staff receiving regular training where equipment is not standardised.
A full range of emergency drugs including drugs to treat rare situations and specific reversal agents, such as dantrolene, intralipid, naloxone, sugammadex and flumazenil, should be available.	■ Immediate availability of above drugs in 100% of remote locations. ■ Dantrolene and Intralipid are located in a designated area and an in-date supply maintained.
All local anaesthetic solutions should be stored separately from intravenous infusions to reduce risk of wrong route administration.	■ 100% of remote sites with local anaesthetics stored separately from intravenous solutions.

Requires measurement on regular basis	
All anaesthetists should be fully familiarised with remote areas prior to undertaking anaesthetic procedures in that location.	■ % of anaesthetists with a record of covering remote sites at Trust Induction.
Wherever possible anaesthesia in remote sites should be provided by appropriately experienced consultants.	■ % of elective and emergent remote site cases performed by Consultants vs Trainees or Specialty Doctors.
Mandatory monitoring as per Association of Anaesthetists guidelines, which includes end-tidal CO2 according to level of sedation/anaesthesia. Peripheral nerve stimulator must be used where muscle relaxants are given. Depth of anaesthesia monitoring is recommended when using total intravenous anaesthesia with neuromuscular blockade.	■ 100% of cases of sedation and anaesthesia have the appropriate level of monitoring.
A dedicated and fully trained anaesthetic assistant should be available at all times.	■ A suitable assistant is present at 100% of cases of remote site sedation/anaesthesia.
A team-based safety briefing should take place prior to commencing any procedures, including WHO checklist and VTE assessment where indicated.	■ Team brief and completion of a safety check list in 100% of cases.
Expert recovery care is required after general anaesthesia or deep sedation.	■ 100% of cases are recovered by appropriately qualified recovery staff in the remote site or theatres recovery after general anaesthesia or deep sedation.
It is essential to have documentation of the anaesthetic procedures and patient monitoring used.	■ An anaesthetic record has been filled out in 100% of cases.

6.2 Remote site anaesthesia

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Quality improvement methodology

- Identify which standards consistently fail to be achieved. This can be done using a snapshot audit to point to where standards are slipping. This will form the basis of any project.
- Where standards have not been reached, engage relevant stakeholders (eg endoscopy, recovery and radiology staff), as well as budget holders such as service managers, in identifying the factors involved and areas for change. Different methods to illustrate where interventions can lead to improvements include constructing process maps and cause-and-effect diagrams.
- A driver diagram can be constructed to plan the improvement work.
- Use sequential plan-do-study-act cycles to gradually make incremental changes to the system. This allows regular review and feedback of changes and learning can build on ideas that work in each cycle.

Mapping

ACSA standards: 2.1.1.2, 2.2.1.3, 2.2.1.4
Curriculum competences: RR_HAB_02, RR_HAB_03, RR_HAB_04, RR_HAB_05, RR_HS_01, DI_HK_01, DI_HS_01, DI_HS_02
CPD matrix codes: 2A08, 3100, 2A10
GPAS 2020: 7.1.1, 7.1.2, 7.1.3, 7.1.5, 7.2.3, 7.2.9, 7.2.10, 7.2.13, 7.2.16, 7.2.18, 7.2.19, 7.2.22, 7.4.1, 7.5.14

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Anaesthesia and sedation outside theatre

6.3 Sedation competency

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Why do this quality improvement project?

Sedation for a variety of procedures is common in multiple areas of the hospital; often in remote sites, performed by professionals of various specialties. Ensuring that practitioners are competent and maintain nationally approved standards is foundational for safe sedation.

Background

Historically, sedation has carried large risks; a 1995 prospective audit of 14,149 gastroscopies found a 30-day mortality of 1 : 2000 and morbidity of 1 : 200, with sedation as a significant contributor to these poor outcomes.[1] More recently, a prospective audit of 368,208 endoscopies demonstrated more reassuring results, with a mortality of 1 : 24,500 and 1 : 10,000 suffering major complications.[2] This improvement is arguably down to large changes in sedation practice and governance, spearheaded by national level guidance such as the Academy of Medical Royal Colleges' guidance on safe sedation practice.[3]

Best practice

Chief among this report's recommendations is to ensure that formal training and competence standards are met by all practitioners who administer sedation.[3] Sedation now features highly in the RCoA curriculum at all levels (see Mapping below), although it has only done so since 2010.[4] Other specialties have implemented their own guidelines and frameworks for training in liaison with the RCoA, for example in emergency medicine and dentistry.[5,6]

Suggested data to collect

Assessing sedation-related governance

- Formal training and assessment of competency in sedation.[3]
- An anaesthetic 'sedation lead' and anaesthetic representation on the hospital's sedation committee.[3]
- Policies for provision of anaesthetist-led and non-anaesthetist sedation.
- Carry out an audit of sedation and its complications.[3] Auditable outcomes should include number of procedures performed by each operator, unplanned admissions and operations within eight days of procedure, 30-day mortality, use of flumazenil, use of naloxone, need for ventilation, sustained drop in O_2 saturation less than 90%.[3]
- Presence of a sedation team with 'a role analogous to a pain team, with the aim of improving clinical standards, clinical effectiveness and the quality of patient care in procedural sedation'.[3]

Assessing practice and knowledge to gauge competency of practitioners

Knowledge of:

- depth of sedation[3]
- preassessment, fasting[3]
- pharmacology, choice of technique, multiple drugs, titration to effect, extremes of age, antagonist drugs[3]
- monitoring, capnography, supplementary oxygen[3]
- documentation, record keeping, discharge.[3]

Assessing infrastructure for sedation

While not strictly competency-related, this would be sensible to assess (eg there is little sense in practitioners being competent in use of capnography if it is not available).

