SAFE
ANAESTHESIA
LIAISON GROUP

PATIENT SAFETY UPDATE

April – October 2024

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Including a clinical review of incidents relevant to anaesthesia safety reported to the NHS in England and Wales in the period from 1 April–31 October 2024.

SALG Update

SALG Scholars Fellowship Round 7 (2026-2028): Open now for applications

In collaboration with the Association of Anaesthetists and the Royal College of Anaesthetists, SALG are offering a unique programme of formal training through Harvard Medical School that aims to develop international expertise in perioperative quality and safety. The successful candidates will be provided with:

- A fully funded place in a Master of Healthcare Quality and Safety course from Harvard University, while also engaged in clinical practice at a suitable level at the Beth Israel Deaconess Medical Centre (BIDMC), a major Harvard Medical School teaching hospital in Boston
- Co-mentorship during the programme under the leadership of the BIDMC department chair, Professor D Talmor, from:
  - Prof Satya-Krishna Ramachandran at Harvard/ BIDMC
  - The co-chairs of SALG
  - Professor JJ Pandit (University of Oxford)
- Scholars will identify project(s) in the UK that they will develop and lead on, after their return to the UK.

Further information about this opportunity, and details of how to apply can be found on the SALG website.

SALG Patient Safety Conference

Save the date – Wednesday 12 November 2025

This year's SALG Patient Safety Conference, which will be held online on Wednesday 12 November, will focus on the topics of Local Anaesthesia Systemic Toxicity and Rapid Sequence Induction, along with safety updates from our partners. We do hope that you'll join us for what promises to be an interesting and useful day.

Medication safety

SALG has continued to concentrate on improving medication safety in 2025, with a particular focus on improving availability of pre-filled syringes of anaesthetic medications. The group are currently working with stakeholders from a variety of organisations to support this agenda. Stakeholders that we are currently working with, or plan to work with soon include pharmaceutical companies and manufacturers of medical equipment such as needles, syringes and syringe drivers, procurement specialists, human factors professionals, regulators and patient organisations that have a particular interest in this area.

Following the SALG conference, we have had a lot of interest from anaesthetists in this pre-filled syringes workstream. We're aware that many were prompted to raise this issue with their departments. SALG representatives met with the MHRA recently regarding the difficulties that trusts have been having in gaining access to pre-filled syringes of suxamethonium in particular. We will continue to follow this up with the MHRA and will keep colleagues posted on developments. Recently we have been made aware that there is now a licensed pre-filled syringe of rocuronium is available in the UK for purchase in a sterile prefilled syringe (50mg/5ml).

SALG is currently developing a list to be shared with manufacturers, and procurement and pharmacy colleagues of anaesthetic medications that should be available in a pre-filled format. The aim of this list is to specify standardised volumes and dosages of medications commonly used by anaesthetists in theatres to optimise patient safety. In addition, SALG will be working with clinical human factors specialists to ensure that any changes that are proposed will not have unintended negative consequences.

The SALG website will continue to be updated with information and links as they become available, so we would encourage anaesthetists who are interested in this area of work to look at the resources that are included and send us any queries or feedback related to this area of work.

Perioperative care of patients currently taking GLP-1 agonist medications

SALG would like to draw attention to the recent publications from the Association of Anaesthetists and MHRA regarding perioperative care of patients currently taking GLP-1 agonist medications (e.g. Ozempic, Wegovy etc.).

The Association of Anaesthetists has produced an infographic that usefully summarises the main points in the full consensus statement published in *Anaesthesia*.[1]

The MHRA has also produced a Drug Safety Update on this topic,[2] that references the above clinical guidance.

1. El-Boghdadly, K *et al*. Elective perioperative management of adults taking glucagon-like peptide-1 receptor agonists, glucose-dependent insulinotropic peptide agonists and sodium-glucose cotransporter-2 inhibitors: a multidisciplinary consensus statement. *Anaes* 2025, Apr; 80(4):412-424.
2. Medicines and Healthcare Products Regulatory Agency. Drug Safety Update: GLP-1 and dual GIP/GLP-1 receptor agonists: potential risk of pulmonary aspiration during general anaesthesia or deep sedation. January, 2025 [Accessed 10 April, 2025].

Modified release opioid medication

SALG would like to ensure that anaesthetists are aware that prolonged release opioids are no longer licensed for the treatment of post operative pain. The use of these medications is associated with an increased risk of persistent post-operative opioid use and opioid induced ventilatory impairment. This reflects the Association of Anaesthetists guidelines on management of perioperative pain, issued September 2024[1] and a drug safety alert issued by the MHRA in March 2025.

SALG, the Faculty of Pain Medicine, the RCoA and the Centre for Perioperative Care (CPOC) sent a letter in August 2023 signed by internationally respected experts in this field to Dr Alison Cave, Chief Safety Officer at the MHRA. In this letter, we requested that the MHRA strengthen warnings around the use of modified-release opioids following strong international evidence against their use in managing acute pain. We therefore welcome the development of the drug safety alert and the accompanying public assessment report, published in March 2025 on this topic.[2]

1. El-Boghdadly, K *et al*. Perioperative pain management in adults: a multidisciplinary consensus statement from the Association of Anaesthetists and the British Pain Society. Anaes 2024 Nov, 79(11): 1220-1236.
2. Medicines and Healthcare products Regulatory Agency. Drug Safety Update: Prolonged-release opioids: Removal of indication for relief of post-operative pain. March, 2025 [Accessed 10 April, 2025].

Prevention of Future Deaths Report (Regulation 28) in the matter of Mrs Pamela Anne Marking

All Prevention of Future Deaths reports received by the RCoA/Association of Anaesthetists are reviewed by SALG and a joint response produced. The RCoA and the Association were requested to respond to a report from a coroner following the sad death of a patient, Mrs Pamela Marking. The report raised concerns relating to the practice of rapid sequence induction (RSI). Full details of the report are available on the coroner's website.

