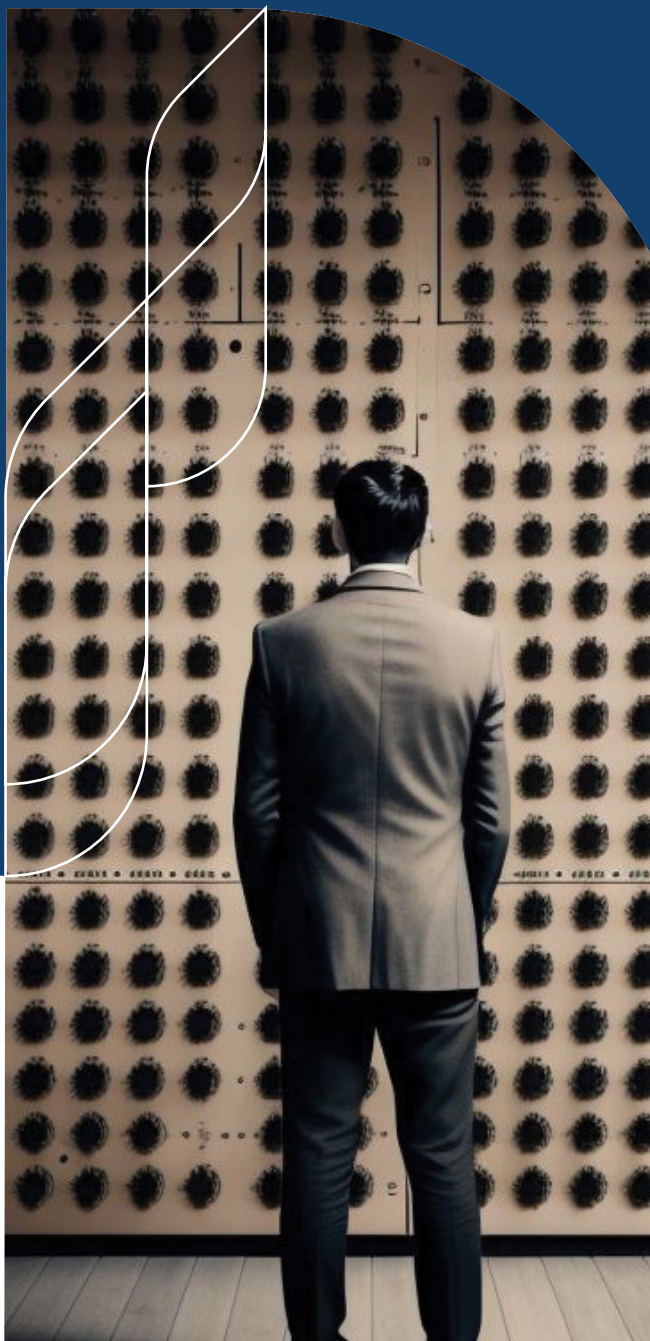
Royal Australasian College of Surgeons
Australian and New Zealand Audits of Surgical Mortality

National Case Note Review Booklet

LESSONS FROM THE AUDIT

VOLUME 30
NOVEMBER 2024

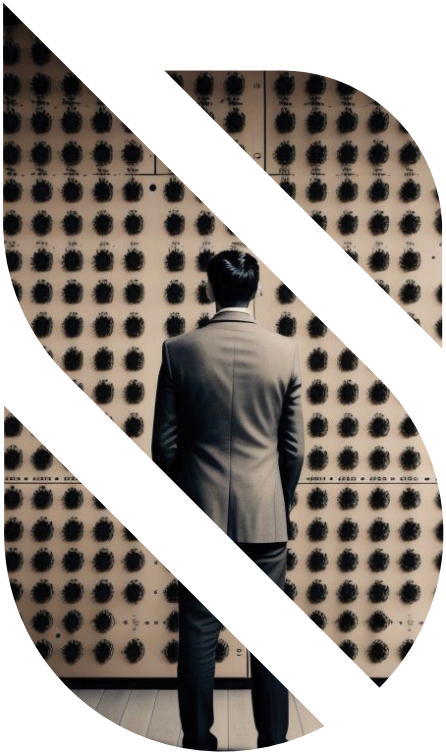
COMPLEX SURGERY/ TECHNICAL PROBLEMS



Royal Australasian College of Surgeons

Australian and New Zealand College of Anaesthetists

The Royal Australian and New Zealand College of Obstetricians and Gynaecologists
Excellence in Women's Health



Front cover image created using AI depicting a man standing in front of a large Enigma machine

Royal Australasian College of Surgeons
Australian and New Zealand Audit of Surgical Mortality
24 King William Street
Kent Town SA 5067

Email: anzasm.racs@surgeons.org
Website: www.surgeons.org/anzasm

Contents

Chair's Report

Recent editions of the case note review booklet have been led by guest editorials from Professor David Watson and Professor Villis Marshall.

On this occasion, the topic of complex surgery/technical problems is the theme of the cases highlighted within the booklet. Surgery is potentially always complex and some operations are inherently highly complex, irrespective of the patient undergoing the procedure. Add to this, complex anatomy, complex comorbidities, and the difficulties in obtaining adequate input and support for procedures that go off track, it is little wonder that complex surgery and technical problems lead to poor outcomes on occasion. As surgeons, we can only try to mitigate these problems by excellent preparation, engaged teamwork and scrupulous care of our patients at all stages through not only the hospital but also the postoperative discharge period.

The cases highlighted in volume 30 certainly emphasise these points. All of us probably are able to identify with these types of cases from our own practice over the years. There can be no doubt that complex surgery and technical problems will continue to develop as surgery gains access to more devices, interventional techniques, imaging and artificial intelligence-facilitated decision-making. In order to succeed in this environment, the need to have a reliable, engaged team of not only surgeons but also other medical colleagues, combined with nursing and physiotherapy support, will be essential to ensure the best possible outcomes for the patients who rely on our treatment. We must ensure that the resources needed for complex surgery are present in the hospital in which it is performed. Some private and rural centres cannot supply appropriate anaesthetic and medical support when difficulties arise.

I trust volume 30 will be a valuable addition to what has already been an outstanding series of case note review booklets.