- Availability of oxygen, capnography monitoring and emergency drugs flumazenil and naloxone, guidelines for anaesthetic emergencies and resuscitation equipment in all areas where sedation may occur.[3]
- Adequate staffing for sedation, including presence of an operating department assistant for all anaesthetist-led sedation.
- The availability of a designated and appropriately equipped recovery area following sedation and the use of discharge criteria.[3]

Quality improvement methodology

Sedation-related governance

- Assess with a checklist what governance exists (sedation lead, sedation committee with anaesthetic representative, policy, sedation team).
- Assess with a questionnaire or interviews how formal training is done (among anaesthetists or indeed among other sedating specialties) and whether there is scope and enthusiasm to add training outside of portfolio-based activities.

Practice and knowledge

The above questionnaire can also be used as a test of knowledge and attitudes to identify deficiencies. Strategies to remedy knowledge gaps could include:

- teaching and training with assessment of competencies
- team rehearsal of management of sedation-related emergencies.[3]

Sedation infrastructure

- Assess with a checklist the infrastructure and equipment available in areas where sedation occurs.
- The presence of appropriate staffing could be included in the above audit and attitudes towards this assessed in the questionnaire or interviews.
- The team rehearsal above could include in-situ simulation that may identify infrastructure challenges to timely management of emergencies.

Mapping

ACSA standards: 1.3.1.1, 1.3.1.2, 1.4.4.3, 1.1.2.4, 1.3.16, 1.2.1.1, 1.2.1.4, 2.1.1.2, 1.4.1.1, 1.1.2.5, 2.2.1.4, 2.3.1.1, 2.5.1.3, 2.5.4.1
Curriculum competences: Basic CS_BK_01 to CS_BK_13; CS_BS_01 to CS_BS_05 (Annex B pages 68–70)
Intermediate: CS_IS_0 to CS_IS_03, CS_IK_01 to CK_IK_07 (Annex C pages 42–43)
Higher: CS_HK_01, CS_HS_01 to CS_HS_05 (Annex D page 30)
CPD matrix codes: 2A10, 2D06
GPAS 2020: 7.1.1, 7.1.2, 7.1.3, 7.1.5, 7.2.3, 7.2.9, 7.2.10, 7.2.13, 7.2.16, 7.2.18, 7.4.2, 7.4.3, 7.4.5, 7.4.6, 7.5.3, 7.5.10, 7.5.11, 7.5.12, 7.5.13, 7.5.14

References

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6.4 Sedation and anaesthesia in endoscopy

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Why do this quality improvement project?

Sedation for endoscopy is becoming increasingly challenging as procedures become more complex and patients present with increasing comorbidities. For these procedures the sedation is delivered by both anaesthetists and non-anaesthetists using a variety of agents. Endoscopy suites are often remote and isolated in location, from main operating theatre and recovery facilities. The aim of this project is to ensure that patients receiving sedation or general anaesthesia for endoscopy are cared for to the same standards as those that have their procedures in the theatre complex.

Background

Sedation is defined as a drug-induced depression of conscious level, with the aim of providing analgesia, anxiolysis and potentially amnesia for the patient. The types of procedure and the variety of patients with increasing comorbidities who undergo endoscopy present specific challenged to anaesthetists that provide sedation and general anaesthetic in endoscopy suite.

Doctors or practitioners who deliver sedation must be aware of how to assess a patient pre-procedure:

- history of sleep apnoea
- history of drug allergies and current medications, which may interact with sedation
- previous anaesthetic history
- fasting time
- airway assessment and risks of aspiration.

Monitoring, emergency equipment, staffing and recovery facilities must be standardised to all other operating theatre areas as guided by the RCoA and British Society of Gastroenterology (BSG).[1–4]

Best practice

Three key guidelines have been published which advise best practice and minimum standard recommendations:

- Guidelines for the Provision of Anaesthesia Services in the Non-theatre Environment.[1]
- Guidance for the use of propofol sedation in adult patients undergoing endoscopic retrograde cholangiopancreatography (ERCP) and other complex upper gastrointestinal endoscopic procedures (RCoA and BSG).[2]
- Guidelines for sedation and anaesthesia in gastrointestinal endoscopy (American Society for Gastrointestinal Endoscopy).[3]

Suggested data to collect

Standards	Measures
Patient preoperative assessment	
All patients should undergo preoperative assessment, which includes the five key points mentioned above.	■ Percentage of patients who undergo this evaluation and by whom (staff grade, specialty).
There is a specific chart to record the preoperative assessment and sedation.	■ Percentage of patients with this information documented in a specific chart.
There is a workflow to refer patients who are deemed at higher risk following preassessment (eg anaesthesia, intensive care).	■ Percentage of appropriate/trigger patients referred.
There is a hospital sedation policy which has been updated in the last two years.	