SALG's full response can be read here

SALG would like to highlight that the most important step to reduce the risks associated with RSI, as recommended by NAP4,[1] is to undertake an individualised risk assessment and act on it. The NAP4 report states "All patients should have their risk of aspiration assessed and recorded before anaesthesia. The airway management strategy should be consistent with the identified risk of aspiration." Furthermore, NAP7[2] recommends "Anaesthetists should treat cases of acute abdomen as high risk for aspiration, assess the extent of that risk and plan airway management accordingly. Each airway manager should decide which elements of RSI they wish to use and be prepared to justify their use or omission." We reinforce our support for these statement. As part of this, we will publish a best practice statement on RSI.

1. Major Complications of Airway Management in the United Kingdom. Report and findings of the 4th National Audit Project of the Royal College of Anaesthetists and the Difficult Airway Society (NAP 4). Royal College of Anaesthetists, March, 2011.
2. At the heart of the matter: Report and findings of the 7th National Audit Project of the Royal College of Anaesthetists examining perioperative cardiac arrest (NAP 7). Royal College of Anaesthetists, November, 2023.

Near-Miss Epidural Administration of Tranexamic acid (TXA)

This content has been developed for SALG by the consultant anaesthetist involved in the individual case.

A patient underwent caesarean birth under epidural ('top-up') anaesthesia. Shortly after delivery, the patient started to haemorrhage and 1g tranexamic acid (TXA) was requested. While preparing the drug for administration, one of the ampoules of TXA was mistakenly replaced with an ampoule of preservative-free morphine, intended for administration via the NRFit™ epidural catheter.

The error was recognised when the ampoule of TXA was seen in the colour-coded epidural drug tray before the epidural drugs had been drawn up, but after the woman had been given the morphine intravenously.

Commentary

In 2022, the WHO published a Medical Product Alert[1] warning of the serious risks associated with intrathecal administration of TXA, including a mortality rate of 50%. There has been at least one case report of inadvertent epidural administration of TXA[2], which appeared to cause less harm than the intrathecal route (possibly due to intact dural protection and use of saline lavage). Use of NRFit™ connectors for neuraxial drug administration reduces the risk of wrong route error[3] but does not eliminate it, as there is no protection when the wrong drug is drawn up into the neuraxial syringe. Other safety systems, such as two-person checks, can be (and are) 'worked around' during high acuity situations. The use of a specified colour-coded tray for epidural equipment and drugs may well help to identify substitutions errors like these (see photo), although there is nothing to stop the syringe/ampoule from being placed in the wrong tray.

Encouraging vigilance around 'slip errors' (i.e. an error that occurs due to a lapse in attention) is largely ineffective. Practical measures, such as designating TXA a 'high risk' medication to be stored away from other drugs, are more effective. Manufacturers are encouraged to label ampoules to highlight the contents (rather than the manufacturer's branding) to reduce the risk of inadvertent substitution (see photo).

Pre-filled Luer syringes of TXA would significantly reduce the risk of accidental neuraxial administration. Unfortunately, these are not currently available. SALG will be asking manufacturers of pre-filled syringes to prioritise this product for development.

1. World Health Organization. Risk of medication errors with tranexamic acid injection resulting in inadvertent intrathecal injection.March, 2022 [Accessed 26th February 2025].
2. Pysyk, C.L. and Filteau, L. Accidental administration of tranexamic acid into the epidural space: a case report. CJA 2022 Jun, 69(9): 1169–1173.
3. NHS England. National Patient Safety Alert – Transition to NRFit™ connectors for intrathecal and epidural procedures, and delivery of regional blocks. January, 2024 [Accessed 26th February 2025]

Three colour-coded trays for different drug classes

TXA and preservative free morphine ampoules side by side

Accidental administration of rocuronium instead of tranexamic acid

This incident was originally reported to NHSE. Further details have subsequently been provided by the trust.

Following delivery, five units of oxytocin were administered intravenously (IV), during an emergency Caesarean section. The uterus remained poorly contracted and there was excessive bleeding. In response the obstetrician requested a further 5 units of IV oxytocin and tranexamic acid in line with guidance for managing post-partum haemorrhage.

The anaesthetist slowly injected the solution from a 5ml ampoule [thought to be TXA] IV. Approximately 2 minutes later the patient became restless, her breathing became shallow, and she became unresponsive. The patient required intubation and ventilation.

Following the completion of the surgery and after a head CT scan the patient was transferred to ICU. She was extubated later that day and transferred back to the maternity ward. Review of the case suggested that an ampoule of rocuronium had probably been replaced in the

box of tranexamic acid in the drug cupboard following a previous theatre case.

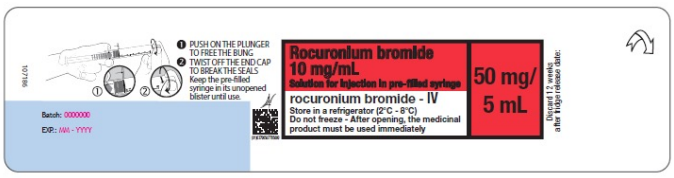
The Operating Department staff informed members of the investigation team that prior to this, it was common practice that when tidying up after procedures, unused ampoules of medication were put away back in their boxes or on their own in the drug cupboard or fridge. The rationale behind this was to reduce medicines wastage and costs.

Commentary

This case highlights the dangers involved in 'tidying ampoules away' by replacing them into their boxes. the Association of Anaesthetist's guidelines on handling injectable medications in anaesthesia states clearly 'do not replace single 'stray' ampoules into boxes if discovered; they should be thrown away'.[1]

SALG recognises that both rocuronium and tranexamic acid (TXA) are commonly used during emergencies and that time-critical situations can make errors such as this one more likely. This is one of the reasons why SALG is working to ensure priority is given to the production, licensing and procurement of such 'emergency' drugs, in clearly labelled pre-filled syringes.