Guy Maddern
Chair, ANZASM

Case Studies

Case 1: Iatrogenic brainstem and neurovascular injury with stroke following trans-sphenoidal surgery

Neurosurgery

CASE SUMMARY

A 37-year-old woman was admitted for her third endoscopic trans-sphenoidal pituitary surgery for a non-functioning macroadenoma. Her first operation occurred in the Philippines 7 years prior to her final admission. Her second surgery occurred in Australia 10 months prior to her final admission. The third operation took place semi-electively in the same hospital as the second surgery. It occurred in the context of worsening vision with pre-existing left ocular blindness and a radiologically progressive pituitary tumour with chiasmatic mass effect on serial imaging.

The surgery was mostly unremarkable. Comment was made of visualised intraoperative cerebrospinal fluid (CSF) leak and small-volume subarachnoid haemorrhage. There were no immediate postoperative concerns; however, the patient quickly developed problems relating to fluctuating conscious state, pituitary insufficiency with diabetes insipidus (DI) and hydrocephalus. An external ventricular drain (EVD) was inserted on postoperative day 2 to manage hydrocephalus. This provided some initial improvement but she continued to have problems relating to fluid balance and DI. The endocrine team was involved early in patient management and provided appropriate advice about fluid replacement, electrolyte correction and desmopressin administration. The patient remained moderately confused during this period, with some difficulty meeting oral fluid intake recommendations and associated hypernatraemia.

On postoperative day 9, the endocrine team suggested nasoenteric fluid administration to aid fluid balance management. A case note entry at 17:00 stated that a nasogastric (NG) tube was ‘placed by NS’ (possibly indicating nursing staff but perhaps Neurosurgery) and that after a check X-ray the tube was withdrawn by 4 cm prior to commencement of NG fluid administration.

On postoperative day 10, the NG tube was replaced on the ward. Documentation in the case notes regarding this is relatively poor—there is no nursing entry stating that the patient had removed the NG tube nor that it had been reinserted. The resident medical officer (RMO) documented an entry at 11:45 noting a request to review the patient regarding ‘blood-stained CSF in EVD’. The RMO further noted that ‘while inserting EVD, RN noticed some resistance then blood came out

through NGT. RN stopped advancing. Then noticed EVD had blood-stained CSF.' At this stage, the patient had a measure of 8/15 on the Glasgow Coma Scale (GCS).

The case was discussed with the neurosurgery registrar, who advised removal of the NG tube and an urgent computed tomography (CT) brain scan. The scan demonstrated that the NG tube that had been reinserted and subsequently removed, had passed through the sphenoidal surgical defect into the patient's midbrain and finally into the cerebellum. There was a degree of pneumocephalus. The EVD continued to drain blood-stained CSF. The consultant neurosurgeon and ear, nose and throat (ENT) surgeon were notified, and the patient was taken to theatre for urgent exploration of the nasal surgical site for haematoma evacuation and repair of the dural defect.

The patient was subsequently managed in the intensive care unit (ICU). Repeat imaging, including CT and magnetic resonance imaging (MRI) brain scans, demonstrated cerebral ischaemia with arterial vasospasm. Initial management for vasospasm, consisting of intravenous (IV) nimodipine, hypervolaemia and hypertensive therapy, was unsuccessful.

On postoperative day 11, the patient underwent cerebral angiogram for endovascular vasospasm management strategies, including verapamil and angioplasty. During the procedure, it was noted that the left A1 segment of the anterior cerebral artery had been punctured—with associated bradycardia and hypotension and with frank blood draining rapidly from the EVD. After resuscitation, an urgent CT brain scan demonstrated a large amount of IV contrast diffusely within the subarachnoid space. The patient was transferred back to ICU sedated on propofol and fentanyl (GCS 3T/15). A new EVD was inserted. The patient subsequently developed a fixed and dilated left pupil. The patient's family was advised of a probable catastrophic brain injury and it was decided not to provide any further interventional treatment. Both pupils became fixed and dilated. A cerebral perfusion scan to confirm brain death occurred on postoperative day 15. The patient was extubated later that day and died secondary to cardiac arrest.

DISCUSSION

The case notes indicate that the NG tube was reinserted by a member of the nursing staff after the patient had removed it in a confused state. Concerningly, there is no documentation from the staff member who performed the reinsertion, no indication that medical staff were aware that the NG tube had been removed, nor any instruction given for nursing staff to reinsert it. The assessor suspects that the nurse who reinserted the NG tube may have done so on their own initiative, potentially without discussing it beforehand with medical staff. If so, the dangers associated with doing this were likely not appreciated.

The neurosurgery and endocrine teams must have had some concerns about the risk of iatrogenic injury associated with NG tube insertion and/or reinsertion in this patient when an NG tube was initially recommended for fluid balance management, particularly given the patient's confusion and the high possibility that the tube would become inadvertently dislodged. This would have been the opportunity to alert all staff involved in the patient's care to the risks associated with NG tube insertion.

The iatrogenic vascular injury secondary to angioplasty to manage cerebral vasospasm is most likely the main cause of the brain injury and the patient's subsequent death. But it was the brain injury secondary to NG tube insertion that necessitated the angiogram. Considering how difficult it was to manage the vasospasm with conventional methods, the assessor has no concerns regarding the decision to perform the cerebral angiogram and angioplasty.

CLINICAL LESSONS

Reinsertion of an NG tube following trans-sphenoidal surgery is a significant adverse event that almost certainly caused the death of this patient, who would otherwise have been expected to survive her elective surgery. Inserting an NG tube in this setting carries a moderate amount of risk and should only be performed by medical staff trained to do so.

ANZASM COMMENT

In healthcare, seemingly innocuous procedures (in this case an NG tube placement) can be exceedingly dangerous in certain circumstances (in this case after pituitary surgery where the base of the skull is removed during the procedure). The importance of training is emphasised. It should also be noted that this was yet another example of poor documentation, despite the critical importance of accurate medical notes for the protection of both patients and health practitioners.

Case 2: Elderly comorbid neck-of-femur fracture patient with perioperative arrest. Would orthogeriatric care have made a difference?

Orthopaedic Surgery

CASE SUMMARY

An elderly female patient was admitted after sustaining an intertrochanteric proximal femoral fracture. She had significant comorbidities including ischaemic heart disease, cognitive impairment, previous stroke and an implantable defibrillator.

Preoperative medical review and assessment was mentioned but appears not to have happened. The anaesthetic team reviewed the patient's chart as part of the preoperative assessment. An appropriate acute resuscitation plan was put in place after treatment options and consent were discussed with the patient's power of attorney.