Minimum equipment, monitoring and environment	
The endoscopy unit is self-contained, including recovery facilities.	■ Are all minimum standard equipment and monitoring available (eg piped oxygen and suction in all areas, full resuscitation equipment and drugs, tilting trolleys, airway rescue/management trolley), Procedure for checking and maintaining records for the equipment.
Minimum staff training	
Lead clinician appointed.	■ For the hospital or specialty.
Appropriately trained and qualified staff working in recovery or management of patients undergoing sedation.	■ Percentage of staff in the unit and per patient.
Regular technical and non-technical skills training for all staff.	■ Evidence of percentage of staff trained.
Standardised training for staff delivering sedation.	■ Evidence of training and updates.
Patient outcomes.	■ Percentage of procedures abandoned resulting from complications arising from sedation (under- or over-sedated). ■ Use of reversal agents (naloxone, flumazenil). ■ Percentage of cases in recovery requiring unplanned medical management (airway, other). ■ Patients requiring unplanned admission to hospital, as a result of sedation or recovery complications. The reason for admission documented. ■ Use of World Health Organization (WHO) checklist; percentage of cases for which the WHO checklist is completed (see also section 2.1).

6.4 Sedation and anaesthesia in endoscopy

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Quality improvement methodology

- Form a stakeholder group and identify standards that are consistently not met. What are the barriers to implementation of these standards?
- Locally identified problems are likely to be powerful drivers (eg instances of critical equipment non-availability or patient complications) and to improve learning and compliance these problems should be reviewed and discussed by all members of the multidisciplinary team. Repeated focused measurements in key problem areas are more likely to lead to patient focused improvement and culture change than wholescale audits.

Mapping

ACSA standards: 1.1.1.8, 1.1.2.4, 1.1.2.5, 1.2.1.1, 1.3.1.1, 1.3.1.2, 1.3.1.3, 1.3.1.6, 1.4.1.1, 1.4.4.1, 1.4.4.3, 2.1.1.2, 2.2.1.4, 2.3.1.1, 2.5.1.3, 4.1.2.1, 4.2.2.1

GPAS 2020: 7.1.1, 7.1.2, 7.1.3, 7.1.5, 7.2.6, 7.2.8, 7.2.10, 7.2.12, 7.2.13, 7.2.17, 7.3.17, 7.3.42, 7.3.43, 7.3.44, 7.4.2, 7.4.3, 7.4.5, 7.5.7, 7.5.9, 7.5.13

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Anaesthesia and sedation outside theatre

6.5 Use of capnography outside operating theatres

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Why do this quality improvement project?

Patients commonly receive procedural sedation and anaesthesia outside the operating theatres in places such as radiology, endoscopy, the emergency department and on the intensive care unit. Capnography allows early detection of oesophageal intubation and inadvertent displacement or disconnection of airway devices and therefore potentially reduces the mortality and morbidity associated with these airway complications.[1]

Despite Association of Anaesthetists (AABGI) recommendations for the use of capnography in all patients who are anaesthetised or moderately or deeply sedated, regardless of their location, uptake is still not universal in all clinical areas.[1,2]

Background

The fourth National Audit Project (NAP4) identified that the absence, or failure of interpretation of capnography, contributed to over 70% of deaths from airway complications on the intensive care unit and 50% of deaths in the emergency department.[3]

The Resuscitation Council (UK) 2015 guidelines recommend that waveform capnography must be used to confirm and continually monitor tracheal tube placement in cardiac arrest and may be used to monitor cardiopulmonary resuscitation quality and can indicate return of spontaneous circulation.[4]

Best practice

- Association of Anaesthetists 2011 Safety statement on the use of capnography outside of the operating theatre.[1]
- AABGI 2015 Recommendations for standards of monitoring during anaesthesia and recovery.[2]
- Resus Council (UK) 2015 guidelines.[4]

Suggested data to collect

Standards	Measures
Continuous waveform capnography must be available for all patients undergoing general anaesthesia and moderate or deep sedation outside of operating theatres.	■ Percentage of patients that capnography is used for during general anaesthesia and moderate/deep sedation.
Continuous capnography must be used for all patients being transferred within the hospital with a tracheal tube or supraglottic airway in place.	■ Percentage of patients that have capnography during transfer.
Continuous capnography should be readily available in recovery for patients who have undergone anaesthesia, moderate or deep sedation, and used in high-risk cases.	■ Number of capnography modules available in recovery and, if not, reasons why it is not immediately available.
In recovery, if patients remain intubated or have their airways maintained with a supraglottic or other similar airway device, continuous capnography should be used until patient has recovered fully.	■ Percentage of patients that have continuous capnography, if they required continued airway support.
Continuous capnography should be used for all patients undergoing advanced life support.	■ Percentage availability and ease of access to capnography.