Rocuronium has in fact recently become available in pre-filled syringe format, in a colourway that conforms to the ISO 26825: 2008 user applied labels colourway for muscle relaxants (see below). SALG encourages hospitals, in line with the Royal Pharmaceutical Society's guidance on the safe and secure handling of medicines[2] and the Association's guidelines already mentioned above, to ensure where possible, that rocuronium is available in a ready-to-administer preparation in a storage arrangement that allows for immediate access in the event of a clinical emergency. The pre-filled syringe has a 3-year shelf life when refrigerated, and 12 weeks stability once removed from the fridge.



1. Kinsella, SM. et al. Handling Injectable Medications in Anaesthesia. Association of Anaesthetists. June, 2023
2. Royal Pharmaceutical Society. Professional guidance on thesafe and secure handling of medicines. January, 2024

Review of clinical incidents

Following are reviews of incidents reported to the NHS in England and Wales in the period from 1 April-31 October 2024.

Perioperative anaphylaxis

This content has been generated for SALG by the Perioperative Allergy Network.

Case 1

A patient underwent general anaesthesia for urgent laparoscopic cholecystectomy. Following a modified rapid sequence induction with propofol, remifentanil and rocuronium, it was noted the patient's heart rate had increased from ~100 to ~150bpm, with a fall in blood pressure from 127/63 to 65/33. Mild erythema over the upper chest and face was noted. A clinical emergency was declared resulting in assistance from several consultant anaesthetists. IV adrenaline (1x 100mcg IV) was given with resolution of the hypotension and tachycardia. Ephedrine was subsequently given for a further episode of hypotension. Following discussion with the surgical team, the case was cancelled. The patient was successfully extubated after a period of monitoring under general anaesthesia. Recovery was uneventful with resolution of the erythema and tachycardia and the patient was subsequently discharged to the ward. Samples were taken for mast cell tryptases and the patient referred to immunology for further investigation.

The differential diagnoses included anaphylaxis (potential causative agents rocuronium or cefazolin) or relative overdose of induction agents in an obese and anxious patient, with possible underlying hypovolaemia.

Case 2

A patient attended for their second total knee replacement 3 months after the first was undertaken uneventfully. Teicoplanin and midazolam were administered prior to spinal anaesthesia. The patient reported nausea, became bradycardic and hypotensive and developed hypoxia and erythema. A diagnosis of anaphylaxis secondary to teicoplanin was made. The patient was intubated, ventilated and given an adrenaline infusion. Mast cell tryptases were sent and the procedure cancelled.

Case 3

A patient underwent uneventful induction of anaesthesia using propofol, fentanyl and rocuronium. After a central venous catheter was inserted, the patient was transferred to theatre and anaesthesia maintained with isoflurane. Following skin preparation and administration of cefuroxime and teicoplanin the blood pressure was noted to be low. The patient was placed head down and intravenous fluids were increased to no effect. Immediate review of ventilation revealed a poor end tidal CO_2 trace. Anaphylaxis was declared.

Case 4

Intravenous co-amoxiclav and metronidazole were administered to a cardiovascularly stable, anaesthetised patient prior to surgery. Rising airway pressures, falling end tidal CO2 , decreased tidal volumes and a significant drop in invasively monitored blood pressure led to an anaesthetic emergency being declared. The position of the endotracheal tube and patency of breathing circuit were confirmed and a bolus of metaraminol was given with no response. Cardiopulmonary resuscitation (CPR) was commenced. The presenting rhythm was pulseless electrical activity (PEA). Adrenaline 1mg was given. The metronidazole infusion was stopped. Blood gas analysis revealed good oxygenation, normal potassium with no obvious cause for the cardiac arrest. A brief period of return of spontaneous circulation (ROSC) occurred after 15 minutes but this was short lived despite further boluses of IV adrenaline. The rhythm alternated between PEA and ventricular fibrillation (VF). Bilateral surgical thoracostomies were performed for suspected tension pneumothorax. A central venous catheter was inserted and adrenaline and noradrenaline infusions administered. An echocardiogram revealed a moderate pericardial effusion considered not to be amenable to drainage with no right ventricle collapse. After 90 minutes of CPR and a total of 23mg adrenaline, resuscitation efforts were abandoned.

Commentary

Perioperative anaphylaxis can be challenging to identify due to the wide range of differential diagnoses, including exaggerated physiological responses to induction agents, airway manipulation and surgical interventions. Anaphylaxis should be considered whenever unexpected and significant cardiovascular or respiratory compromise occurs and treated promptly.[1] The Perioperative Allergy Network (PAN) in collaboration with the Resuscitation Council UK (RCUK) have published an algorithm for the emergency management of peri-operative anaphylaxis[1] which aligns with the Quick reference handbook.[2] Emergency guidance should be used to improve outcomes in the management of infrequent challenging scenarios.[3]

First-line treatment of peri-operative anaphylaxis is intravenous adrenaline (epinephrine). An initial dose of 50 micrograms (0.5 ml of 1 mg/ 10 ml [1:10,000]) is recommended in adults and children aged 12 years and over.[1] Adrenaline must be supported by intravenous crystalloid fluid. Multiple large volume fluid boluses may be required (up to 3-5L in adults).[1]

If signs of anaphylaxis persist despite boluses of adrenaline, an adrenaline infusion should be initiated. A low-dose adrenaline infusion, given via a peripheral venous line, is an effective alternative if central venous access is not immediately available. If there is a poor clinical response to an adrenaline infusion and appropriate fluid resuscitation, a second-line vasopressor should be given, *in addition* to adrenaline.[1]

Intravenous adrenaline should be administered as per advanced life support protocols if cardiac arrest occurs. Prolonged cardiopulmonary resuscitation (including extrapulmonary life support, if available) should be considered, as anaphylaxis is a potentially reversible cause of cardiac arrest.[4]

Fatal cases of anaphylaxis should be referred as soon as possible to the UK Fatal Anaphylaxis Registry. Local laboratories should be advised to retain all peri-mortem samples to facilitate post-mortem investigation.