On day one post-admission, a long intramedullary nail was placed to reduce and fixate the fracture. Cardiovascular output was supported intraoperatively by small doses of inotropes. The patient deteriorated in recovery, resulting in a medical emergency team (MET) call. Admission to ICU was considered; however, it was inappropriate, given her premorbid function, resuscitation plan and ceilings of care.

The patient received supportive care on the ward and passed away several hours after surgery.

DISCUSSION

The Australian and New Zealand Hip Fracture Registry (ANZHFR) has established best practice guidelines for the management of neck-of-femur fracture patients. The elderly neck-of-femur fracture patient cohort is often frail and typically has significant medical comorbidities. Patients remain with a significant perioperative mortality rate at 30 days and 1 year. An orthogeriatric model of care is considered best practice.

This patient received timely treatment from the consultant surgeon. There is increasing level-one evidence in the literature that a long intramedullary nail is associated with longer operating times and higher mortality. Consideration of which fracture patterns are appropriate for a short nail or dynamic hip screw is needed. Potentially, these could be associated with shorter operating times and reduced perioperative morbidity. It is acknowledged that both treatment

options—short and long nail—are considered clinically appropriate. Each should be applied on the basis of the fracture pattern, the surgeon and institutional experience.

CLINICAL LESSONS

Perioperative assessment from orthogeriatric physicians and anaesthetists with a perioperative interest can optimise patient outcomes. Surgical techniques including those that are rapid and expeditious should be considered, particularly in the comorbid cohort. Nonoperative care with palliation can be considered for the patient group for which the perioperative morbidity and mortality is considered too high.

ANZASM COMMENT:

The Australian and New Zealand Guideline for Hip Fracture Care recommends an orthogeriatric model of care. It also recommends timing of surgery within 36 hours of first presentation. This case highlights the difficulties in coordinating timely multidisciplinary care to optimise often medically complex patients, while at the same time competing with the urgency of surgical fixation in the provision of best clinical care standards.

Case 3: Pleurodesis and thoracic duct ligation in a 5-month-old infant with chylothorax

Paediatric Surgery

CASE SUMMARY

A 5-month-old girl presented to a metropolitan hospital with a 1-day history of increased work of breathing, reduced feeding and 2 episodes of vomiting. She had been born prematurely at 35 weeks weighing 2.85 kg. On examination, she was pale and underweight (5 kg; second percentile). Her oxygen saturations were in the high 80s, with signs of a large right pleural effusion. She was afebrile. Chest X-ray showed a complete white-out of the right lung field. She was transferred to a children's hospital for further investigation and management.

The patient was admitted to the paediatric intensive care unit (PICU). A right pleural drain was placed, which drained large volumes of chyle, requiring significant fluid replacement and IV immunoglobulins. Medical management (fasting, total parenteral nutrition [TPN] and somatostatin) failed to stem the high-volume chyle losses. An MRI scan with contrast showed leakage of lymph at the right diaphragm in the aortic hiatus.

A right video-assisted thoracoscopic surgery (VATS) and attempted povidone–iodine pleurodesis was performed 4 days into admission, which slowed the loss of chyle but did not halt it. Respiratory function worsened and left-sided pleural effusion subsequently developed, which was drained. The patient also developed a pericardial effusion. Left-sided povidone–iodine pleurodesis was attempted 6 days into admission and a pericardial drain was inserted 2 days later (8 days into admission).

A multidisciplinary team (MDT) meeting was convened and a consensus reached that there were no low-risk options for the patient. It was felt that right thoracotomy and ligation of the thoracic duct was advisable.

The surgery was carried out 3 weeks into admission. It was complicated by cardiac arrest due to hypovolaemia and hyperkalaemia secondary to significant bleeding related to injury to an intercostal artery. The patient required prolonged resuscitation and massive transfusion, with return of circulation after 38 minutes. After returning to PICU, the patient required ongoing ventilation, renal replacement therapy and multiple blood products for massive transfusion coagulopathy. There was escalating inotropic requirement. Ultrasound on postoperative day one showed ascites, extensive hepatic infarction, splenic

infarction and possible infarction in the right kidney. There was rising lactate suggestive of gut ischaemia. Treatment was withdrawn on postoperative day 3.

Autopsy showed 4 pledgeted sutures just above the diaphragm producing aortic stenosis (2 mm) and patchy infarction of the liver and bowel ischaemia. Dysmorphic features raised the possibility of Noonan's syndrome.

DISCUSSION

Chylothorax is a potentially life-threatening disorder with substantial fluid loss, electrolyte imbalance and immunocompromise. Its management is often difficult, particularly in small, possibly syndromic infants. Chylothorax in children is most commonly associated with trauma as a result of operative injury in the context of cardiothoracic surgical operations (2.5–4.7%).[1] These surgeons have the most experience in its management. Spontaneous chylothorax is exceedingly rare.

Management principles are well described, with measures to reduce the chyle flow in the thoracic duct while awaiting spontaneous healing. Such measures include a low-fat and medium-chain triglyceride diet progressing to enteric rest and TPN. Octreotide appears to reduce chyle flow, although the exact mechanism is unclear. Surgical treatment includes drainage of the effusion (Denver or Leveen shunts), direct closure of the leak including thoracic duct ligation and mechanical or chemical pleurodesis by VATS or open operation.

In this case, the appropriate medical measures failed to control the chyle leak. Pleurodesis using povidone–betadine was then attempted. (A study in 2020 showed some promising results with this technique.[2]) Unfortunately, this measure also failed to control the chyle losses. The patient then developed a left-sided pleural effusion and a pericardial effusion containing chyle. Faced with a deteriorating patient, an MDT proposed thoracic duct ligation. The management of such a large spontaneous chylothorax in this type of infant is notoriously difficult, and the result of a technically successful thoracic duct ligation is also unclear as there may well be other anomalous lymphatic channels. Ideally, a paediatric cardiothoracic surgeon should have been part of this process. Consultation with paediatric cardiac surgeons early in this infant's management may have assisted in making this decision.

The assessor notes the reluctance of the surgeon to offer the child and family the eventual thoracic duct ligation as there were grave concerns about the operative risk and benefit for this child, whose overall condition was very poor. The surgical team was aware of the risk of this relatively uncommon procedure. The assessor also notes that a cardiothoracic surgeon was involved in the procedure. This is appropriate, given their experience with major arteries in the chest in redo situations. Given the rarity and complexity of such cases, timely transfer of the child to a tertiary paediatric cardiac surgery hospital might have been considered.