Quality improvement methodology

Audit the percentage use of capnography in clinical areas outside of theatres as outlined above. For example, if three of five patients on a radiology list receiving deep sedation had capnography monitoring then capnography use is 60% and standards are not met.

- Interview staff providing care to patients undergoing anaesthesia or sedation in these areas to understand the reasons why capnography may not be in use (eg lack of availability of equipment or unaware of recommendations).
- Construct process maps, cause and effect diagrams to explore in further detail the factors leading to capnography not being used. This will allow areas for change to be identified. A driver diagram can then be constructed to help define areas for improvement and plan improvement work.
- Reviewing reporting tools such as Datix, root cause analyses of critical incidents and cases reported in mortality and morbidity meetings will be useful to identify whether any patient harm has occurred from failure to use or inappropriate interpretation of capnography.
- Depending on the findings from local incidents, the aim of the project may include:
  - taking to zero the number of events where patients come to harm from a lack of capnography use
  - delivering consistent use of capnography where indicated.
- Sequential plan-do-study-act cycles monitored with run charts, aiming to increase capnography use over time.

Mapping

ACSA standards: 1.1.1.4, 1.4.1.1, 1.4.5.2, 2.1.1.2
Curriculum competences: Annex B (PC_BK_71, DI_BS_01), Annex C (PK_IK_15)
CPD matrix codes: 1A03, 1B04, 2C05, 3A07
GPAS 2020: 7.2.10, 4.2.11, 4.2.12

References

1. Association of Anaesthetists of Great Britain and Ireland. The Use of Capnography Outside the Operating Theatre. AAGBI Safety Statement. London: AAGBI; 2011.
2. Association of Anaesthetists of Great Britain and Ireland. Recommendations for Standards of Monitoring during Anaesthesia and Recovery. London: AAGBI; 2015 (https://anaesthetists.org/Home/Resources-publications/Guidelines/Standards-of-monitoring-during-anaesthesia-and-recovery).
3. Cook TM et al, eds. Major Complications of Airway Management in the UK. 4th National Audit Project of the Royal College of Anaesthetists and the Difficult Airway Society: Report and Findings. London: RCoA; 2011 (https://www.niaa.org.uk/NAP4-Report?newsid=513#pt).
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6.6 Anaesthesia and sedation in the radiology department

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Why do this quality improvement project?

Non-theatre areas such as the radiology department have unique hazards which must be considered as part of continuing anaesthetic risk assessments. The aim should always be to maintain and improve patient safety by implementing, maintaining and improving the application of best practices. There should be a local committee reporting to a named hospital board member, which ensures that practice is appropriate for relevant procedures (eg hospital sedation committee). Any serious adverse incident should be subjected to a root cause analysis to ensure that appropriate quality improvement and learning points are identified and disseminated.

The radiology department is often sited away from the operating theatre suite and so practitioners must be able to work independently without immediate help. All drugs and equipment for safe anaesthesia should be present, as well as a skilled assistant. Consideration must be made to where patients are to be recovered; will they for example need transfer back to the main recovery area?[1]

Background

Procedures and interventions are being increasingly performed outside the theatre environment because they involve specialist equipment, which may be unavailable elsewhere (eg magnetic resonance imaging, MRI). The expectation is that much of this work should be performed on an outpatient or daycase basis.

Advances in practice mean that this workload is becoming increasingly challenging both in terms of technique and patient complexity. The patient may require anaesthesia or sedation performed by an anaesthetist for a variety of reasons including comfort, length of procedure and patient- or technique-related factors. The anaesthetist must therefore have the ability to provide both safe anaesthetic or sedation interventions for the patient and to provide optimum operating conditions for the interventionist within the confines of an alien environment. Particular hazards will be related to patients at extremes of age, children and patients of high American Society of Anesthesiologists (ASA) grade.

Procedures may be elective or emergency in nature and can involve specific intervention related risks (eg allergy to radiographic dye) or environmental hazards (eg radiation exposure, access to patients, poor lighting) which must be considered within the normal risk assessment process. Such procedures will include MRI, computed tomography and guided procedures, as well as angiography and associated interventions.[2]

Best practice

Patients undergoing such procedures must be managed to the same standards of practice that would be expected in an operating theatre environment, irrespective as to whether sedation or anaesthesia is being administered by the anaesthetist.[5–10]

Suggested data to collect

Outcome measures

Outcome measures are measures which aim to improve outcome and experience for patients. In areas where anaesthesia or sedation is being delivered outside the operating theatre environment, the facilities and equipment available must reflect that which is available in the operating theatre. This audit can be performed when such a clinical area is first opened and may be repeated at locally determined intervals to ensure that facilities have been maintained to an appropriate standard.