Peri-operative anaphylaxis occurs most commonly following induction. During this period multiple drugs are given over a short period of time making it difficult to identify the causative agent. All patients with suspected peri-operative hypersensitivity reactions should be referred to a specialist allergy service for formal allergy testing, *irrespective of tryptase results*, to identify the causative agent(s) and facilitate safe future anaesthesia.[5]

Teicoplanin is the most common cause of perioperative anaphylaxis. It is 17 times more likely to cause anaphylaxis than alternative antimicrobials (Case 2: patient may have had a sensitising event to teicoplanin during their first knee replacement, leading to anaphylaxis with their second exposure). Teicoplanin should be given by infusion or a slow bolus over 3-5 minutes. There is cross reactivity with vancomycin. Both can cause 'red man'-type reactions that may mimic anaphylaxis, if given rapidly.[6]

Chlorhexidine accounts for 9% of perioperative anaphylactic reactions and must be considered as a potential causative agent.[3] Chlorhexidine is a so-called hidden allergen with patients often experiencing multiple exposures (e.g. Case 3: skin preparation for peripheral and central cannulation & surgical skin preparation).

We would like to encourage anaesthetists to report incidents of suspected or confirmed perioperative allergy and to ensure that the results of investigations are added to the report when available, to enable better understanding of these incidents.

References:

1. Dodd A, Turner PJ, Soar J, Savic L; representing the UK Perioperative Allergy Network. Emergency treatment of peri-operative anaphylaxis: Resuscitation Council UK algorithm for anaesthetists. *Anaes*. 2024 May;79(5):535-541.
2. Association of Anaesthetists. Section 3.1 Anaphylaxis (v5). Quick Reference Handbook. April, 2022 [Accessed 10 April, 2025].
3. Simmons WR, Huang J. Operating Room Emergency Manuals Improve Patient Safety: A Systemic Review. *Cureus* 2019 Jun;11(6):e4888.
4. Garvey LH *et al.* Management of suspected immediate perioperative allergy reactions: an international overview and consensus recommendations. *BJA* 2019 Jul; 123(1): E50–E64.
5. Harper NJN *et al.* Anaesthesia, surgery, and life-threatening allergic reactions: epidemiology and clinical features of perioperative anaphylaxis in the 6th National Audit Project (NAP6). *BJA* 2018 ;121(1):159-171.
6. Electronic Medicines Compendium. *Datapharm*.

Patient with a known difficult airway

This content has been generated for SALG by the Difficult Airway Society.

A young adult was admitted for elective foramen magnum decompression. The patient had a rare congenital syndrome associated with a high likelihood of a difficult airway. Awake fibreoptic intubation with maxillofacial team support was planned. Attempts at intubation however were unsuccessful and the decision was taken to stop and send the patient to the high dependency unit (HDU). The following day the patient was returned to theatres where an ear nose and throat (ENT) surgeon from a tertiary centre attempted fibreoptic intubation which was also unsuccessful. The ENT team then proceeded with surgical tracheostomy under local anaesthetic. After the procedure, sedation was allowed to wear off whilst still in theatre. This was followed by intermittent obstruction of the tracheostomy with high airway pressures and acute desaturation on movement of the patient's head. The patient was re-sedated and admitted to the intensive care unit (ICU). Deep sedation was required to minimise movement which was associated with intermittent obstruction and distress to the patient. Surgery planned for two days later was cancelled due to unavailability of necessary equipment. It was then decided to allow more time for the tracheostomy tract to become established, before surgery was attempted. Over the next 6 weeks the patient remained in ICU and suffered repeated episodes of airway obstruction requiring re-sedation. During the 7th week on ICU, despite re-positioning under direct bronchoscopy, a satisfactory airway could not be established. Granulation tissue was found to be encroaching on the airway, preventing effective ventilation. Finally, a size 5.5 reinforced endotracheal tube was inserted, and the patient was transferred to a tertiary centre for definitive airway management. Revision of the tracheostomy, microlaryngobronchoscopy and excision of granulation tissue was undertaken. Further episodes of intermittent obstruction were managed by a multidisciplinary team including critical care, maxillofacial ENT surgeons.

Commentary

The HSSIB report: 'Advanced airway management in patients with a known complex disease',[1] highlighted that there are no national guidelines for managing patients with an anticipated difficult airway. The Royal College of Anaesthetists are working with the Difficult Airway Society and other stakeholders to produce a framework for caring for patients who have a known or suspected difficult airway who may require advanced airway management.

The Difficult Airway Society Awake Tracheal Intubation (ATI) guide[2] gives useful information on how to plan for an ATI, including using a checklist, ensuring availability of ENT colleagues and planning ahead for what to do should a problem occur.

1. Health Services Safety Investigations Body. Report: Advanced airway management in patients with a known complex disease. January, 2024.
2. Ahmad, I; El-Boghdadly, K *et al.* Difficult airway society guidelines for awake tracheal intubation (ATI) in adults. *Anaesthesia*, 2020; 75: 442-6.

Transfer of critically ill children

This content has been generated for SALG by the Association of Paediatric Anaesthetists of Great Britain and Ireland.

A previously well [paediatric] patient was referred to the retrieval team by the emergency department of a hospital without specialist paediatric services in the early hours of the morning. The child had a one-day history of vomiting and abdominal distension. Abdominal x-ray showed dilated loops of bowel. The patient was hypotensive and

had a lactic acidosis (pH6.89) despite 40ml/kg fluids via intraosseous (IO) access. Following arrival of the retrieval team, the patient was intubated and was given 80ml/kg fluid and 1 unit PRBCs. An adrenaline infusion was started via a femoral line. Following multiple phone calls it was agreed that the patient would go straight to theatre on arrival at the receiving centre.

Despite phone warning of imminent arrival, it took one hour from arrival in emergency department of the receiving hospital until theatres were ready.

Surgical exploration revealed congenital malrotation, volvulus and ischaemia affecting 90% of the bowel. The bowel was drained through the appendix and the abdomen left open to facilitate reperfusion.

The reporter was of the opinion that the extent of ischaemia would have been less had there not been the delay in getting this patient to theatre.

