Royal Australasian College of Surgeons

Australian and New Zealand Audits of Surgical Mortality

National Case Note Review Booklet

LESSONS FROM THE AUDIT

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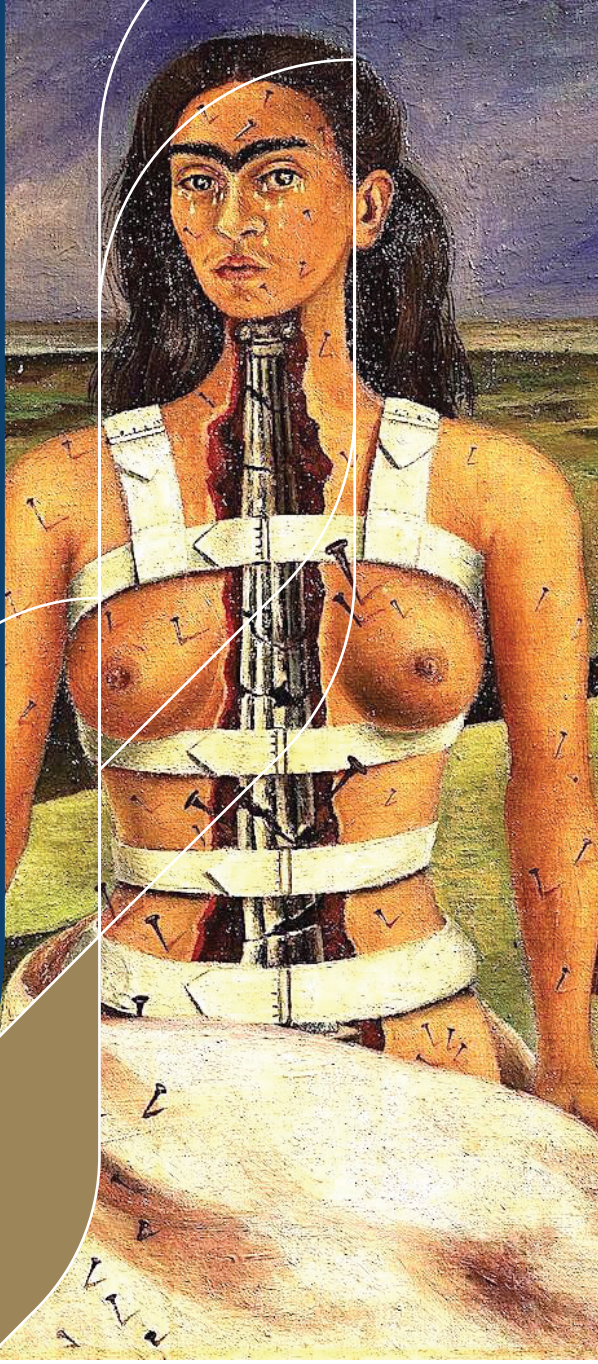

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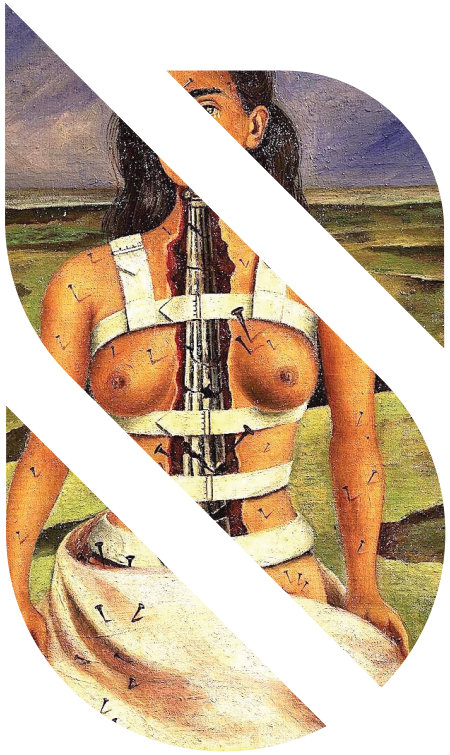

Cover image: 'The broken column' by Frida Kahlow

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Chair's Report

This collection of surgical deaths that underwent a second line assessment demonstrates the benefit of hindsight. Some deaths indicate failure to respond to diagnostic clues that became obvious later. Others highlight communication problems between treating teams. Some patients had almost untreatable problems for which no adverse event could be tolerated. These factors we can all work on to try to improve the care we provide.

There are also cases where we develop tunnel vision of the patient or problem facing us. This can be a difficult situation to overcome and requires both insight and systems to help. Any complex or unexpected findings should be discussed with experienced trusted colleagues. Their experience or perceptions may help challenge a 'mindset' of the treating consultant. I have never met a colleague reluctant to provide such assistance, but we must also be prepared to receive an alternative view to the one we may currently be holding.

Previously, these case note booklets have highlighted the lack of consultant input. If our care of the surgical patient is to further improve, regular second opinions should be sought and constructively offered.

Any feedback, as always, would be appreciated.

Guy Maddern
Chair, ANZASM

Case Studies

Case 1: Prophylactic anticoagulation in a high-risk patient could prevent death from major thrombotic event

General Surgery

CASE SUMMARY

A patient age 61 transitioning from male to female presented to a regional hospital with a 2-week history of abdominal pain, urgency and dark stools. A computed tomography (CT) scan showed portal and superior mesenteric venous thrombosis and bowel oedema. The patient was promptly anticoagulated with intravenous (IV) heparin and transferred to a tertiary hospital.

Some 5 months previously, the patient had been investigated for atypical chest pain. The patient was known to have anticardiolipin antibodies. Other risk factors for thrombosis were hypertension, hyperlipidaemia, smoking, high alcohol intake and hormone replacement therapy. On admission to the regional hospital, the patient was polycythemic (haemoglobin [Hb] 16.9 g/L) but it was not clear if this was acute or long-standing. Despite these significant thrombotic risk factors, the patient did not appear to be taking any regular prophylactic anticoagulants.

The patient was managed nonoperatively with IV heparin in a tertiary intensive care unit (ICU) setting. The initial infusion dose was found to be subtherapeutic. This was appropriately corrected. The patient showed signs of clinical deterioration approximately 48 hours after transfer. As serum lactate increased, concerns were raised regarding the possibility of abdominal compartment syndrome, so an emergency laparotomy was performed.

At laparotomy the small bowel was found to be oedematous but entirely viable; no resection was required. The abdomen was closed with a temporary vacuum-assisted closure device. Two days later, upon planned re-look laparotomy, a segment of small bowel was resected due to evidence of necrosis. The patient also developed hepatic encephalopathy and required dialysis for renal failure. Three subsequent planned re-look laparotomies took place at 48-hour intervals, each requiring further resection of the small intestine.