These checks will include:

- the availability of adequate oxygen supply (preferably piped)
- the adequacy of lighting
- Association of Anaesthetists standard monitoring, including capnography, is available. In relation to MRI, all monitoring equipment must be MRI compatible and appropriately secured
- emergency drug and anaesthetic equipment trolleys are immediately available and anaesthetic emergency drugs such as dantrolene, sugammadex are available within five minutes
- the availability of a trained dedicated anaesthetic assistant

- dedicated areas equipped to appropriate Association of Anaesthetists and Guidelines for the Provision of Anaesthetic Services (GPAS) standards for pre-procedure assessment and post-procedure recovery
- appropriate personal protective equipment is available (eg lead coats, ear protectors)

Other local requirements may be identified, which can be included on this list.

Organisational systems

Organisational systems exist to embed processes that enhance patient safety. Carry out an annual review of service need and performance, including:

- total number of cases performed per annum under sedation and anaesthesia as a percentage of all cases performed with breakdown of cases performed by specialty and patient demographic (age, ASA grade etc)
- percentage of such sessions which have an anaesthetist assigned to them with regular and continuing experience in this field (standard 100%)
- anaesthetic staff assigned to these lists have regular sessions working in these environments and perform a regular number of cases per annum
- percentage of cases abandoned, patients experiencing complications or having unplanned admission, with learning factors and trends identified
- breakdown of cases performed by specialty, and patient demographic (age, ASA grade etc)
- percentage of patients who recover in a facility complying with Association of Anaesthetists and GPAS standards.

Process measures

Process measures concern monitoring of the conduct of anaesthesia and sedation. The conduct of anaesthesia or sedation must adhere to standards established in Association of Anaesthetists and other guidance.

- Percentage of planned emergency and elective sessions for which a list of patients and procedures is available.
- Percentage of patients who have an assessment by the anaesthetist prior to anaesthesia/sedation with a discussion of consent recorded.
- Percentage of times that 'five steps to safer surgery' is fully applied in full (brief, sign in, time out, sign out, debrief).[11]
- Percentage of patients with an anaesthetic chart completed.
- Percentage of patients undergoing sedation with an assessment of conscious level during the procedure recorded.
- Percentage of patients who have had full Association of Anaesthetists monitoring standards applied (with exceptions recorded).
- Percentage of occurrence of critical events:
  - use of flumazenil reversal for following midazolam
  - unexpected progression from sedation to anaesthesia
  - unexpected emergency (anaphylaxis, cardiac arrest etc).
- Percentage of patients intended to be discharged who are unplanned admissions.

Quality improvement methodology

Process mapping the patient pathway for both emergency and elective procedures may help to identify specific local issues to be addressed. The quality improvement team should include anaesthetists, representatives from specialties performing procedures (surgeons, radiologists, gastroenterologists etc), theatre staff and radiographers. This should lead to a coherent understanding of the barriers to best practice and how they can be circumvented. Illustrating such challenges in a driver diagram or similar methodology will help to draw together the improvement project structure. Other smaller projects can be regularly performed to look at individual elements of patient care.

Case examples

Review a number of 'operating lists' for procedures carried out under anaesthesia or sedation in the radiology department with regards to documentation of 'five steps to safer surgery'.[11]

Survey of anaesthetists and theatre and radiology suite staff with regards to knowledge of particular hazards and safety practices within the radiology department (eg what personal protective equipment is required). This could be repeated following educational interventions and monitored using the plan-do-study-act cycle methodology.

Review a selection of anaesthetic charts of patients who have undergone such procedures.

6.6 Anaesthesia and sedation in the radiology department

Dr James Watts
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Mapping

ACSA standards: 1.1.2.4, 1.1.2.1, 1.2.1.1, 1.3.1.1, 1.3.1.2, 2.1.1.1, 2.1.1.2, 1.3.1.5, 1.4.1.1, 1.4.4.3, 1.1.2.5, 2.1.1.2, 2.1.1.11, 2.1.1.4, 2.1.1.3, 2.2.1.4, 2.3.1.1, 1.3.1.3, 1.3.1.4, 2.5.1.3, 2.1.1.14

Curriculum competences: DI_HK_01, DI_HS_02, CS_HK_01, CS_HS_01, CS_HS_02, CS_HS_03, CS_HS_04

CPD matrix codes: 1A02, (1A03), (2A10), (3A07)

GPAS 2020: 7.1.1, 7.1.2, 7.1.3, 7.1.4, 7.1.5, 7.1.6, 7.2.3, 7.2.4, 7.2.8, 7.2.9, 7.2.10, 7.2.11, 7.2.12, 2.2.15, 7.2.16, 7.2.17, 7.2.18, 7.2.19, 7.2.23, 7.2.24, 7.2.25, 7.2.27, 7.3.4, 7.3.6, 7.3.7, 7.3.15, 7.3.17, 7.3.19, 7.3.21, 7.3.22, 7.3.23, 7.3.25, 7.3.26, 7.4.1, 7.4.4, 7.4.5, 7.5.4, 7.5.6, 7.5.8, 7.5.9, 7.5.10, 7.5.11, 7.5.12, 7.5.13, 7.5.14, 7.7.4

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Anaesthesia and sedation outside theatre

6.7 Cardioversion

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Dr Vivek Sharma, St George's University Hospitals NHS Foundation Trust, London

Why do this quality improvement project?