Commentary

This case was clearly challenging clinically and logistically. Adult critical care staff may be required to resuscitate, stabilise and transfer critically ill children.[1] There should be local hospital protocols in place that clarify the roles and responsibilities of MDT members in caring for critically ill children.[2]

For transfer there should be portable age-appropriate monitors, transfer equipment (including a portable ventilator) and drugs readily available.[2]

It is important that clear lines of communication are maintained between referral and receiving teams to ensure timely management of time-critical pathologies.

References

1. The Faculty of Intensive Care Medicine / Intensive Care Society. Guidelines for the Provision of Intensive Care Services (2022). 4.11 Care of the Critically Ill Child in an Adult Intensive Care Unit.
2. Royal College of Anaesthetists. Guidelines for the Provision of Anaesthesia Services. Chapter 10 – Guidelines for the Provision of Paediatric Anaesthesia Services (2025).

LVAD drainage cannula dislodgement

This content has been generated for SALG by the Association for Cardiothoracic Anaesthesia and Critical Care.

Dislodgement of the drainage cannula of a left ventricular assist device (LVAD) resulted in a major haemorrhage. The flow through the LVAD suddenly dropped then spontaneously resolved. At this point the patient was awake and moving, although not excessively. Upon investigation there was bleeding from the drainage cannula. Flow became increasingly erratic. There was no response to fluid loading. Bleeding increased and the patient became haemodynamically compromised. There was an immediate but non-sustained improvement when the LVAD drainage cannula was advanced slightly. The major haemorrhage protocol was activated and the patient was transferred to theatre with staff holding the cannula during transfer. The chest was reopened and the cannula re-sited.

Commentary

This case demonstrates the risk of haemorrhage whilst LVADs are in situ. Bleeding is the most common complication of LVAD use occurring in 30-60% of patients.[1] Bleeding can occur early or late including from cannulae, as in this case. Other potential sites include the gastrointestinal tract and intracranialbleeding.[2] Patients with LVADs require anticoagulation to reduce the risk of thrombosis within the LVAD system increasing the risk of bleeding. Although recent advances have allowed a reduction in the level of anticoagulation required, there is still an elevated bleeding risk.[3]

In this case the bleeding was identified as the cause of the reduction of flow and attempts were made to reposition the cannula on ICU. Once it was evident this was not improving the situation, the team expedited return to theatre for cannula repositioning and securing of the LVAD cannula. Early identification of bleeding in these patients is essential and early re-exploration to avoid massive transfusion as this can precipitate right heart dysfunction or failure.[2]

References

1. Leebeek FWG, Muslem R. Bleeding in critical care associated with left ventricular assist devices: pathophysiology, symptoms, and management. *Hematology Am Soc Hematol Educ Program*. 2019 Dec 6;2019(1):88-96.
2. Kilic, A., Acker, M., Atluri, P. Dealing with surgical left ventricular assist device complications. *J. Thorac. Dis.*, 2015 Dec; 7(12):2158-2164.
3. Giménez-Milà M, Sandoval E, Farrero M. Let's Reduce Bleeding Complications in Patients With Left Ventricular Assist Device. JCVA, 2022, Sep; 36(9): 3435-3438.

Pre-op assessment

Case 1

A patient who had become hypotensive with ECG changes during attempted spinal insertion was transferred to a nearby hospital for monitoring. Cardiologists at this hospital considered the patient required primary percutaneous coronary intervention (PPCI) which was not available so the

patient was transferred for a second time. On arrival at the Cath Lab the patient was in cardiogenic shock. Following resuscitation, the consultant cardiologist diagnosed severe biventricular impairment, (there was no previous echo for comparison). This cardiologist did not feel there was a clear indication for PPCI. The patient was taken to ICU for vasopressor and inotropic support but continued to deteriorate and passed away later in the night.

Case 2

An in- patient in one hospital was referred to another for endoscopic retrograde cholangiopancreatography (ERCP) under general anaesthetic. The patient had significant cardiorespiratory comorbidities and was deemed high risk for anaesthesia. Following extubation, the patient became hypotensive and hypoxic. There was only a temporary response to adrenaline, blood gas analysis showed a pH 7.1. The patient passed away in the endoscopy suite.

Case 3

During hemiarthroplasty a patient developed signs myocardial ischaemia. Unknown to either the surgeon or anaesthetist, a pre-operative test had shown raised D-Dimers A CT pulmonary angiogram (CTPA) showed massive bilateral pulmonary emboli.

Case 4

Retrospective review of a perioperative death, during a urological procedure, under spinal anaesthesia, uncovered a 6-9 month history of worsening chest pain in an elderly patient with a history of cardiovascular disease. This was not highlighted during the surgical and anaesthetic pre-assessment of the patient.

Commentary

GPAS for Perioperative Care of Elective and Urgent Care patients[1] states that "each hospital should have a consistent system in place to identify high risk patients who require additional assessment". This is pertinent for the patient in case 3 who had elevated D-dimers and the patient in case 4 whose angina was not detected before urological surgery, and may have been relevant to the patient in case 1 who was found to be in biventricular failure but had not had preoperative echocardiography,

High-risk patients can deteriorate at any time during the perioperative journey, as illustrated by Case 2 where the patient experienced acute deterioration following extubation.[2] When ICU is deemed unsuitable, managing these cases in the non-theatre environment can be particularly challenging. Patients in the non-theatre environment should receive the same standard of care as that would be provided in an operating theatre.[3]

1. Guidelines for the Provision of Anaesthesia Services for the Perioperative Care of Elective and Urgent Care Patients 2024, Royal College of Anaesthetists.
2. At the heart of the matter: Report and findings of the 7th National Audit Project of the Royal College of Anaesthetists examining perioperative cardiac arrest (NAP 7). Royal College of Anaesthetists, November, 2023.
3. Guidelines for the Provision of Anaesthesia Services in the Non-theatre Environment 2025, Royal College of Anaesthetists.