After a week of convalescence, the patient again deteriorated. A repeat CT scan demonstrated the progression of thrombosis and further bowel ischaemia. The patient's family indicated that in the unlikely event that the patient survived,

their inevitable disability and poor quality of life would be unacceptable. After discussion and consensus agreement, active treatment was withdrawn and the patient died a few hours later.

DISCUSSION

The care provided by the medical and surgical teams was appropriate in this case. Treatment of the patient was timely and there was evidence of consultant-led decision-making, both within the surgical department and with other contributing specialties.

The treating surgeon commented that the patient had been discussed at the unit morbidity and mortality meeting, where it was noted that the coordination of care for this critically unwell patient was facilitated by extensive and appropriate consultant involvement. It was agreed by the unit that there was nothing more that could have been done surgically to alter the patient's outcome.

The course-to-death text was 'copied and pasted' directly from the discharge summary, presumably written by a junior medical officer. This discharge summary did not comment on the initial subtherapeutic heparin infusion and gave the impression that withdrawal of treatment was due to a lack of progress rather than further deterioration. This also suggests that the surgeon did not personally review the patient records when completing the surgical case form.

CLINICAL LESSONS

Patients with anticardiolipin antibodies should receive long-term prophylactic anticoagulation to reduce the risk of life-threatening thrombotic events. In 'simple' cases, aspirin will often be sufficient; however, this patient's thrombotic risk was significantly increased, secondary to the multiple risk factors listed above. In retrospect, this oversight was a likely contributor to this patient's demise, despite the best efforts of the treating team.

Case 2: Failed overnight extubation after cardiac surgery triggers downward spiral

Cardiothoracic Surgery

CASE SUMMARY

As part of a workup for renal transplantation, a 51-year-old man was found to have triple vessel coronary artery disease. His left ventricle was mildly impaired. He had previously suffered a non-ST-elevation myocardial infarction and occasional angina. He had dialysis-dependent end stage renal disease on the background of longstanding diabetes. He also suffered from cataracts and hypertension.

The patient underwent coronary artery bypass graft surgery, with 4 grafts placed using an off-pump technique. The anaesthetic record of a preoperative transthoracic echocardiogram indicated severe left ventricular dysfunction with an ejection fraction of 24%. The operation was reportedly uneventful. The ICU admission noted an improvement in left ventricular performance. A few hours after return to ICU, the patient developed excessive chest drainage. At the unplanned return to theatre the sternal wire used to close the chest was found to have perforated the right internal mammary artery. This was repaired and the patient returned to ICU. Extubation was planned for later that night. There was no further bleeding, the patient was haemodynamically stable on minimal support and investigations were unremarkable. At 02:00 he was considered suitable for extubation, having met all criteria.

Shortly after extubation, the patient complained of difficulty breathing and lost consciousness. He became hypoxic and was reintubated. Initially, satisfactory gas exchange and blood pressure were achieved on some support. There were further episodes of hypoxia and hypotension with ischaemic changes on echocardiogram. A cardiac arrest occurred and cardiopulmonary resuscitation began. The rhythm was non-shockable. The chest was re-opened as per cardiac advanced life support (CALS) protocol; no evidence of bleeding causing haemodynamic compromise was seen. The heart was dilated with no activity. Following a period of internal cardiac massage and some intra-aortic adrenaline, a stable rhythm returned. The chest was closed and the patient underwent a CT brain scan. There was no evidence of a bleed. There had been approximately 20 minutes of downtime during which the massage did not generate an adequate cardiac output. The patient was returned to ICU for dialysis and temperature management. A CT cerebral angiography and perfusion scan showed no anomaly of the cerebral vasculature and no evidence of diminished perfusion.

The patient was subsequently managed expectantly. Magnetic resonance imaging (MRI) a few days later confirmed global hypoxic injury to the brain. Repeated clinical assessments, which included a neurology opinion, showed evidence of irreversible global cerebral injury. An electroencephalography confirmed diffuse neurological injury. The patient remained in a persistent vegetative state. He underwent regular citrate dialysis. Following a period of excellent expectant management, the patient developed sepsis and passed away.

DISCUSSION

There are several areas for discussion in this case.

Unplanned return to theatre

This issue was recognised quickly and the bleeding source dealt with promptly. Red cells and prothrombinex were given in view of the renal impairment. Re-exploration occurs in up to 7% of cases and this was managed entirely appropriately.

Failed extubation leading to cardiac arrest

By all accounts, the patient was awake, alert, and had good muscle strength and cough immediately prior to extubation. He was reviewed by a medical officer and met all the criteria for extubation, that being:

- minimal underlying disease process (patient on low dose inotrope)
- gas exchange satisfactory, appropriate respiratory rate on pressure support ventilation; satisfactory FiO2 (fraction of inspired oxygen <40%) and SaO_2 (arterial oxygen saturation >85%)
- reversal of sedation with good muscle strength, adequate cough
- neurologically satisfactory (Glasgow coma scale [GCS] 14–15).

Despite appearing suitable for extubation, the subsequent events make one wonder whether extubation was appropriate, given the history of renal failure and the bleeding episode earlier.

Much has been written regarding the policy of overnight extubation. In an analysis of some 40,000 patients undergoing cardiac surgery in 2 eastern states in USA (Virginia and North Carolina), Krebs et al concluded that extubation 'after hours' was not associated with increased morbidity, mortality or reintubation rates.[1]

Haemodynamic collapse following extubation

Changes associated with weaning leading to global myocardial ischaemia have been well described. Reduction of preload and afterload can unmask silent ischaemia, leading to pulmonary oedema. Long-standing diabetes, as present in this patient, leads to small vessel dysfunction, which was likely triggered immediately after extubation. Despite CALS being instituted, cerebral hypoxia followed, with a severe ischaemic injury to the brain. On opening the chest, the heart was described as asystolic and grossly dilated, indicative of a major cardiac ischaemic event. Coronary bypass deals with the epicardial vessels but has minimal effect on the intramural circulation.

Could this have been predicted or prevented?

In a recent review of weaning failure, Routsi et al provide a sequence of likely events that may occur in some patients.[2] While diabetes is not specifically listed as a risk factor, this must be considered. In this case, the poor preoperative ventricular function may have been an alarm bell. Although Routsi et al describe a detailed plan for management, this was unlikely to be applicable in this case or possible at 02:00.

In another study, San Filippo et al conclude that worse diastolic function was associated with weaning failure.[3]

CLINICAL LESSONS

This was an unpredictable sequence of events. Explanations can be offered, as above, but once set in motion the course was probably irreversible. The cerebral circulation in the post-arrest period was unable to be supported, despite internal massage. The subsequent events and death resulted from irreversible ischaemic cerebral damage.