This project aims to ensure that the same standards of care are applied whether cardioversion is carried out as a planned or emergency procedure.

Background

Cardioversion is carried out as both a planned and unplanned procedure. Patients requiring cardioversion often have multisystem disease, and those patients requiring emergency cardioversion will have unstable haemodynamic parameters.

Cardioversion requires either sedation or very brief general anaesthesia. For elective procedures, patients are preassessed and attention should be paid to the underlying rhythm. Atrial fibrillation has a high incidence of atrial thrombi and systemic anticoagulation for elective cardioversion should be followed as per local and national guidelines.[1,2]

Atrial fibrillation is the most common cardiac arrythmia managed in acute medicine. It comprises 10% of all UK emergency admissions, is the most frequently encountered arrythmia in the intensive care unit (up to 46% in septic shock) and can range from 25% to 60% following cardiac surgery.

Cardioversion may be needed urgently to treat arrythmias causing significant cardiovascular compromise often in remote and unfamiliar surroundings. Anaesthesia for cardioversion can pose unique challenges when undertaken in the emergency department, wards, the intensive care unit or theatres and requires a flexible and individualised approach. The role of the anaesthetist is to oversee all clinical and procedural aspects to ensure the best patient outcomes, as well as ensuring at all times the safety of the team. This relies on a good clinical setup, efficient communication and the presence of the appropriate skilled personnel.[5]

Best practice

The Resuscitation Council (UK) outlines principals of safe conduct of external direct current cardioversion and the Association of Anaesthetists standards of monitoring apply wherever the procedure is undertaken, including the availability of capnography.[3,4] Recommendations for anticoagulation are described in the 2016 European Society of Cardiology guidelines on cardioversion and in the National Institute for Health and Care Excellence guidance on the management of atrial fibrillation.[1,2]

Suggested data to collect

Standards	Measures
All elective patients should undergo a pre-procedure assessment to ensure suitability for the procedure and to avoid on-the-day cancellations.	■ Percentage of patients who do not have a preassessment documented. ■ Percentage of on-the-day cancellations and reasons.
Review the current local guidelines available.	■ When were the local guidelines produced and what is timeframe for update? ■ Review how the current guidelines match the actual setup and facilities.
What is the governance structure to ensure safe provision of anaesthesia for cardioversion?	■ Is there a lead for anaesthesia in remote site? ■ Is there an equivalent lead from the cardiology department and resuscitation departments? ■ How are critical incidents and near misses reviewed and the learning disseminated from them (eg combined cardiology/anaesthesia governance day)?

Equipment availability.	■ Percentage of cases that have capnography available. ■ Percentage availability of minimum recommended monitoring. ■ Percentage biphasic cardioverter with external pacing facility available. ■ Percentage airway kit availability and immediate access to resuscitation drugs. ■ Percentage of trained personnel who is responsible for cardioversion.
World Health Organization (WHO) check list use compliance.	■ Percentage of cases that have WHO surgical safety checklist use documented.
All clinical areas have standardised resources for emergency external direct current cardioversion.	

Quality improvement methodology

Form a stakeholder group to identify a recurring problem (eg on-the-day cancellations to improve compliance by all members of the multidisciplinary team).

- Have a brainstorming session involving all members of multidisciplinary team to design a pre-procedure checklist.
- Use of an electronic pro forma would allow easier documentation and data collection which can be used to plan interventions.
- Introduction of any intervention should be done on a small scale to see whether a change results in improvement.
- Use of in-situ simulations to help identify infrastructure problems and inform what interventions are likely to result in positive change.

Mapping

ACSA standards: 1.2.1.4, 1.3.1.3, 1.3.2.1, 2.1.1.5, 2.1.1.6

GPAS 2020: 2.5.17, 3.2.18, 3.2.30, 7.2.17, 7.3.34, 7.5.1, 7.7.4

Curriculum competences: Annex B page B-55, Annex C page C-13, C-53

CPD matrix code: 2A08

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6.8 Provision of anaesthesia in magnetic resonance imaging

Dr Lauren Oswald
The Christie NHS Foundation Trust

Why do this quality improvement project?

Anaesthetists are increasingly requested to provide anaesthesia or sedation in the magnetic resonance imaging (MRI) suite. This typically remote area presents unique challenges. The quality of care provided to patients in the MRI suite should not differ from that provided in the main operating theatre environment. Safety is reliant on appropriate patient selection, clinical leadership, staff training and education and risk mitigating practices.[1] Engagement in quality improvement in this area should appeal to individuals with an interest in remote site anaesthetic practice and anyone expected to deliver (or supervise) anaesthesia services for the MRI suite.