Epidural timeliness

A patient requested an epidural during labour of a stillbirth. While siting the epidural, the anaesthetist was called away to an emergency c-section. An hour later, the anaesthetist was called to a second obstetric emergency c-section. The Senior midwife bleeped two other anaesthetists who were unable to attend. A fourth anaesthetist was due to attend following a request to the anaesthetic office, however, baby was delivered before they arrived. The patient and her partner were very distressed during and after delivery.

Commentary

Delay in receiving epidural analgesia during labour is a common cause of complaint, particularly if there's a failure to provide the woman with an epidural before birth. National guidelines state that the anaesthetist should attend within 30 minutes, or exceptionally 1 hour, of a request for an epidural, where the preconditions for regional analgesia have been met. There should be a robust escalation plan to ensure this timeframe is achieved.[1] In this case, if the anaesthetic office had been contacted earlier, the problem may have been avoided.

1. Guidelines for the Provision of Anaesthesia Services for an Obstetric Population 2025, Royal College of Anaesthetists

Scheduling and mental health

Delay to a patient's surgery, due to lack of theatre availability, caused significant deterioration in their mental health. The patient was known to have mental health issues, and a plan had been made for pre-medication but due to the delay this did not happen. The patient was anxious prior to surgery and woke significantly agitated and upset. The ward team were unaware of the potential problem. The patient was discharged home but later took an overdose at home with suicidal intent. The patient blamed this on how they felt when they woke up from the anaesthetic.

Commentary

Pre-medication is used less frequently now that day-case surgery and enhanced recovery protocols are the norm. Where anxiolytic pre-medication is required, it is essential that there is clear communication between theatres and the wards to ensure that it is given in a timely fashion. This case illustrates a potential consequence if this does not happen.

Haemorrhage during elective gynaecological surgery

A patient suffered a 3000ml haemorrhage during elective gynaecology surgery undertaken during a weekend waiting list initiative. The list was overbooked. None of the patients attended pre-assessment. The patient's haemorrhage was predictable: Surgery involved open laparotomy and resection of a large vascular fibroid in a young patient with high BMI (over 35) and poor venous access.

Commentary

Major haemorrhage was the commonest cause of perioperative cardiac arrest in NAP7, accounting for 20% of reported cases.[1]

Patients at increased risk of intraoperative bleeding require careful pre-operative planning involving a multi-disciplinary team including input from other surgical specialties (such as vascular surgeons who in this case may have been able to perform intra-operative balloon tamponade of the uterine arteries) or interventional radiology. Had this patient been seen pre-operatively, the patient might have been offered medical treatment to reduce the size of the fibroid prior to surgery such as gonadotrophin-releasing hormone agonists.

Poor peripheral venous access may necessitate the use of central access. Invasive blood pressure measurement may also be required. Such high-risk elective cases should be carried out during working hours at a location where all necessary specialties are available for consultation when required.

1. Soar, J; Kane, A *et al*. Chapter 4: NAP7 headlines and summary of key findings. At the Heart of the Matter: Report and findings of the 7th National Audit Project of the Royal College of Anaesthetists examining perioperative cardiac arrest. Royal College of Anaesthetists, Nov. 2023.

Inter-hospital transfer

A patient in their 40s with a stroke underwent thrombolysis in the emergency department and was referred to the local stroke unit. The transport requested by the ED consultant was unavailable and a plan was made to undertake transfer with an clinician from the hospital and the local ambulance service. The patient's Glasgow coma scale (GCS) score was 8, and there was concern about the patient's airway and potential deterioration en route. It was unclear who should escort the patient. Once it was decided this should be an anaesthetist further time was spent deciding whether or not the patient needed to be intubated prior to transfer and finding the equipment and arranging for this to happen. Due to ongoing delays trying to organise transport, it was decided to undertake thrombectomy locally. However by the time the patient had been intubated the window of opportunity for thrombectomy had passed and was therefore not undertaken.

Commentary

There should be clear lines of communication between on-call anaesthetic and intensive care teams so it is clear who is responsible for transferring critically ill patients to other units. Departments should have clear local guidelines, including agreed time frames[1] Each hospital should have a lead consultant for critical care transfers with responsibility for staff training, competencies and equipment provision.[2] This is essential to avoid delays in time-critical care transfer such as occurred in this case.

1. Guidelines for the Provision of Emergency Anaesthesia Services, 2024. Royal College of Anaesthetists.
2. The Transfer of the Critically Ill Adult. Faculty of Intensive Care Medicine, The Intensive Care Society. London. May 2019.

Transfer from theatre to recovery

On arrival in the recovery unit in the late evening a patient was found to be unresponsive with shallow breathing and unrecordable SpO2. They rapidly went into cardiac arrest, requiring advanced life support. After return of spontaneous circulation, the patient was transferred intubated and ventilated, with vasopressor support to critical care. The anaesthetic team was present during the incident.

Commentary

The NAP 7 audit described 30 cardiac arrests in recovery, 10 of which would have been prevented with better patient monitoring in theatre and during transfer from theatre to the recovery area.[1] Patients should not be transferred from theatre to recovery after extubation until there is a patient airway, adequate respiratory effort and cardiovascular stability. All patients should be monitored during transfer.[2]

1. Cordingly, J; Nolan, J; Soar, J and Cook, T. Chapter 39: Postoperative cardiac arrests in recovery, critical care and ward areas. At the Heart of the Matter: Report and findings of the 7th National Audit Project of the Royal College of Anaesthetists examining perioperative cardiac arrest. Royal College of Anaesthetists, Nov. 2023.

2. Klein, AA *et al*. Recommendations for standards of monitoring during anaesthesia and recovery, 2021. Guideline from the Association of Anaesthetists. Anaes. 2021 May. 76(9): 1212-1223.

IV access for spinal anaesthesia for C-section

A patient received spinal anaesthesia for caesarean section. During spinal insertion, the iv cannula through which a vasopressor infusion was being delivered,tissued and the patient became hypotensive. Once IV access was re-established, the vasopressor infusion was reconnected and a bolus of glycopyrrolate administered. The patient then became markedly hypertensive. They suffered a seizure requiring intubation and ventilation and were admitted to ICU. Troponin levels were raised and regional wall abnormalities detected on ECHO. Coronary artery dissection was suspected, due to the episode of hypertension.