CLINICAL LESSONS

Thoracic duct ligation in a small, compromised infant is not a straightforward procedure, especially after a prolonged period in PICU and following earlier procedures in the right pleural cavity of direct suture and later pleurodesis. The anatomy in this case was grossly distorted, making identification of the aorta and oesophagus difficult. The procedure was complicated by catastrophic bleeding from injury to intercostal branches of the thoracic aorta.

Given this presentation of a large spontaneous chylothorax in the context of an unwell, underweight infant, thoracic duct ligation may have been considered a first-line intervention, as it seems lesser procedures such as pleurodesis were unlikely to be successful.

REFERENCES

1. Asbagh PA, Shirazi MAN, Soleimani A, Razzazz M, Asbagh NA, Hussein R, Shariat M. Incidence and etiology of chylothorax after congenital heart surgery in children. *J Tehran Heart Cent.* 2014; 9(2):59-63.
2. Long WG, Cai B, Liu Y, Wang WJ. Povidone–iodine chemical pleurodesis in treating spontaneous chylothorax in pediatric patients. *Ann Palliat Med.* 2020; 9(3):1004–1012.

Case 4: Iatrogenic laparoscopic small bowel injury followed by inadequate antimicrobial cover leads to septic shock and death

General Surgery

CASE SUMMARY

A 75-year-old woman presented in the early evening with a 24-hour history of nausea, vomiting and worsening abdominal pain. Medications included salbutamol, pantoprazole, tiotropium bromide (Spiriva), sertraline and ezetimibe. She was noted to have a history of rash from penicillin. She was appropriately triaged and returned to the waiting room. She improved throughout the night with IV fluids. The documented pain score was recorded as zero until 06:00 and then jumped to 7/10.

A CT scan was performed around 02:00, presumably after a doctor's review, although there is no record of this. The first documented medical review was at 06:00 by a surgical registrar. The patient had a soft abdomen with some tenderness in the right iliac fossa. Clinical observations and laboratory tests were normal other than C-reactive protein (CRP) of 54 mg/L. The provisional CT report from the radiology registrar suggested a closed-loop small bowel obstruction, with no evidence of ischaemia or perforation.

A subsequent medical note at 09:30 documented a consultant review. The patient had a diffusely tender abdomen and a heart rate of 110 bpm. Emergency laparoscopic adhesiolysis commenced 75 minutes later with both a consultant anaesthetist and surgeon present. The patient was given 600 mg clindamycin at induction, presumably due to a documented penicillin allergy.

Laparoscopic entry was achieved with an open Hasson technique. Sharp laparoscopic adhesiolysis was attempted. An iatrogenic perforation was created in the mid-ileum when attempting to grip the bowel using an A-Trac grasper. There was significant enteric contamination. The operation converted to open laparotomy. Metronidazole was added. An adhesional band causing a closed-loop obstruction was released, the iatrogenic perforation was resected and a side-to-side stapled anastomosis was performed.

The patient was transferred to ICU. Her metaraminol requirements increased overnight, with a corresponding rising lactate. A further dose of metronidazole and clindamycin was given that evening. Noradrenaline commenced early the following morning, as did gentamycin. She was re-intubated in the early afternoon; meropenem was added at 15:50. Despite adding vasopressin and

dobutamine, septic shock progressed and the patient died that evening, almost exactly 48 hours after walking into the emergency department (ED). Blood cultures grew *Klebsiella pneumoniae*.

DISCUSSION

This patient had a dramatic septic response followed by rapid deterioration and death. However, there are several areas that could have changed the outcome.

Firstly, in the setting of a small bowel obstruction, the decision to proceed laparoscopically was questionable. It appears that this was a simple adhesional band. Handling of the dilated proximal small bowel should be avoided, and the distal collapsed bowel should be followed retrogradely to the point of transition. If this is not possible, the laparoscopic approach should be abandoned. In retrospect, an open approach would have avoided the iatrogenic enterotomy, subsequent sepsis and death.

Use of the A-Trac grasper was a poor choice because it has a small gripping surface area. It is the assessor's view that this should not be used for handling bowel.

Secondly, the antimicrobial management of this patient was inadequate. A single dose of clindamycin at induction is insufficient coverage for a potential bowel contamination. Adding metronidazole only duplicated the anaerobic cover and failed to provide the gram-negative cover required. The gentamycin given the following morning was the first gram-negative coverage.

The surgical case form suggests confusion between the surgical and ICU teams regarding the administration of ciprofloxacin. There is no evidence it was ever prescribed. The patient needed gentamycin, ciprofloxacin or a cephalosporin intraoperatively, not 22 hours later.

CLINICAL LESSONS

The root cause of this death was the decision to undertake the surgery laparoscopically. The literature reports that few emergency laparotomies are undertaken laparoscopically and many are converted to open operations. Surgeons should not feel pressured or obliged to undertake an emergency laparotomy laparoscopically.

The failure to provide adequate antibiotics is difficult to defend.

ANZASM COMMENT

This case highlights several points:

- Care is needed in handling distended loops of small bowel. Even gentle traction during open surgery, and particularly during laparoscopic surgery, can lead to perforation due to the weight of the liquid contents and fragility resulting from intestinal wall oedema.
- There is no surgical instrument available for use in laparoscopic surgery that does not carry some risk of perforation when applied to distended loops of bowel.
- There is danger from peritoneal contamination with small bowel contents when an obstruction has been established. While small bowel contents are normally sterile, they should be treated as bacterially contaminated when obstruction has been present for several hours, and almost certainly after 24 hours.

  Hence, management of this case should have included thorough total peritoneal lavage with a large volume (3–4 L) of normal (0.9%) saline, as well as broad antibiotic cover at the time of contamination if it had not been given prophylactically.

Case 5: Endovascular treatment of a complex thoracoabdominal aortic aneurysm complicated by mesenteric and renal ischaemia

General Surgery/Vascular Surgery

CASE SUMMARY

A 71-year-old woman was admitted for a planned thoracoabdominal aortic aneurysm stent-graft repair at a large private hospital. She had had a previous aortic valve and ascending aorta repair (possible elephant trunk repair), presumably for an ascending aortic aneurysm.