Background

Anaesthesia for MRI is an evolving area. Recent developments include increases in magnetic field strength, improved compatibility of implantable medical devices and the advancement of interventional MRI.[1] Movement during scanning distorts the final image and scanning time is long compared with computed tomography. The aim of anaesthesia is to obtain immobility while maintaining safety.[2] Anaesthetic technique ranges from sedation to general anaesthesia. Scanning time varies but may take several hours. Specific risks include:

- remote site practice
- lack of access to patient during scan
- high magnetic field (projectiles)
- current induction (dysrhythmias, muscle spasms, interference with electrocardiogram monitoring)
- radiofrequency energy (burns)
- changes to programming of implanted medical devices (eg shunts)
- MRI contrast use (allergic reactions, renal injury)
- loud acoustic noise (hearing damage)
- potential harm to the unborn fetus
- helium escape (from emergency 'quench' procedures).

Best practice

The Association of Anaesthetists has published guidelines on the safe provision of anaesthesia in MRI areas.[1] The Medicines and Healthcare products Regulatory Agency has provided guidelines on MRI safety.[3]

Suggested data to collect

Standards	Measures
A modified World Health Organization (WHO) surgical safety checklist is completed for all patients requiring MRI under anaesthesia; the patient and all staff have an MRI safety and exclusion questionnaire completed before entering the magnetic field.	■ Percentage completion of modified WHO safety checklist. ■ Percentage of patients and staff with MRI safety and exclusion questionnaire completed before entering the magnetic field.
The lead anaesthetist is senior, ideally a consultant, and accompanied by a trained anaesthetic assistant; inexperienced staff unfamiliar with the magnetic resonance environment should not manage a patient in this environment, particularly out of hours.	■ Grade of the most senior anaesthetist present. ■ Qualification and training of the anaesthetic assistant present. ■ Time of scan (does staffing seniority change out of hours?) ■ Percentage of anaesthetists with the responsibility for providing anaesthesia for MRI (including out-of-hours cover) who have been orientated to the area.

All staff required to provide anaesthesia in the MRI suite should be trained on the anaesthetic equipment in this area and the challenges of working in this unique environment, which is different from elsewhere in the hospital.	■ Conduct an anonymised questionnaire regarding magnetic resonance safe, conditional and unsafe equipment, including restrictions in equipment location according to Gauss line.
There is standardised and specialised equipment for the management of difficult airways reliably available within five minutes in every area where anaesthesia is given.	■ Time taken to bring adult and paediatric difficult airway equipment to the MRI suite.
All staff are familiar with emergency evacuation (eg in the event of cardiac arrest) and quench procedures; in the event of an adverse incident, the patient is removed from the scanning room without delay; a tipping trolley and immediate access to an anaesthetic area is available.	■ Timed extraction drills using simulation.

Quality improvement methodology

Checklists

Review your department's modified WHO checklist for use in the MRI suite. Are all five stages reliably completed? Could the content be improved upon? If one is not currently in use, develop one using existing guidance on checklists.

Process mapping

Review the journey of a critical care patient from the intensive care unit to the MRI suite and back. Were there any stages at which safety and efficiency could be improved? Were checks completed at appropriate stages? Were there any delays? Explore these areas to guide which may require improvement.

6.8 Provision of anaesthesia in magnetic resonance imaging

Dr Lauren Oswald
The Christie NHS Foundation Trust

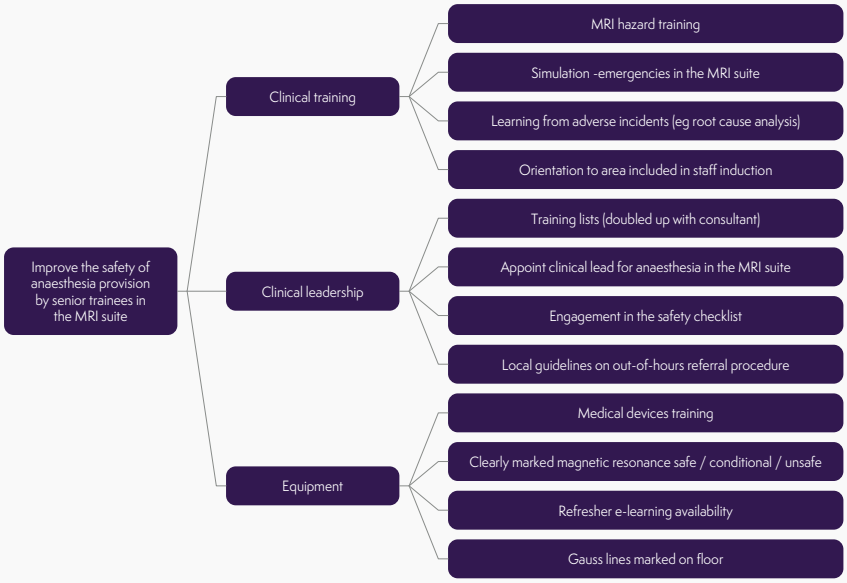

Figure 6.8.1: Example driver diagram to improve the safety of anaesthesia provision by senior trainees in the magnetic resonance imaging (MRI) suite.

Driver diagrams

Figure 6.8.1 shows an example of a driver diagram for improving the safety of anaesthesia provision by senior trainees in the MRI suite.