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Case 3: Undiagnosed postoperative gastric overdistension

Urology

CASE SUMMARY

A man age 68 was transferred from a regional hospital to a major teaching hospital after presenting with renal failure secondary to bilateral hydronephrosis from a large bladder mass. The patient was in renal failure and hyponatraemic. He had a background history of controlled schizophrenia with type II diabetes. He also had a long history of primary polydipsia. On presentation, there was an element of atrial fibrillation (AF) and cardiac impairment. The patient was treated with nephrostomy tubes to stabilise renal function, followed by a resection of the bladder mass, which confirmed a muscle invasive bladder cancer. Once the patient was stabilised, a decision was made to proceed to a radical cystectomy and ileal diversion for the primary bladder cancer.

The operation was uneventful and the patient was admitted to ICU. On postoperative day 1, he was treated for fast AF and required noradrenaline support. It was noted that the patient was passing flatus on the first day; postoperative instructions stated diet as tolerated. On the morning of postoperative day 3, noradrenaline was ceased. The patient was mobilising and tolerating diet and had drunk 2.5 L of fluid, presumably related to his primary polydipsia. He was due to be transferred to the ward but developed anuria in the afternoon. There was no note of stomach distension; he was scheduled for review by the surgical team. Chest X-ray (CXR) confirmed air under the diaphragm, a massively distended stomach and dilated small bowel. A nasogastric tube (NGT) was inserted, which drained 3.5 L of fluid. An urgent laparotomy was undertaken on the evening of postoperative day 3, where a massively distended stomach was noted and a further 2.5 L of fluid was drained by a larger tube. There was no obvious small bowel perforation, but there was a disruption of the ureteroileal anastomosis, which was sutured.

Following this second procedure, the patient required noradrenaline for 3 days, but very little note was made regarding gastrointestinal function. His urine output deteriorated, and creatinine levels from the drain were positive for urine, suggesting another urine leakage, most likely from the anastomosis. This was treated with bilateral nephrostomy tubes.

The day after nephrostomy tube insertion, the patient succumbed to a massive aspiration pneumonia after vomiting—despite having an NGT in place. After discussing goals of care with the family, treatment was withdrawn and the patient passed away.

DISCUSSION

There were no issues with the diagnosis, work-up and decision to undertake the original operation. The turning point was the gastric distension.

Historically, toxic gastric dilation was not infrequent. It was a well-recognised cause of death—the subject of a Hunterian Lecture delivered by Sydney surgeon Kenneth Starr at the Royal College of Surgeons of England in 1952.

The proposed pathophysiology is that as the stomach dilates, the vagus nerve is stimulated, causing bradycardia, hypotension and the often-seen associated sweating. If not treated promptly this can lead to asystolic arrest, likely followed by reflux and aspiration. Continuing vagal stimulation makes restarting the heart notoriously difficult.

Improved perioperative care, including preoperative optimisation, early mobilisation, early feeding, better electrolyte control, administration of prokinetic drugs and avoidance of drugs such as opioids that paralyse the small bowel, has almost completely eliminated the condition of toxic gastric dilation. The advent of ERAS (enhanced recovery after surgery) has been associated with the avoidance of a nasogastric tube (NGT) or its very early removal. There is general agreement that early oral feeding after bowel surgery has major advantages; however, there needs to be a high index of suspicion in patients who are only 1–3 days postoperative when oral feeding commences.

Diagnosing gastric overdistension is not straightforward. Early recognition is often not easy as the signs are subtle and in the context of a postoperative patient, not easily discernible. ICU documentation notes that this patient was passing flatus, but no comments were made regarding the patient's abdomen in particular, or the presence or absence of any abdominal distension. Gastric overdistension can occur with good bowel sounds and the passage of flatus, and can be hard to detect without an index of suspicion. Identifying the gastric distension at an early stage may have reduced the possibility of the patient's subsequent complications. It was only when the patient vomited and had a CXR that the dilation was discovered. Once the stomach is emptied the vagal stimulation is removed and the patient normally improves within minutes.

A high index of suspicion is required and if gastric overdistension is suspected, replacement of the NGT should occur immediately and not be delayed by confirmative radiology. The gastric distension in this case was possibly exacerbated by the patient's history of primary polydipsia; if he was given unlimited access to fluids then his fluid intake may have been much greater. Either way, the gastric distension was significant and may have contributed to the disruption of the anastomosis, requiring the second laparotomy. Certainly, the gastric distension did contribute to the patient's demise due to the massive aspiration pneumonia.

Many years ago a bedside examination of the abdomen was the standard of care for every patient post-abdominal surgery. Perhaps regularly looking for abdominal distension may have resulted in earlier insertion of an NGT and reduced the patient's very high oral water intake early in his postoperative recovery.

CLINICAL LESSONS

It is almost certain that this patient had a toxic gastric dilation, which is highly lethal and historically has been a major cause of death.

Although now rare, toxic gastric dilation can still occur. Diagnosis requires a high index of suspicion; treatment requires the immediate placement of an NGT.

Case 4: Thrombosis and bleeding complication following hysteroscopy

Gynaecology

CASE SUMMARY

A woman age 42 was admitted for day surgery (hysteroscopy and sampling) at a private facility for her long-standing and worsening menorrhagia, secondary to uterine adenomyosis/fibroids. There was a need to exclude endometrial cancer. A recent episode of chronic menorrhagia (Hb 35 g/L) required blood transfusion. She had sought fertility advice from several gynaecologists due to 3 previous miscarriages.

During surgery the patient had significant bleeding, requiring intraoperative insertion of 2 intrauterine balloons to stop the flow. Blood transfusion was required (3 units packed cells, 2 units fresh frozen plasma). Tranexamic acid (Cyklokapron 1 g IV) was administered in theatre and postoperatively (oral) as per protocol. Deep vein thrombosis (DVT) prophylaxis included sequential compression devices (thromboembolic deterrent stockings), continuous calf compressions and enoxaparin sodium (Clexane) 12 hours postoperatively.

On postoperative day 1, the patient expressed left leg and calf pain. A venous doppler ultrasound and CT scan were performed, which showed no abnormality detected; no DVT seen. On postoperative day 2, the intrauterine balloons were removed in theatre. The patient had further bleeding, requiring bimanual compression, tranexamic acid and flow seal to cease. On postoperative day 3, the patient collapsed on the ward, secondary to a massive pulmonary embolism. She was transferred to ICU for extracorporeal membrane oxygenation (ECMO). On postoperative day 4, the patient showed signs of neurological deterioration. After appropriate discussion with the family, treatment was withdrawn and the patient passed away in the late afternoon.