The endovascular repair of the thoracoabdominal aortic aneurysm began early in the morning and was completed in 7 hours. A total of 12,000 units of heparin was given in 2 doses of 5,000 and 7,000 units. Bilateral femoral artery percutaneous access and open left brachial artery access was attained. The aorta was covered from just beyond the left subclavian artery origin (into the recently placed elephant trunk from the aortic arch surgery) down to just above the aortic bifurcation. The operation note consists only of a drawing of the graft placement. It appears there was a fenestrated branched graft with fenestrations for the coeliac artery, the superior mesenteric artery and both renal arteries. It appears that the right renal artery was unable to be cannulated through the branch of the stent-graft and was thus occluded off with an Amplatzer plug, followed by a chimney technique used from below the stent-graft to gain access to the right renal artery. The coeliac, superior mesenteric and left renal arteries were all accessed and stented in a standard planned manner. One assumes that the final angiographic picture showed all these 4 main arteries to be patent, as no mention was made otherwise.

At the end of the operation, when the patient was moved from the table, the left arm was found to be pulseless. The patient was transferred back to the operating table, presumably for an exploration of the left brachial artery. (This was only revealed via the theatre nursing notes. It was not mentioned in any operation or anaesthetic records, thus it is unclear what the exploration entailed.) About an hour later, the patient was removed from the operating table with good perfusion of the left arm.

The ICU assessment shortly after admission did not document any concerning features. The next medical notes at 04:00 stated that the patient had become unwell with decreasing urine output, rising lactate (>8 mmol/L) and a platelet count of 19 x 10^9/L (vs a platelet count of 80 x 10^9/L on the day of surgery). A

CT scan showed that the stent-graft and branches were patent but there were multiple renal and splenic infarcts, and sections of the bowel appeared ischaemic. A large type 1 endoleak was also identified, meaning the aneurysm was not excluded. A platelet transfusion was given and a Vascath inserted to initiate dialysis for the rising lactate.

At 08:00, a general surgery review concluded an emergency laparotomy was essential. Due to concerns over financial costs, the patient (uninsured) asked to be transferred to a tertiary public hospital. She arrived at a tertiary public hospital ICU 2.5 hours later. An immediate emergency laparotomy showed global bowel hypoperfusion with no frank full-thickness ischaemia. No bowel resection was performed; the plan was for a relook laparotomy if she remained stable. The patient was returned to ICU and passed away several hours later due to multiorgan failure.

DISCUSSION

Thoracoabdominal aortic aneurysms are extremely complicated cases. They are very challenging and have a high risk of minor and major complications, even with endovascular repair. There is high mortality, even in the hands of experienced proceduralists. The procedure would generally be performed by 2 consultant vascular surgeons. It is disturbing that this case was attempted without even an assistant.

That stated, no technical complications were identified. It appears that the major issue was an atheroembolic phenomenon of all the stented major visceral branches. The cause of the severe thrombocytopenia (platelet count 19 x 10^9/L) several hours later is unclear, as is whether it may have been heparin-induced thrombocytopenia and thrombosis syndrome that may have caused thrombus formation in the mesenteric and renal arteries.

It is concerning that the operation was undertaken in a private hospital on an uninsured patient (at a hospital-only cost of over $75,000). One hopes that there was a preoperative conversation about potential complications and related costs. That the patient chose to be transferred to a public hospital after the cost implications of the complications were discussed, suggests perhaps not. Uninsured patients undergoing a complex and costly operation with a high complication risk should be managed in a public hospital. Nevertheless, it appears there was no delay in transfer and, ultimately, any small delays would not have altered the outcome. Once the patient started deteriorating, mortality was imminent.

CLINICAL LESSONS

This case illustrates 2 issues that ANZASM has documented in a number of previous reports. The first, is that very complex operations should be undertaken by 2 consultants. The second, is that complex cases should not be undertaken in private hospitals. Even if the private hospital has the ability to manage the primary operation, they frequently cannot manage postoperative complications, especially if the preferred management is with non-interventional techniques (e.g. radiology).

Case 6: Arteriocolic fistula post-iliac stenting

Vascular Surgery

CASE SUMMARY

A 73-year-old woman presented with rest pain, one year after pelvic evisceration for a malignant squamous cell carcinoma of the pelvis involving open reconstruction of the left external iliac artery and vein, followed by radiotherapy. Imaging showed the common and external iliac artery occlusion.

Two previous attempts at recanalisation had been unsuccessful. Using standard endovascular techniques, the external and common iliac artery lesions were crossed, and covered stent grafts were subsequently placed from the common iliac artery to the mid-external iliac artery. To preserve collaterals, a distal bare metal stent was inserted.

The patient was stable postoperatively and discharged 2 days later to a local hotel. She was found peri-arrest by her husband. Cardiopulmonary resuscitation (CPR) commenced out of hospital and continued in hospital. She was resuscitated and underwent a CT scan, which demonstrated an arterioenteric fistula at the site of the distal external iliac artery. Aortic balloon occlusion was undertaken in the ICU and she was transferred to the catheterisation lab for covered stenting of the distal external iliac artery. This successfully stopped the bleeding. However, the patient developed multiorgan failure. She was eventually palliated with hypoxic brain death.

DISCUSSION

This was a very difficult case in a patient with multiple comorbidities and previous aggressive resected disease. She had had extensive vascular reconstruction and multiple attempts to recanalise the occluded iliac graft. Recanalisation of the iliac artery was successful at the final attempt.

The surgical management was appropriate, especially since open reconstruction would be near impossible and the patient had rest pain. Without this procedure, major limb amputation may have been required.

Intraoperatively, a covered stent graft could have been used throughout the whole occluded iliac artery, as one suspects the multiple ballooning of the stents created the fistula. Use of a covered stent graft may have prevented the bleeding. However, the reasoning of the operating surgeon to use a bare stent to preserve collaterals is understandable.

The postoperative management was standard and appropriate, with a suitable discharge plan. The readmission was well-managed, with appropriate interventions to stop the haemorrhage. Management of the resuscitation during the second admission is commendable. Unfortunately, the patient died despite the best efforts of ICU and the vascular surgeons.

CLINICAL LESSONS

There are two important linked lessons. The first, is that although the current delivery of radiotherapy causes far less tissue damage than in the past, operating within a previously irradiated field is still fraught with hazard. One wonders whether an extra-anatomic bypass was considered. The second, is that this represents another example of a complex vascular case being undertaken by a solo surgeon. While there is no suggestion of obvious intraoperative misadventure, it was a postoperative complication that led to the patient's death.