Mapping

ACSA standards: 1.1.2.1, 2.1.1.5, 2.1.1.14
Curriculum competences: DI BK 01, 02, 03, 04, 05, DI BS 01, 02; DI IK 01, 02, 03, 04, DI IS 01, DI HK 01, DI HS 01, 02
CPD matrix code: 3A15
GPAS 2020: 7.1.1, 7.2.3, 7.2.16, 7.2.17, 7.2.19, 7.3.34, 7.3.35, 7.3.36, 7.4.4, 8.8.4

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Anaesthesia and sedation outside theatre

6.9 Provision of anaesthesia for cardiac catheterisation

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Why do this quality improvement project?

The growing number and complexity of cardiac interventional procedures is attributed to the rise in adults surviving with congenital heart conditions and cardiovascular disease related to ageing. This makes anaesthetic involvement integral and essential to support services in the cardiac catheterisation laboratory (CCL). Anaesthesia involvement is expected to expand even further in the future. This document outlines general practical aspects and suggestions for quality improvement.

Background

The UK National Institute for Cardiovascular Outcomes Research 2016/2017, in the National Cardiac Audit report, highlights considerable variation in performance between centres undertaking interventional procedures.[1] The report recommends optimising local quality improvement initiatives to drive improvement in service and outcomes.

The provision of anaesthesia in the CCL should not differ from provision of anaesthesia in the theatre suite but presents its own unique challenges.[2–4]

- CCL may be an isolated and unfamiliar environment, not uncommonly, with limited access to help, equipment and drugs.
- Communication between the anaesthetist and cardiologists needs to be in real time and is facilitated by dual screens, microphone speaker and consoles visible from the control station.
- Radiation exposure is frequent and appropriate shielding with lead aprons, thyroid collar, acrylic stands and, if available, leaded glasses must be used for radiation protection. Procedures under general anaesthesia may allow the anaesthetist to position themselves at an acceptable distance away from exposure to radiation.

Best practice

- The RCoA Guidelines for the Provision of Anaesthetic Services 2019 for cardiothoracic procedures in chapter 18 and broadly in non-theatre environment in chapter 7 describe special requirements for CCL.[2,3] Association of Anaesthetists standards of monitoring apply.[5]

Suggested data to collect

Standards	Measures
Pre-procedure	
Use of British Cardiovascular Society safety checklist for CCL.[6]	■ Percentage of cases that use the checklist.
Availability of equipment.	■ Line and circuit extensions. ■ Depth of anaesthesia monitoring. ■ Infusion pumps. ■ Warming devices. ■ Urinary catheter for prolonged cases. ■ Availability of personal protective equipment including thyroid shields and dosimeter badges.
Intra-procedure	
Use of antibiotics during insertion of implantable devices.	■ Percentage of appropriate timely use of antibiotics.

Monitoring of contrast load.	■ Percentage of patients that develop contrast-induced nephropathy and identify a baseline for local organisation.
Availability of temperature monitoring equipment and warming devices.	■ Percentage of patients who have intraoperative temperature monitoring. ■ Number of warming devices availability. ■ Percentage of patients with body temperatures below 36.6 degrees C in recovery. ■ Availability of temperature measurement in recovery. ■ Availability of warming devices in recovery areas.
Post-procedure	
Post procedural destination should be discussed at the start of case.	■ Reasons for delay in accessing recovery facilities.
A plan for surgery, if it is deemed necessary, should be available at the start of each procedure.	
Emergency percutaneous coronary intervention (PCI)	
Use of wide-bore gastric tubes and fluoroscopic confirmation of tube during the procedure.	■ Percentage of patients where gastric tube failed to be identified in correct position and remedial actions that were taken.
There should be a pathway for post-procedure destination for all the patients following emergency PCI.	
There should be a local guideline in centres without in-house cardiac surgical support, to facilitate unplanned 'transfer out' to the nearest specialist centre in life-threatening emergencies.	

6.9 Provision of anaesthesia for cardiac catheterisation

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Quality improvement methodology

- Involving stakeholders from cardiology, radiology and anaesthesia departments is more likely to have a lasting and positive change in outcomes than isolated decision making.
- Identify the trend of contrast-induced nephropathy at your centre. Awareness of its incidence can help to modify peri-procedure hydration and contrast doses. What are the local protocols in following-up patients with known renal impairment post-procedure? How are these patients highlighted to community services?
- Use of in-situ simulation can help to identify problems with infrastructure and focus on particular areas of improvement (eg declaring major haemorrhage, cardiac arrest).
- Using combined governance meetings to discuss near misses and critical events. Patient focus should feature highly when driving any new quality improvement intervention and is essential for any chance of success. Suggestions might be to tackle areas where there have been problems noticed by any of the above stakeholders as they are likely to be two-way in nature.

Mapping

ACSA: 1.3.1.3, 1.3.2.1, 1.4.1.1
GPAS 2020: 7.1.1, 7.2.3, 7.2.8, 7.2.10, 7.2.16, 7.2.17, 7.2.18, 7.2.19, 7.3.22, 7.3.23, 7.3.26, 7.4.2, 7.4.3, 7.4.4, 7.5.1, 7.2, 18.7.3, 18.7.4, 18.7.5

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