The case was referred to the coroner, with the cause of death confirmed as pulmonary embolism.

DISCUSSION

This patient, with significant menorrhagia and known fibroid uterus equal in size to a 24-week gestation, was booked electively for hysteroscopy and endometrial sampling to exclude cancer. Recent history of blood transfusion, aspirin (non-prescribed), Provera and tranexamic acid may have added to her preoperative risk.

No deficiencies of care were found. Dosing of tranexamic acid was given due attention and its use appeared to be entirely within usual protocols. Both procedures were undertaken with care and consideration of the situation. Appropriate withdrawal of care occurred (signs of brain death) after discussion with the family. The case was appropriately referred to the coroner.

Consideration of preoperative review by a vascular surgeon may have assisted in defining the potential risks and understanding the expectations of the patient and her family. In hindsight, perhaps a venogram to provide a better view of the common iliac vein (as the patient had a large uterus) may have diagnosed thrombosis a little earlier. However, this was unlikely to have changed the outcome, unless a filter could have been inserted in the inferior vena cava.

The only other possible alternatives—if bleeding did not cease with balloon catheters—were either to embolise the uterine arteries or perform a hysterectomy in an unconsented 42-year-old woman who wished to have children. Neither procedural alternative would have necessarily prevented the risk of a thromboembolic event in this patient.

CLINICAL LESSONS

This case highlights the difficulties of care when there is a potential for thrombosis in the context of life-threatening bleeding even in a young, relatively healthy patient.

Case 5: Open repair of an infra-renal aortic aneurysm

Vascular Surgery

CASE SUMMARY

A man age 81 presented to hospital for elective open repair of a 5.4-cm infra-renal aortic aneurysm. He was not considered suitable for endovascular repair. A tube graft was inserted at 09:00 on the day of admission and he was discharged to ICU.

Later that day, it was apparent that the patient had developed sensory motor deficit in his lower limbs with acute ischaemia of both legs. He was returned to theatre at 18:00 for a re-look laparotomy, where an acutely thrombosed graft was found with a false lumen dissecting into the left iliac artery. A thrombectomy was performed. The graft was extended into both iliac arteries with endarterectomies and embolectomies performed and a left calf fasciotomy for compartment syndrome. Circulation appeared to have been restored to both legs and the patient was returned to ICU.

The patient subsequently developed anuric renal failure secondary to rhabdomyolysis compartment syndrome that required treatment. He was also on pressure support. He was initially extubated but aspirated during a CT scan 2 days later. This caused aspiration pneumonitis, resulting in reintubation. He was haemodynamically unstable and required high dose inotropes and fluid resuscitation. Ventilation remained difficult, resulting in hypoxia. Renal function continued to deteriorate, prompting a family discussion resulting in a joint decision for withdrawal of treatment. The patient died on postoperative day 4.

DISCUSSION

This case highlights the fact that elderly patients have limited ability to tolerate complications. The return to theatre for a re-do surgery with fasciotomy precipitated this patient's decline and eventual death.

The decision on whether to perform a tube graft or a bifurcated graft can be heavily influenced by intraoperative findings regarding the condition of the aortic bifurcation and the iliac arteries. A tube graft is likely quicker and easier to perform in an 81-year-old man, but given the complication that occurred, a bifurcated graft may have been more appropriate in hindsight. Initial inspection of the arteries should have indicated this.

From a technical point of view nothing inappropriate occurred during this patient's care. The main concern is intraoperative decision-making, which can be difficult

when the objective is to complete the operation quickly. However, it should be borne in mind that sometimes, if the arteries aren't suitable for a tube graft, a bifurcated graft may be the better option.

CLINICAL LESSONS

Situational awareness needs to be maintained when operating, so surgeons remain cognisant of what will result in the best possible outcomes for their patients.

Case 6: Bilateral oophorectomy for advanced ovarian cancer

Gynaecological Surgery

CASE SUMMARY

A woman age 60 was admitted to hospital, where she was diagnosed with stage 3 ovarian cancer. Notable medical history included diabetes mellitus, previous LLETZ (large loop excision of the transformation zone) for high-grade dysplasia, breast reduction surgery, vaginal hysterectomy and rectopexy. At laparotomy the cancer was found to be more advanced than expected—with large omental cake densely adherent to the transverse colon, spleen, small bowel, mesentery, serosal surfaces and diaphragm—and deemed not amenable for resection. A bilateral oopherectomy was performed and the patient was returned to the ward.

Following the operation, the patient appeared otherwise well. She was due for discharge, when a medical emergency team (MET) call occurred on postoperative day 8 in response to abdominal distension. A return to theatre for exploratory laparotomy found no collection. A subsequent MET call in response to tachycardia and hypotension resulted in the patient being admitted to ICU for vasopressor support and fluid resuscitation. Her admission was further complicated by bilateral non-obstructing pulmonary thromboemboli, bi-basal pleural effusions, lung consolidation and *Clostridium difficile* colitis (secondary to antibiotic therapy). Despite medical intervention the patient developed multiorgan failure. Following discussions with the patient's family, treatment was withdrawn and she died.

DISCUSSION

There appear to be considerations at each stage of this patient's management. A preoperative anaesthetic assessment seems not to have occurred and there are inconsistencies with the reported medical history. There was an appropriate referral to endocrinology (by gynaecology) due to her badly self-managed diabetes mellitus, although no mention was made of the preoperative basis for this referral, which resulted in her being accepted with a routine timing of greater than 30 days.

While no technical issues are apparent with the operation itself, it is not clear why she was not operated on by the gynaecology oncology unit, given the clinic notes state that a pelvic mass was felt, as well as a friable area at the vault, and it was concluded that she likely had an omental cake. A request for gynaecology oncology involvement after the operation was noted.

Postoperatively, there is a concerning lack of detail in the notes regarding tests ordered, communication with other medical teams and documentation of antibiotic therapy. Despite this, her management by ICU appears to have been appropriate.

CLINICAL LESSONS

Effective communication between medical and surgical teams and with supervising consultants is particularly important when managing complex patients. When ovarian cancer is suspected, early referral to a gynaecological oncologist is recommended. Improved survival has been demonstrated with early referral to gynaecological oncological units.

Many of these cases are managed with image-guided biopsy followed by neo-adjuvant chemotherapy before proceeding to definitive surgery. This has been shown to decrease morbidity and perioperative mortality.