Case 7: Delayed diagnosis of anastomotic leak after colonic resection precipitates multiple returns to theatre

General Surgery

CASE SUMMARY

A 77-year-old woman presenting with abdominal pain was found to have a locally advanced stenosing hepatic flexure tumour. Her medical history was significant for right breast cancer 23 years earlier, recurrent breast infections, rheumatoid arthritis, ischaemic heart disease on dual antiplatelets, gastro-oesophageal reflux disease (GORD) and asthma.

The patient was initially planned for a colonoscopy but was taken for surgery, given developing obstructive symptoms. She underwent an open right hemicolectomy and right oophorectomy 6 days into admission. A large ascending colon mass was found, with local invasion of the peritoneum laterally and Gerota's fascia posteriorly.

On postoperative day 7, a CT scan suggested postoperative ileus but no free fluid or free gas. On postoperative day 10, the patient's white cell count rose to 31 x 10^9/L. On postoperative day 12, CRP rose to 300 mg/L. Piperacillin/tazobactam commenced to treat bacteraemia (*Bacteroides fragilis*), which improved the white cell count, with CRP stagnant around 170–190 mg/L. On postoperative day 16, a MET call for tachycardia and hypotension prompted another CT scan, which demonstrated large-volume free fluid and gas and intra-abdominal sepsis.

Subsequent patient management involved 5 operations in addition to the initial laparotomy. At the third laparotomy, an ileal perforation adjacent to the staple line was found and the patient underwent an ileocolic resection and end ileostomy and partial abdominal closure. Despite ongoing surgical intervention and ICU support, the patient deteriorated, ultimately succumbing to sepsis and organ failure. Palliation commenced approximately 6 weeks after the initial presentation.

DISCUSSION

Anastomotic leak after colonic resection can sometimes be difficult to determine. Postoperative ileus is common—almost universal—after patients present with symptoms of obstruction, which can cloud the picture for assessing for anastomotic leak. Nevertheless, a leak must be excluded, as this may be the precipitating cause of the presumed ileus. A CT scan that shows no evidence of free fluid or free gas does not rule out a leak or the likelihood that one that will develop.

An ileus itself can precipitate a leak, as increased intraluminal pressure can result in venous ischaemia, especially to the newly formed anastomosis.

The area of consideration raised by the first-line assessor relates to the 10-day period after an ileus was diagnosed on CT scan and prior to when the patient was noted to have intra-abdominal sepsis requiring return to theatre. This sepsis was ultimately found to be an anastomotic leak. There were multiple biochemical clues to suggest there was more than just an ileus at play in this patient. The white cell count of 31 x 10^9/L and CRP of 300 mg/L in the days following the CT, which demonstrates ileus, should have raised significant concern that there was an underlying anastomotic leak. An ileus without bowel compromise should not prompt such an inflammatory response. These biochemical signs represent a missed opportunity to intervene earlier. Whether this be via a repeat CT with/without contrast or via operative exploration, the leak should have been diagnosed at this stage, allowing a better opportunity to salvage the situation before the patient became too physiologically compromised.

CLINICAL LESSONS

It is important to always suspect a leak when the postoperative course is not as expected. Timely diagnosis and treatment—whether that be antibiotics alone, drainage of collections or return to theatre—is required to prevent a poor outcome such as occurred here. This case demonstrates a period of more than a week of missed opportunities to diagnose the surgical complication. It could have been acted upon days earlier, before it resulted in significant intra-abdominal sepsis and organ failure; something that ongoing surgery and intensive care could not salvage.

Case 8: To intervene or not to intervene, that is the question

General Surgery

CASE SUMMARY

An 87-year-old man with generalised peritonitis arrived by ambulance in the very early morning to a private hospital. About 6 weeks earlier, he had been admitted to the same hospital with colitis, *Clostridium difficile* infection (treated with vancomycin), peptic ulcer disease and acute calculus cholecystitis (treated with a percutaneous cholecystostomy; the tube was removed). The patient self-discharged 10 days prior to the current admission. He had a background of ischaemic heart disease, atrial fibrillation (AF) treated with warfarin, rheumatoid arthritis, urethral stricture and hypertension.

At this admission, the patient had a rigid abdomen, a white cell count of 21 x 10^9/L and an international normalised ratio (INR) of 2.8. A CT scan was verbally reported at 04:23, showing an infarcted short segment of distal jejunum as well as severe (>70%) superior mesenteric artery (SMA) ostial stenosis, but enhanced distal to that point. The superior mesenteric vein, inferior mesenteric artery, inferior mesenteric vein and portal veins were normal.

The patient was seen by the surgeon at 05:15. Thorough discussion took place between the patient and the family, ED doctors and the surgeon. Although the patient was not for resuscitation, he agreed to major surgery, intubation and ICU admission. He was promptly taken to theatre for a laparoscopy (commenced at 05:52). A 5 cm necrotic small bowel segment 30 cm from the caecum was found and resected via a mini-laparotomy. A routine side-to-side stapled anastomosis was performed. At the time, it was noted that the rest of the small gut, colon and gall bladder appeared normal. The procedure took 75 minutes.

The patient was taken to ICU after surgery. Later that day, he started to deteriorate. The surgeon reviewed him at 18:30, with the impression of a possible progression of ischaemia. A second CT with arterial phase was done. The surgeon reviewed the patient again at 22:00 (CT not yet reported), suspecting a filling defect of the SMA. The CT scan verbally reported at 23:50 showed 'a long filling defect of SMA origin, presumed acute, as well as non-enhancement of the origin of the coeliac axis (possibly acute).'

ICU discussed the patient with the vascular surgeon and documented 'no specific plan for intervention suggested'. The primary surgeon indicated in the case form that the vascular surgeon did not review the images and thought the findings to be chronic.

The surgeon reviewed the patient at 06:30 the next day and noted the discussion with the vascular surgeon. The impression was that the patient was unlikely to survive another laparotomy. Heparin infusion was suggested and commencement of TPN. The surgeon reviewed the patient again at 09:30 and discussed the case with the vascular surgeon, who agreed that a thrombectomy and a stent were required. There was difficulty securing an anaesthetist and a theatre for immediate surgery.

The procedure eventually commenced at 13:10. A thrombectomy was performed and a stent placed. The caecum, ascending colon and gall bladder were gangrenous. A right hemicolectomy with cholecystectomy was performed and a laparostomy was formed using a vac (vacuum-assisted closure) dressing. The procedure took 4 hours. The plan was to review the patient in 24 hours; however, he continued to deteriorate. After discussion with the family palliation commenced and he died the next day.