Commentary

Prevention of hypotension during spinal anaesthesia for caesarean section involves prophylactic use of phenylephrine via infusion pump and intravenous fluids.[1] Both require a patent IV line. Anti-reflux valves are necessary to prevent phenylephrine back tracking into the IV infusion giving set if flow is obstructed to avoid inadvertent boluses of phenylephrine when flow is re-established. The majority of pregnant women have prominent peripheral veins, making the management of those with poor venous access more challenging as it is often unexpected. Ultrasound should be considered when available where difficulty is anticipated or encountered. The Safe vascular access guideline[2] from the Association of Anaesthetists is under review and an updated version is due to be published later this year. Anaesthetic-related morbidity and mortality associated with hypertension in pregnancy is now a rarity but there is no room for complacency.

1. Kinsella SM *et al*. International consensus statement on the management of hypotension with vasopressors during caesarean section under spinal anaesthesia. *Anaes* 2018 Jan; 73(1): 71–92
2. Bodenham A *et al*. Association of Anaesthetists of Great Britain and Ireland: Safe vascular access 2016. *Anaesthesia* 2016; 71: 573–85.

Postoperative respiratory complications

Case 1

A Patient with COPD, SpO2 on air of 93%, underwent transsphenoidal surgery for acromegaly after full preoperative work-up in the high-risk clinic. The surgery was uncomplicated. Post operatively the patient was very drowsy and slow to wake, with a GCS of 9. Arterial blood gas showed pCO2 9.8 at the time and 10.7 two hours later. The perioperative fluid balance was >2 litres positive. The pCO2 remained elevated overnight and the patient remained very drowsy with reduced GCS, but was not reintubated The following day it was noted that a high dose of fentanyl had been given intraoperatively. , After naloxone was administered the patient's conscious level and ventilation improved, and they were discharged to the ward the following day and home 5 days after that.

Commentary

Even with optimal preoperative assessment and optimisation, patients with COPD are at increased risk of developing post-operative respiratory complications, including respiratory failure. When mechanical ventilation is required, settings should be adjusted to minimise air trapping with attention paid to fluid management as overload can exacerbate respiratory performance. Prior to extubation, there should be full reversal of neuromuscular block and hypoventilation due to residual volatile anaesthesia/ opioids should be avoided. Post operative oxygen therapy should be based on arterial blood gas analyses in patients whose ventilatory drive may depend on relative hypoxia.[1]

1. O'Driscoll BR, Howard LS, Earis J, Mak, V on behalf of the British Thoracic Society Emergency Oxygen Guideline Group. BTS guideline for oxygen use in adults in healthcare and emergency settings. Thorax 2017 May. 72 ii1-ii90

Case 2

A patient underwent a partial knee replacement, having undergone similar procedures uneventfully at the same hospital previously. Pre-assessment revealed no significant comorbidities – in particular there was no history of chronic respiratory compromise. Following extubation, the patient required high flow oxygen to maintain oxygen saturations. Auscultation suggested secretions. The patient managed to complete some deep breathing exercises and cough up a significant quantity of infected looking sputum. On questioning the patient gave a history of a dry cough for the past 3 weeks. Nebuliser therapy and IV antibiotics were continued on the ward and the following day the patient was transferred to the local NHS trust for further monitoring and intervention. The patient's condition deteriorated requiring intubation and ventilation. Despite initial improvement the patient did not survive.

Commentary

Sometimes patients do not reveal significant medical history pre-operatively. In the case of elective surgery, the patient may withhold information because they do not want the surgery to be delayed or cancelled. Even patients with no history of chronic respiratory disease can develop post operative complications such as those outlined here. Direct questioning about acute respiratory tract conditions is recommended.

Haemothorax during adult liver transplantation surgery

A patient developed a haemothorax due to left innominate vein injury. This occurred during insertion of a veno-venous (VV) bypass line in the right internal jugular vein during adult liver transplantation surgery. The injury was identified whilst attempting to place the patient on VV bypass. There was a drop in blood pressure, the bypass machine would not run and the patient went into cardiac arrest. CPR and advanced life support (adrenaline and fluid boluses using a rapid infuser) were given and the major haemorrhage protocol activated. Output was restored after thoracotomy and clamping of the left hilum. The line was retracted and the vessel repaired. After bilateral intercostal drains were inserted, the chest was closed and liver transplantation surgery proceeded.

Commentary

Complications of insertion of catheters for veno-venous (VV) bypass although rare may be associated with severe morbidity and even mortality. This is partly due to the size of catheter (typically 18 Fr, 6mm), twice the size of a multi-lumen central line (9 Fr, 3mm). In the context of liver transplantation surgery, coagulopathy may be a contributory factor.1 As with any central venous cannulation, ultrasound visualisation should be used for insertion. The smallest bore catheter possible should be used, and minimal force exerted for insertion. There should be a low threshold for abandoning an insertion attempt should difficulties be encountered. The position must be confirmed before use.

1. Jackson P, Jankovic Z. Veno-venous bypass catheters for hepatic transplant risk unique complications. *Anaesl Intensive Care*. 2007 Oct; 35(5):805-6

Complication of supra-scapular block

An attempt to insert a supra-scapular block by an anaesthetist was unsuccessful, and surgery was conducted under GA instead. Postoperatively the patient developed shortness of breath, required supplemental oxygen then collapsed. Chest x-ray revealed a pneumothorax. A chest drain was inserted by the ENT consultant.

Commentary

Although supra-scapular blocks are associated with fewer complications than interscalene brachial plexus blocks, pneumothorax is a recognised complication of both. Whenever there is new onset respiratory or cardiovascular compromise following such blocks, pneumothorax must be excluded/ rapidly treated.