Case 7: Ruptured abdominal aortic aneurysm

Vascular Surgery

CASE SUMMARY

A man age 81 presented to the emergency department (ED) 3 days after open repair of a left inguinal hernia. Around 21:30 he experienced sudden onset of severe abdominal pain and phoned the ambulance service, which brought him to hospital. He was registered at 23:34 at the ED, where he was seen by a medical intern who documented severe ongoing pain radiating to the back but with no hypotension or tachycardia. Blood pressure was noted to be fluctuant by the ambulance service but recovered upon admission. Differential diagnoses of renal colic and constipation were provided at this stage. The patient was noted to have a history of AF on rivaroxaban. There was no comment regarding other medications.

At 04:15 on day 1, the patient was examined by an ED registrar, who noted severe pain and hypotension. The patient was transferred to the resuscitation area and an abdominal ultrasound demonstrated an 8-cm abdominal aortic aneurysm with likely rupture. Vascular surgeons attended with a plan to proceed straight to theatre. At 04:37, the patient lost consciousness with no cardiac output noted. Cardiopulmonary resuscitation (CPR) commenced and the patient was taken to the operating theatre for an open repair.

The operation began at approximately 05:00. Cardiac output was restored after application of an aortic clamp. The patient's abdomen was left open and he was returned to theatre the next day for closure. In ICU the patient underwent continuous renal replacement therapy for acute kidney injury. Postoperatively, unequal pupils were noted and a brain CT scan demonstrated multifocal infarcts in the right frontal lobe, both occipital lobes and cerebellar hemispheres, likely related to hypovolaemic shock and CPR. Neurological recovery after 72 hours without sedation was minimal. A family meeting was held and withdrawal of treatment initiated. The patient died after extubation, 7 days after presentation.

DISCUSSION

It is unclear from the notes provided whether ED ramping had occurred and what triage category the patient had been placed in upon arrival. A ruptured abdominal aneurysm carries a dismal prognosis, but it is possible that this death could have been prevented had the diagnosis been made on presentation to the ED, rather than when the patient ultimately deteriorated almost 5 hours later.

Once the diagnosis was made, treatment was expedient and appropriate and did not contribute to the patient's death. There are some areas of concern prior to the diagnosis.

- The notes lack clarity regarding where the patient was physically located. There are no notes from ED staff to say whether the patient was in an emergency-room bed. The first-line assessment form suggests that the patient was ramped in an ambulance until he became haemodynamically unstable.
- The patient had had abdominal surgery 3 days prior to admission. It is unclear whether the patient had previous imaging that demonstrated the aneurysm or whether the surgeon who operated on the patient's hernia had examined the patient's abdomen preoperatively.
- The patient was of an age group where ruptured aneurysms have to be considered in the event of severe abdominal pain with fluctuating blood pressure. There is no comment in the notes to suggest that this was a differential diagnosis.
- The patient was seen by a medical intern on arrival in the ED. An 8-cm aneurysm would be expected to be clinically palpable, suggesting the abdomen was not examined.

The patient ultimately died due to complications of haemorrhagic shock, namely widespread ischaemic cerebral events.

CLINICAL LESSONS

There were multiple opportunities in this case where earlier intervention may have resulted in a more positive outcome. It is difficult to believe that an 8-cm aneurysm would not be clinically palpable intraoperatively or not be detectable when the patient was being prepared for hernia repair. This suggests an over-reliance on scan results for diagnosis.

The clinical presentation of an abdominal aortic aneurysm can mimic virtually any intra-abdominal pathology. Renal colic is a frequent misdiagnosis in these scenarios, to the point that the possibility of a ruptured aneurysm should be excluded before renal colic is considered.

This case highlights the importance of timely review and of senior clinician input into management of such cases. The delays that occurred rendered the outcome unavoidable.

Case 8: Compromised patient with multiple pathologies—a case for multidisciplinary care

Otolaryngology Head and Neck Surgery

CASE SUMMARY

A man age late-50s presented with ongoing face and neck pain and left facial swelling. He had received prednisone for the swelling several months earlier with no response. On admission the patient declined a sandwich saying that he could not open his mouth enough to chew. He was noted to have weight loss from 65 kg to a current weight of 47 kg.

The patient had a history of T3N2 (tumour 3 node 2) tongue squamous cell carcinoma treated 24 months prior to this admission by left hemiglossectomy and bilateral neck dissection accompanied by a postoperative course of radiotherapy. He was a habitual smoker with a history of alcohol withdrawal-related seizures and multiple presentations due to alcohol consumption.

The patient was admitted under the care of the gastroenterology team, due to self-reported intermittent melaena and Hb 73 g/dL on admission; white cell count (WCC) 10 x 10^9/L. ENT (ear, nose and throat) review noted the presence of trismus (reduced jaw opening of 1 cm) and the neck exhibiting swelling and 'post-treatment changes'. It was planned to review the patient in the head and neck clinic—keeping a previously arranged appointment scheduled 3 days after admission.

On day 1 of admission, the trismus—ascribed to mandibular necrosis—prevented oral oesophagoscopy. This was the patient's third admission with the problem of inadequate oral intake; management with nasogastric feeding had been employed previously. The patient reported throbbing oral pain and black bowel actions. It was decided to manage the melaena conservatively.

At 20:00 on day 2, a CT scan suggestive of osteonecrosis of the jaw with soft tissue collection was reported. Blood cultures were taken prior to commencement of IV flucloxacillin; C-reactive protein (CRP) was 159 mg/L. No obvious dental origin of infection was identified by oral surgery review. The medical team considered the patient to be stable enough to await the previously arranged ENT clinic the following afternoon.

On day 3 of admission the ENT team advised of an additional finding of metastatic disease in the right lung. At 18:00, the ENT consultant noted: 'fine needle aspirate yielded 0.5 ml frank pus from the left submandibular area'.

On day 4 of admission the patient underwent incision and drainage of a left submandibular abscess and insertion of an NGT under general anaesthesia. Trismus persisted post-drainage and insertion of drains. Multiple electrolyte disturbances were noted on day 5 and acute medical unit management of electrolytes was conducted (2 packs of red blood cells etc.). On day 6, turbid fluid was noted in the drain after sipping water, raising the possibility of an orocutaneous fistula; Hb was 100 g/dL.

The NGT was removed on the afternoon of day 7. The patient was reviewed by a night intern as 'nil per ng' except for vitamins, with all other meds IV, so attempts to reinsert the NGT were postponed until the following day.

At 05:00 on day 8, the patient asked that the NGT insertion be delayed. This occurred later in the day after 10 attempts, with CXR confirming the NGT tip in situ. WCC was 18.8 x 10^9/L on IV ampicillin and oral fluconazole with liver function tests worsening. A MET call occurred at 10:07 for tachypnoea (24 bpm), with oxygen levels desaturated to 70% and increased work of breathing. A peripherally inserted central catheter (PICC) line was inserted at 15:00 and a radiologically inserted gastrostomy (RIG) was planned. A second MET call occurred at 20:57 for repeat respiratory distress and cyanosis of fingers.