DISCUSSION

The general surgeon did all that could be done by reviewing the patient upon admission and reviewing him frequently during admission. There was no delay in taking the patient to theatre for the first procedure (within 20–30 minutes). The choice of procedure was excellent and it was quick. However, communication issues occurred that either affected the decision-making or delayed management:

- If the report of the first CT scan was noted at the time of deciding to go ahead with the first procedure, the plan might have changed to either involving the vascular team at that stage or considering palliation. The necrotic small bowel segment was clearly due to a vascular occlusion because there was no physiological explanation to account for it, such as internal hernias or adhesion bands.
- Communication with the vascular surgeon after the second CT scan should have been more insistent, especially emphasising that the radiologist favoured acute events. This would have led to either earlier intervention (by 13 hours) or consideration of palliation.

The second procedure was delayed twice: first as in the latter point above and second when no anaesthetist was available in the morning. The decision to go to theatre was made at 10:00 and the procedure was delayed until about 13:00. Though 2–3 hours might not seem a lot, it is a significant delay for an ischaemic

patient. Any hospital that accepts acute cases must be prepared to cancel elective operations to do emergency cases.

CLINICAL LESSONS

An 87-year-old patient with multiple significant medical issues presenting with major mesenteric vascular insult is unlikely to survive, irrespective of medical/surgical intervention. Deciding to intervene twice was a challenge, especially the second procedure. But with the thorough discussion by various specialists with the patient and his family and their insistence on going ahead, it was not unreasonable to proceed.

Case 9: Massive haemorrhage following dislodgement of an endovascular aneurysm repair stent graft

Vascular Surgery

CASE SUMMARY

A 62-year-old woman was admitted electively to a private hospital with a left common iliac artery aneurysm that was causing acute renal failure due to ureteric obstruction. The patient's comorbidities included hypertension and hypercholesterolaemia, which were both being treated with medication. She was not obese, was a non-smoker and was classified as American Society of Anesthesiologists (ASA) grade II. She had previously had a left ureteric JJ stent inserted.

The aneurysm was 78 mm in diameter and had persisted despite an aortic stent graft and iliac bifurcated endograft device (IBD) placed 7 months earlier. An extension stent had been placed in the left internal iliac artery one month after the aortic stent graft and IBD placement; however, acute renal failure developed secondary to left ureteric obstruction caused by the sac.

The day after admission, the patient underwent an aneurysm sac decompression and ureterolysis. The operation was conducted initially via a retroperitoneal approach. The common, external and internal iliac arteries on the left side were apparently clamped and the aneurysm sac opened, but the internal iliac artery stent dislodged from the IBD and much bleeding ensued. Control was obtained by clamping the IBD and the internal iliac artery. An interposition graft was planned; however, the IBD dislodged from the main body of the endovascular aneurysm repair (EVAR) stent causing massive uncontrolled bleeding. A code blue was called 105 minutes into the operation. Downtime extended for 30 minutes, during which attempts were made to control the bleeding via manual compression. This was difficult because of poor visual access. It was decided to convert to a mid-line laparotomy. With a cardiac surgeon assisting, supra-renal clamping was attempted but this was challenging due to the CPR being conducted. Finally, a right femoral artery cut-down was made and a balloon catheter placed in the descending thoracic aorta, which controlled the bleeding. A second vascular surgeon was asked to assist and placed a supra-coeliac aortic clamp. The patient stabilised and the massive transfusion protocol was instituted. The second vascular surgeon departed at this point.

It was decided to explant the EVAR and sew in an aorta bi-iliac graft. However, the right femoral pulse was undetectable, presumably due to an injury to the right external iliac artery during blind guidewire insertion from the femoral artery.

A right iliofemoral bypass graft was performed, followed by an anastomosis between the left limb of the graft and the left iliac artery.

By then, the patient had become coagulopathic and oozing was noted from the proximal anastomosis. A senior vascular surgeon was called in and the proximal aortic anastomosis was redone twice. With bleeding continuing, the procedure was converted to a supra-renal anastomosis with reimplantation of both renal arteries. Ongoing bleeding continued to occur. The aorta was packed with the abdomen left open and the patient transferred to ICU at 04:00, 12.5 hours after commencement of the operation. Despite intensive resuscitation, the patient died 2 hours later with severe acidosis after massive intraoperative blood loss and coagulopathy.

DISCUSSION

Endovascular complications should be treated by endovascular means if at all possible. In this case, it was decided that an open (retroperitoneal) approach was appropriate (likely due to the ureteric obstruction). This approach to the iliac arteries for occlusive disease is often a good and sometimes under-utilised choice.

The presence of a 7.8-cm central iliac artery aneurysm may have made access and control of the arteries involved a little more difficult. Given the presence of a pre-existing EVAR, it may have been more prudent to consider a midline incision. Clamping of arteries with endovascular devices in situ is always associated with the risk of causing displacement of the endoluminal grafts, so complete control of all arteries involved is always advised. Acute displacement of a component of the IBD occurred in this case, which led to the diffuse bleeding. Surgeons should always be adequately prepared to deal with the possibility of significant bleeding in the open surgical repair of endovascular complications.

Explantation of an endoluminal aortic graft is a difficult procedure and there is always a risk of trauma to the native aorta when removing the device. Removal of the EVAR should only be considered as a last resort in trying to salvage a difficult situation. An alternative should be sought if at all possible. Undertaking this task at a late point in a long, complicated procedure is almost invariably going to be associated with a poor outcome.

CLINICAL LESSONS

This case highlights the fragility of EVAR stent grafts, in that the components can become dislodged during attempts to repair them.

Case 10: Fatally high intracranial pressure resulting from iatrogenic internal carotid artery injury

Neurosurgery

CASE SUMMARY

A 63-year-old woman was admitted under Neurosurgery after a subarachnoid haemorrhage secondary to rupture of a right-side posterior communicating artery aneurysm.

The patient underwent a CT angiography that showed a Fisher grade 3 subarachnoid haemorrhage. The day after admission, she underwent balloon-assisted coiling of the right posterior communicating artery aneurysm. The internal carotid artery (ICA) dissected or leaked during the procedure. This was followed by pupillary dilatation. Mannitol and hyperventilation were administered, and a right frontal EVD and an intracranial pressure (ICP) monitor were inserted, revealing very high ICP readings.