Equipment availability outside of theatres

Case 1

A patient was admitted to the emergency department with complete airway obstruction due to possible regurgitation and aspiration of solid material. On arrival of the anaesthetic team, the SpO_2 <30 with a good trace, with pO_2 4.45. Prior to intubation There was no discussion about airway management, no equipment check, videolaryngoscopy was unavailable, end tidal capnography not ready and no drugs were drawn up. The first two unsuccessful attempts to intubate were undertaken without sedation or paralysis. The patient appeared to be gagging and became hypertensive. A third, successful attempt was undertaken by the anaesthetic team using rapid sequence induction with rocuronium and propofol. At this point patient had had SpO_2 <60% for a prolonged period. Following intubation, it was >5 minutes before end-tidal CO_2 was obtained. As this was not working properly, a new monitor had to be sourced.

Case 2

There was a delay undertaking emergency intubation in the neonatal high dependency unit. The first laryngoscope blade handed to the anaesthetist was the wrong size. When a larger blade was requested, the new blade was the same size as the previous one, and the light did not work. There was a further delay extracting the blades from the plastic packaging that needed to be cut open with scissors that were not immediately available.

Case 3

A patient required a time critical transfer to a tertiary neuro centre from ED. When connecting up the patient, the CO_2 module on the transfer module was found to be missing from the transfer trolley. On inspection the module was broken and needed repair. This caused delay to this time critical transfer.

Commentary

Remote site anaesthesia and transfer of patients are high risk points in a patient's journey. The Royal College of Anaesthetists make recommendations around the upkeep and checking of equipment in any area anaesthetists may be asked to provide care.[1] It is important that those involved in the provision of care are trained and have sufficient, frequent and recent experience. Guidelines for the management of airway emergencies should be immediately available in all areas where airway management is carried out.[2]

1. Royal College of Anaesthetists. Chapter 7: Guidelines for the provision of anaesthesia services in the non-theatre environment, 2025. Section 2.2.
2. Higgs, A et al. Guidelines for the management of tracheal intubation in critically ill adults. BJA. 2018. 120(2): 323-352.

Post-operative prescribing

A patient developed signs of sepsis in the post anaesthesia care unit following emergency surgery. Hypotension was resistant to fluid challenges. Post operative instructions were to continue antibiotics; however, the electronic prescribing and medicine administration record contained no details of previous doses given. There was a delay trying to obtain this information from the surgical and anaesthetic teams and it is unclear where this information was recorded. The patient was transferred to critical care.

Commentary

Some electronic prescribing and medicines administration recording systems automatically pull data from the [electronic] anaesthetic chart and will calculate times of subsequent doses. When this is not the case non-anaesthetic staff can find it difficult to access the anaesthetic chart for this information. There should be a local protocol determining who is responsible for postoperative prescribing and how and where this is done. Standardisation of the handover process between different teams and departments has been shown to reduce errors.[1]

1. Blazin LJ, Sitthi-Amorn J, Hoffman JM, Burlison JD. Improving Patient Handoffs and Transitions through Adaptation and Implementation of I-PASS Across Multiple Handoff Settings. Pediatr Qual Saf. 2020 Aug;5(4):e323.

Central line issues

Case 1

A central line was sited by an FY2 doctor supervised by a more senior resident doctor. The hospital protocol was followed, and the guidewire position was confirmed with ultrasound. A post procedure chest x-ray was reviewed by the more senior resident doctor, who confirmed positioning. A further review of the chest x-ray the following day reported 'slightly medial' but acceptable positioning. The Patient was transferred to a different hospital where the line was transduced, revealing an arterial trace.

Case 2

Following emergency laparotomy for small bowel obstruction a patient was admitted to the critical care unit for management of postoperative pneumonia and ileus. Central venous access for total parenteral nutrition was required. Standard procedures were followed for line insertion including use of ultrasound to check guidewire position before dilatation. On flushing the line arterial blood was seen which was confirmed by transducing. Advice was sought from the IR and vascular teams and a CT angiogram confirmed the line had passed through the vein wall and the tip was sitting in the carotid artery. The patient remained well and was transferred to another hospital for removal under the vascular team. Immediately after the procedure the patient developed weakness and a facial droop. CT scan revealed a middle cerebral artery stroke.

Case 3

A patient was anaesthetised for liver resection for which an arterial line was inserted into the left radial artery. The operation was technically difficult and excessive blood loss necessitated cardiovascular support peri and postoperatively with IV vasoactive drugs. The arterial line was found not to be working when the patient was in recovery. It was left in situ despite instructions to remove it. A few hours later it was noted that the patient's fingers looked ischaemic. The line was removed and a vascular opinion sought. Dry gangrene developed in the tips of two of the patient's fingers. The patient subsequently attended ED due to pain and concern the ischaemia had started spreading.

Commentary

As illustrated by case 1, chest x-ray should not be used to confirm the correct position of a central line. It should only be used in these circumstances to exclude pneumothorax or confirm malposition.

Digital ischaemia as described in case 3, is a rare complication of radial arterial cannulation.[1] It is thought to be caused by distal embolization from an arterial thrombus at the site of cannulation. Although arterial cannulation to enable continuous cardiovascular monitoring may well be indicated, the line should be continuously irrigated, hypotension avoided and the line removed as soon as possible.

The Association of Anaesthetists will shortly be publishing an update to their 2016 Safe vascular access guidance.[2] It will recommend that a 'scouting' ultrasound should take place immediately before the procedure using sterile ultrasound gel. The insertion should then be done under real-time ultrasound imaging to identify the needle tip entering the vein and then to confirm, as far as possible that the wire is intravenous and not transfixing any other vessels before dilation takes place.[3] Case 2 illustrates however, that ultrasound visualisation does not always exclude inadvertent arterial placement. Transducers should be used to confirm venous placement once the line is secure.

1. Sfeir R *et al*. Ischaemia of the hand after radial artery monitoring. Cardiovasc Surg. 1996 Aug;4(4):456-8.
2. Association of Anaesthetists of Great Britain and Ireland. Safe vascular access 2016. Anaesthesia 2016; 71: 573-585.
3. Association of Anaesthetists. Safe vascular access. 2025. In Press.

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