At 02:00 on day 9, the family was advised that CT changes indicated neoplasia, not clots, whereupon the family decided not to pursue further medical intervention in ICU. The patient died at 11:50 before transfer to palliative care.

DISCUSSION

This patient's management did not significantly alter the ultimate outcome of death from respiratory failure secondary to pulmonary neoplasia and effusion (and possible aspiration), on a background of previously treated squamous cell carcinoma of the tongue, acute infection around osteoradionecrotic jaw bone, cachexia/malnutrition, anaemia and history of tobacco and alcohol use.

An area for consideration where care might have been more timely, relates to communication between clinical teams and the elapsed time to review the radiological finding of a collection. The CT scan identified the presence of the submandibular abscess on the evening of day 2, but the ENT team did not physically review the patient until the booked ENT clinic appointment on day 3. The aspiration of the abscess did not occur until about 18:00, with formal surgical drainage occurring the following morning on day 4.

When a patient presents with a significant ENT component underlying another acute problem, such as occurred with this patient's anaemia, significant weight loss and melaena, ongoing expert multidisciplinary care of the patient's multiple problems may be of benefit. Joint admission, hence joint responsibility for a patient's care, or admission under the team looking after the acute problem with a promise that the ENT team will remain involved (minimum of daily morning ward rounds to monitor the patient's ENT condition with early ENT contribution as the admission evolves) are alternative pathways that could have been taken in this case.

The swelling noted at presentation may have indicated an earlier CT scan request to investigate the increasingly limited opening of the jaw and ongoing severe pain. Daily ENT ward rounds may have resulted in the jaw and neck CT scan being requested earlier; however, it is unlikely this would have impacted the ultimate clinical course.

Regarding the time of day of the surgical intervention, given this patient's trismus, cachexia and chest findings consistent with metastatic disease, drainage of the abscess at night—rather than the following morning when the procedure could be performed in a fully staffed operating theatre block (extra anaesthetic hands available)—seems justifiable and unlikely to have significantly affected the ultimate respiratory failure. Multiple electrolyte disturbances noted on day 5 post-admission (postoperative day 1) were managed in an appropriate fashion.

Regarding end-of-life planning, the timing of discussion around advanced care directives is an area of consideration. The patient's respiratory distress prompted 2 MET calls on day 8 post-admission (day 4 post-surgical drainage of the abscess). By the time a family meeting was called at 02:00 on day 9 (postoperative day 5) to advise of the pulmonary findings on CT scan (metastases, consolidation) and discuss further management options, the patient was deemed unable to sensibly participate in planning his own end-of-life care. The family stated that he had lost his will to live prior to this admission, thus the family decided on palliative care. The patient died around midday on day 9.

CLINICAL LESSONS

Retrospective case reviews benefit from looking at a case with hindsight, compared to the gradual evolution of a clinical picture over time. Areas for consideration in this case include timely communication between clinical teams and early discussions around end-of-life planning and advanced care directives.

Case 9: Delay in recognition of perioperative iatrogenic bowel injury

General Surgery

CASE SUMMARY

A woman age 79 was admitted for elective laparoscopic caecectomy for sessile serrated adenoma involving the appendiceal orifice.

Multiple adhesions were found at laparoscopy with division of some adhesions in the right abdomen. A transverse right iliac fossa abdominal open conversion was performed, followed by a staple caecectomy. Postoperatively, the patient remained stable without any significant pain or concerning features.

At 06:28 on postoperative day 1, the patient was noted to be confused; other observations were stable. The treating surgeon also noted the confusion with no other critical features. Nursing notes during the day and into the early evening state that the patient had slight confusion, poor urine output and tachypnoea. The treating surgeon reviewed the patient and ICU staff were to be notified. At 22:24 the ICU registrar/registered medical officer (RMO) reviewed the patient, noting confusion, tachypnoea, stable blood pressure, and a distended but soft and non-tender abdomen.

At 06:37 on postoperative day 2, the ICU registrar noted the patient to be increasingly hypoxic and tachypnoeic, requiring continuous positive airway pressure. CXR showed bi-basal atelectasis. A central venous catheter was inserted and CXR review by the ICU registrar noted it to be in a good position with no pneumothorax. The CXR reports suggest a large volume of free gas below the diaphragm, with nothing in the clinical notes to indicate that this was identified or acted upon by the treating team. The patient's condition declined further with development of severe metabolic acidosis, acute kidney infection and delirium with sepsis from either a chest or gastrointestinal tract origin considered. The patient was reviewed by the surgeon, noting that intra-abdominal sepsis needed to be excluded with a CT scan. Intubation revealed faeculent fluid in the airways, leading the ICU RMO to conclude that the patient had aspiration pneumonia and sepsis with high vasopressor requirements and dialysis required. A CT reported at 13:00 noted a large volume of free gas and fluid.

At 17:45 on postoperative day 2 a laparotomy was performed, finding gross intraperitoneal sepsis, mid-ileal perforation and ischaemia of the right colon. A small bowel resection and right hemicolectomy as a damage-control laparotomy was performed. A laparostomy dressing with sponges and adhesive drape dressing was created. Vasopressor requirements reduced postoperatively; however, the patient was severely unwell with ongoing metabolic acidosis, acute kidney infection requiring dialysis, liver failure and disseminated intravascular coagulation.

On the morning of postoperative day 3, the treating surgeon noted the patient to be very unstable with a possible re-look laparotomy required if her condition did not stabilise. A large volume of dark fluid pooling under the abdominal dressing was noted by ICU staff.

On postoperative day 4, the patient remained severely unwell. A planned return to theatre occurred, with the treating surgeon considering ischaemic bowel as a possibility. A second surgeon assisted for this procedure. At laparotomy, extensive patchy necrosis of the entire small bowel to the transverse colon was found. It was decided that the extent of the necrosis was incompatible with life. No further intervention was performed. Appropriate discussion with the patient's family was conducted and withdrawal of care commenced. The patient died on postoperative day 4 and the case was referred to the coroner.

DISCUSSION

This patient died of sepsis with multiorgan failure and small bowel ischaemia related to an iatrogenic small bowel perforation. The main factor leading to the death of the patient was delay in the diagnosis of the postoperative small bowel perforation. The retrospective assessment by the treating surgeon was insightful, honest and appropriate, and addressed the main issues of concern.