The next day, the patient underwent an emergency right-side decompressive craniectomy, temporal lobectomy and cisternostomy with an EVD. She was transferred to ICU.

Postoperatively, the right pupil was persistently dilated. The left pupil was contracting but nonreactive to light. Despite 'aggressive neuroprotective measures' the ICP remained persistently high with the GCS remaining at 3T/15. A repeat brain CT revealed 'extensive right ICA territory infarct with early tonsillar descent, uncal herniation and loss of grey-white differentiation'. After discussion with the family, it was decided to withdraw further treatment and administer palliative care. The patient died 3 days after the attempted balloon-assisted coiling of the aneurysm.

DISCUSSION

Interventional radiology stented the leaking point of the ICA. This may have potentially led to delays and possibly affected the outcome. The patient should have immediately proceeded to theatre for surgical control of the bleeding. During the operation, the leaking point from the right ICA was repaired with a muscle patch.

From the interventional neuroradiologist's report on the attempted coiling of the aneurysm, 2 coils were deployed into the aneurysm and an inflated balloon for the second coil was deployed to prevent prolapse into the parent artery. The interventional neuroradiologist noted extravasation along the ICA wall opposite

the aneurysm and the balloon was inflated for tamponade. Despite intermittent balloon inflation in 5- to 10-minute cycles, there was persistent extravasation when the balloon deflated. Neurosurgery was informed and options of open repair, ICA sacrifice and flow diverter reconstruction were considered. It was decided to perform flow diverter stenting across the rupture point.

The status of neither the author of the preliminary operative report nor the approver of the report is apparent from the hospital record. Thus, the seniority and experience of the 2 interventional neuroradiologists is unknown.

CLINICAL LESSONS

This death occurred due to intraoperative incident. The patient died because of dissection or rupture of the ICA during the interventional endovascular neuroradiological procedure. This led to a fatal rise in ICP that could not be ameliorated by craniectomy and brain resection in time to prevent cerebral death.

Case 11: Skull base injury from functional endoscopic sinus surgery

Otolaryngology Head and Neck

CASE SUMMARY

A 76-year-old man with a medical history of emphysema, AF (anticoagulated), hypertension, type II diabetes, GORD and prostate carcinoma was admitted electively for functional endoscopic sinus surgery (FESS) to treat bilateral extensive sinus disease/chronic sinusitis.

Preoperatively, the patient withheld apixaban for one week. The procedure (FESS/polypectomy) was performed 2 days after admission, commencing at 16:00. The operative notes indicate bilateral extensive polyposis with inflamed mucosa and bilateral maxillary and frontal sinus pus. The procedure notes do not identify extensive bleeding or suspicion of skull base injury. No immediate surgical complications were noted. The preoperative consultation notes, the preoperative assessment of risk of skull base injury, and the assessment of the preoperative CT scan for anatomical details were not provided. The immediate postoperative period was unremarkable and the patient was transferred to the ward at 18:45.

On postoperative day one, he was reviewed at 09:30 and reported to be stable. However, he complained of headache and nausea at approximately 10:00 when he was noted to have an emesis, which delayed discharge. He was prescribed paracetamol and metoclopramide.

The next review of the patient was at 11:20, when he was found unresponsive. A code blue was called. He had a GCS of 4/15 and was not maintaining his airway but he was haemodynamically stable. He was intubated and transferred to another hospital where a brain CT noted a subdural haematoma with midline shift and pneumocephalus. The patient's family declined further transfer for neurosurgical services with possible decompressive surgery. The patient was admitted to ICU for palliation and died at 19:07 on postoperative day one.

DISCUSSION

The preoperative anticoagulation of the patient was managed appropriately. A review of the preoperative CT scan would have been appropriate to determine if the risk of injury and/or complication was higher than usual. The extent of the skull base injury can be assessed with the post-intubation CT scan, but these scans were not available for review. While the outcome was devastating, there are no obvious omissions in this patient's care based on the information provided.

CLINICAL LESSONS

Skull base injuries are a rare but known complication of FESS, and this patient's skull base injury seems to have been occult. While in retrospect it is easy to understand that the headache, nausea and vomiting were due to raised ICP, these symptoms are not uncommon after anaesthetic. The postoperative instructions did not clarify that this needed to be reported to the surgeon. Earlier escalation to the surgeon of the severe headache and vomiting may have been appropriate, but probably would not have changed the outcome in this case.

Abbreviations

ANZHFR	Australian and New Zealand Hip Fracture Registry
AF	atrial fibrillation
ASA	American Society of Anesthesiologists
CPR	cardiopulmonary resuscitation
CRP	C-reactive protein
CSF	cerebrospinal fluid
CT	computed tomography
DI	diabetes insipidus
ED	emergency department
ENT	ear, nose and throat
EVAR	endovascular aneurysm repair
EVD	external ventricular drain
FESS	functional endoscopic sinus surgery
GCS	Glasgow Coma Scale
GORD	gastro-oesophageal reflux disease
IBD	iliac bifurcated endograft device
ICA	internal carotid artery
ICP	intracranial pressure
ICU	intensive care unit
INR	international normalised ratio
IV	intravenous
MDT	multidisciplinary team
MRI	magnetic resonance imaging
NG	nasogastric
PICU	paediatric intensive care unit
RMO	resident medical officer
TPN	total parenteral nutrition
VAC	vacuum-assisted closure
VATS	video-assisted thoracoscopic surgery

Notes

Royal Australasian
College of Surgeons
Australian and New Zealand
Audit of Surgical Mortality

24 King William Street
Kent Town SA 5067

Email:
anzasm.racs@surgeons.org

Website:
www.surgeons.org/anzasm

Royal Australasian College of Surgeons
Australian Capital Territory
Audit of Surgical Mortality

CHASM
Collaborating Hospitals' Audit of Surgical Mortality

Royal Australasian College of Surgeons
Northern Territory Audit
of Surgical Mortality

Royal Australasian College of Surgeons
Queensland Audit
of Surgical Mortality

Royal Australasian College of Surgeons
South Australian Audit
of Surgical Mortality

Royal Australasian College of Surgeons
Tasmanian Audit
of Surgical Mortality

Royal Australasian College of Surgeons
Victorian Audit
of Surgical Mortality

Royal Australasian College of Surgeons
Western Australian
Audit of Surgical Mortality