The operation initially performed was appropriate, and an open conversion when extensive adhesions were found was performed. An iatrogenic injury to the small bowel is a recognised complication of a division of adhesions either laparoscopically or as an open procedure. A midline approach may have revealed the injury more readily, but the chosen right iliac fossa transverse incision seemed a reasonable option. The treating surgeon did reflect that an earlier conversion to an open procedure should have been considered.

Confusion of a previously well patient was recognised, being an early sign of possible systemic deterioration. However, there were no other concerning features initially, including an examination noting no evidence of abdominal tenderness on postoperative days 1 and 2. Subsequent signs of deterioration focused on the patient's respiratory function and possible aspiration. This represents a diagnostic dilemma, but also there may have been a 'premature closure' or 'attentional tunnelling' decision-making error with the focus on aspiration pneumonia as the only cause of sepsis. More detailed documentation of the abdominal examination may have been useful. A missed opportunity by

ICU staff seems to have occurred, in that a CXR showing a large volume of free gas was not identified and if known may have prompted an earlier laparotomy. This was reflected upon by the treating surgeon in the appraisal. A CT scan was ordered because of the diagnostic uncertainty. There is ongoing debate regarding the utility of CT scanning of the abdomen in the early postoperative phase and potential delays to surgery that this may cause, versus early return to theatre.

An appropriate damage-control laparotomy was performed. Ischaemia of the right colon was a concerning feature, possibly reflecting global hypotension, vasopressor effect or more localised superior mesenteric artery or ileocolic thrombosis related to disseminated intravascular coagulation. An earlier return to theatre for the consequent laparotomy could have been considered, given the patient's ongoing severe sepsis, pooling of dark fluid under dressings and the style of laparostomy dressing without use of vacuum pump. Decision-making at the second laparotomy with global ischaemia was appropriate and the inclusion of a second surgeon is strongly supported. The finding indicated severe ischaemia in the superior mesenteric artery/middle cerebral artery distribution potentially from the abovementioned causes.

CLINICAL LESSONS

Systemic issues in this case include a 'failure to rescue' (a common factor related to postoperative mortality) and the risk of 'early closure' or 'attentional tunnelling' diagnostic errors where the focus was primarily on a respiratory cause of decline rather than an intra-abdominal complication. This may have also led to a missed opportunity related to the review of a critical CXR.

Systems should be reviewed to allow for appropriate review of radiology imaging in a critically unwell patient, review of radiology reports in a timely fashion and possibly radiology services creating an alert mechanism for critical findings on imaging.

Case 10: Timing critical for management of large intracranial mass lesions

Neurosurgery

CASE SUMMARY

A man age mid-40s was admitted with headaches and neurological deterioration. Imaging suggested malignancy within the right temporal lobe with associated significant mass effect and shift of midline structures. On admission, the patient appeared to be alert and was appropriately treated with dexamethasone.

MRI seemed to confirm the working hypothesis of a high-grade glioma within the right temporal lobe. Semi-emergent surgery was scheduled for day 5 post-admission to debulk the lesion; however, on day 3 (public holiday) the patient deteriorated neurologically. He was initially confused before possibly suffering a seizure. He was hyponatraemic, with the hyponatraemia changing from the previous days. This was managed with fluid restriction. The patient was kept under close observation in the neurosurgery ward.

In the early hours of the following day (day 4), the patient was found to have had a catastrophic deterioration in neurological status between periods of observation. He had fixed dilated pupils and was classified GCS 3. A MET call occurred, and the patient was intubated for transfer to ICU. A repeat CT scan looked similar to those taken the previous day, with ongoing mass effect from the tumour and diffuse cerebral oedema. ICU staff confirmed the observation of bilateral fixed dilated pupils.

The morbidity and mortality risk of immediate surgery was considered, in view of the persisting hyponatraemia. The patient may have been in status epilepticus. Hypertonic saline and anticonvulsant therapy were administered. Serial neurological examinations across the day showed no improvement. A CT brain scan with CT cerebral angiography demonstrated no cerebral blood flow, indicating brain death.

DISCUSSION

It is well known that patients with such significant intracranial lesions are at risk of catastrophic deterioration in the event of a seizure. However, in the absence of objective evidence of a seizure prior to presentation, it would be reasonable to withhold prophylactic anticonvulsants for patients with malignant gliomas. In some situations, anticonvulsant medications can be considered where a seizure event might lead to catastrophic consequences. It is unclear from the medical

records when the hyponatraemia was diagnosed, how low the serum sodium level had dropped and whether prophylactic anticonvulsants were considered.

Ultimately, the decision not to proceed with surgery was appropriate because the patient had bilaterally fixed and dilated pupils by the time he was intubated and admitted to ICU. It seems there was a small window of opportunity to take the patient to theatre on day 3 (public holiday) when he appeared to show initial signs of neurological deterioration. This window of opportunity to perhaps allow a different sequence of events to unfold was missed. Any discussions that may have taken place between the on-call registrar and the on-call neurosurgeon are unclear.

CLINICAL LESSONS

This challenging case illustrates the importance of concise communication between trainees, treating specialists and on-call specialists, as well as the importance of handover. Often a narrow window of opportunity exists to operate on intracranial mass lesions. Earlier surgery in this case may have produced a different outcome.

Electrolyte monitoring for patients with brain tumours is paramount. Patients with large malignant gliomas and significant shift of midline structures should be considered for early craniotomy following a period of electrolyte monitoring and steroid administration.

Case 11: Improving communication; improving care

General Surgery

CASE SUMMARY

A woman age early-90s was admitted to a regional hospital for a fractured neck of femur. She had a history of asthma and chronic obstructive pulmonary disease (COPD). She was an ex-smoker and was malnourished.

On day 1 post-admission, the patient was transferred to a different hospital where she had surgery for the fracture and was admitted to ICU. She had no abdominal symptoms. Documentation by the treating orthopaedic team was poor. Rehabilitation was involved from postoperative day 6. The patient's chart indicated aperients. Her abdomen was soft and non-tender.

In the afternoon of postoperative day 7, there was an acute change. The patient had mild suprapubic pains and was in distress, requesting pastoral care. At 05:00 on postoperative day 8, the nursing staff noted that the patient had vomited and her abdomen was distended. ICU staff notified the visiting medical officer and formulated an appropriate management plan including CXR and abdominal X-ray, NGT (faeculent) and nil by mouth. A later note mentioned only the abdominal X-ray result, the charting of regular aperients and that the patient was drowsy with the physiotherapist.

On postoperative day 9, the patient was diagnosed with hospital-acquired pneumonia and acute renal failure (prerenal). A CT scan was performed at 14:40, with no documentation of the results in the daily note. In the early evening, a note of the X-ray report suggested mechanical obstruction and a request for general surgical review.

On postoperative day 10, the patient was reviewed by the general surgeon but further documentation is lacking. The notes suggest she was 'distended with high pitched bowel sounds' and 'CT-distal small bowel obstruction'. An NGT on free drainage was planned and Gastrografin was charted with a plan of: 'if no better, for theatre this evening'. Any further notes repeatedly state: 'awaiting surgery tonight'.

An emergency laparotomy and Hartmann's procedure was performed on the afternoon of postoperative day 10. The operation report was brief: 'Small hole in abnormal sigmoid colon. Hartmann's procedure performed. Return to ICU at 21:37.'

On postoperative day 1 from the second operation, the patient was reviewed by ICU, stomal therapy and nursing staff. No surgical review occurred. ICU notes the next day mention that the patient wanted to die. The stoma was noted to be dusky. An ICU entry suggested palliative care measures were to start via a syringe driver. There were minimal entries for day 3. The patient died on day 4.

DISCUSSION

This elderly patient had a high risk of death from a fractured neck of femur, particularly when complicated by an acute abdomen in the postoperative period. She had poor underlying nutrition but had expressed a desire to live. Although surgery was an option, relevant documentation was poor. In particular, neither the goals of care nor options regarding the shared decision to proceed to an emergency laparotomy were charted. The national emergency laparotomy audit (NELA) score and the patient's frailty score were not charted. The surgical documentation was inadequate. It is unclear whether palliative measures were even discussed.

Despite these inadequacies from the surgical team, the input from ICU and nursing staff was good and the patient was well supported.

CLINICAL LESSONS

This case highlights the need for proper discussion and documentation of a patient's values and goals of management, including the likely outcomes from emergency abdominal surgery in a comorbid 90-year-old. In this patient's case, the likelihood of death from a Hartmann's procedure needed to be discussed in the context of recent surgery for a fractured neck of femur, which, in itself, carries a high chance of death in this age group.

Case 12: Comorbidities and the elderly patient

Orthopaedic Surgery

CASE SUMMARY

A man age early-70s, frail with multiple comorbidities, was admitted to his local hospital after a fall at home. His medical history included end-stage renal failure (ESRF), for which he received regular haemodialysis; long-standing type 2 diabetes mellitus treated with insulin; and bilateral nonoperable ureteric malignancy managed by palliative care. He also suffered from obstructive sleep apnoea, hypotension, obesity and dyslipidaemia. He had been a heavy smoker.

On arrival at the ED he was reviewed by the orthopaedic, general medical and anaesthetic teams. He was admitted under the medical team, and operative planning and preoperative optimisation commenced. An advanced health directive was discussed and it was jointly decided that only ward-based care would be appropriate—advanced resuscitative measures or ICU admission would not be used. On the day of his admission, he was transferred to a tertiary referral hospital for planned surgical intervention for the broken hip.

On the morning of day 1 of his admission at hospital 2, a MET call was initiated for asymptomatic hypotension (60 mm Hg systolic). It was noted that the patient had an extensive medical history of longstanding asymptomatic hypotension, which was attributed to ESRF. He was given several intravenous fluid boluses without improvement in hypotension. Other reversable causes such as sepsis or substantial blood loss were excluded. On that basis, a decision was made by the MET and medical teams to alter the calling criteria.

Initially, the hemiarthroplasty was planned for day 2 post-injury (day 2 of admission to hospital 2). According to the notes, this was delayed by a day so the patient could undergo haemodialysis immediately prior to the operation. He was seen by the renal team on day 3 and scheduled for haemodialysis; however, there was a dialysis issue due to the ongoing low blood pressure, so it was decided to postpone dialysis until after the operation.

On the morning of day 4, a right hip cemented hemiarthroplasty was conducted under general anaesthetic. The procedure was performed by an orthopaedic principal house officer (service registrar) with another principal house officer (PHO) assisting. The orthopaedic consultant surgeon was not present.

The patient had an ASA (American Society of Anesthesiologists) score of 5E: a moribund patient not expected to survive longer than 24 hours without an operation. The surgery took approximately 2 hours. The patient was noted to be

persistently hypotensive throughout the procedure and a metaraminol infusion was administered. The patient was weaned from this in recovery. There were no intraoperative complications.

Over the 2 days following surgery, the patient developed ischaemic hepatitis with an increasing lactate level. He was seen every day by the general medical and renal teams. Given his gradual deterioration, further discussions were held with the patient and his family regarding ceilings of care. It was agreed that ward-based care remained appropriate.

On the morning of postoperative day 3 (day 7 post-injury), the patient was noted to be 'very sleepy' and confused when roused. He underwent haemodialysis that day. In the late evening, the ward nurses noted the patient was moaning and in pain. They went to retrieve buprenorphine for administration (as charted), but when they returned, the patient had died.

The case was discussed with the coronial registrar, whereupon it was decided that it did not meet the criteria for a formal inquest. Cause of death was determined to be heart failure secondary to ESRF on a background of multiple comorbidities.

DISCUSSION

The patient's transfer to a tertiary referral hospital was timely and appropriate. Throughout his admission, multidisciplinary input and care was of a good standard. He was regularly seen by medical and renal teams to manage his complex medical comorbidities. The decision to operate and the type of operation was appropriate.

It could be argued that, given the complexity of his comorbidities, his high risk of perioperative mortality and the fact that he was already on a palliative-care pathway, consideration could have been given to nonoperative management and in-patient palliation. However, the decision to operate was appropriate and justifiable. In this context, hemiarthroplasty can be considered as much a pain-relieving operation as a restoration of function.

There is good evidence that early surgical intervention for neck of femur fracture improves postoperative outcomes. Optimally, these patients would receive definitive surgery within 48 hours. In this case, the patient did not have operative intervention until day 4; however, the delay in this case is justifiable due to the complexity of the comorbidities and the need to optimise medical conditions preoperatively. Challenges surrounding dialysis, combined with recalcitrant low blood pressure, played a significant role in delay to surgery.

The procedure was performed by a PHO without a consultant surgeon present. The skill level among PHOs varies widely, with some extremely experienced PHOs currently employed. An 'average' hip hemiarthroplasty procedure would fall within the expected skill level of an experienced PHO. But it can be argued that this patient was much more complex than the average hip hemiarthroplasty.

Given this patient's extremely high risk of complications (ASA 5E), it would be reasonable to expect that a more senior surgeon, such as a consultant surgeon, Fellow or training registrar, would be directly involved in the operation. Although, it should be noted that nothing in the medical notes indicates that surgeon skill played any role in this patient's death. The 2-hour surgical procedure time is reasonable for this operation and there were no apparent intraoperative complications. The cause of death as described on the death certificate is appropriate.

CLINICAL LESSONS

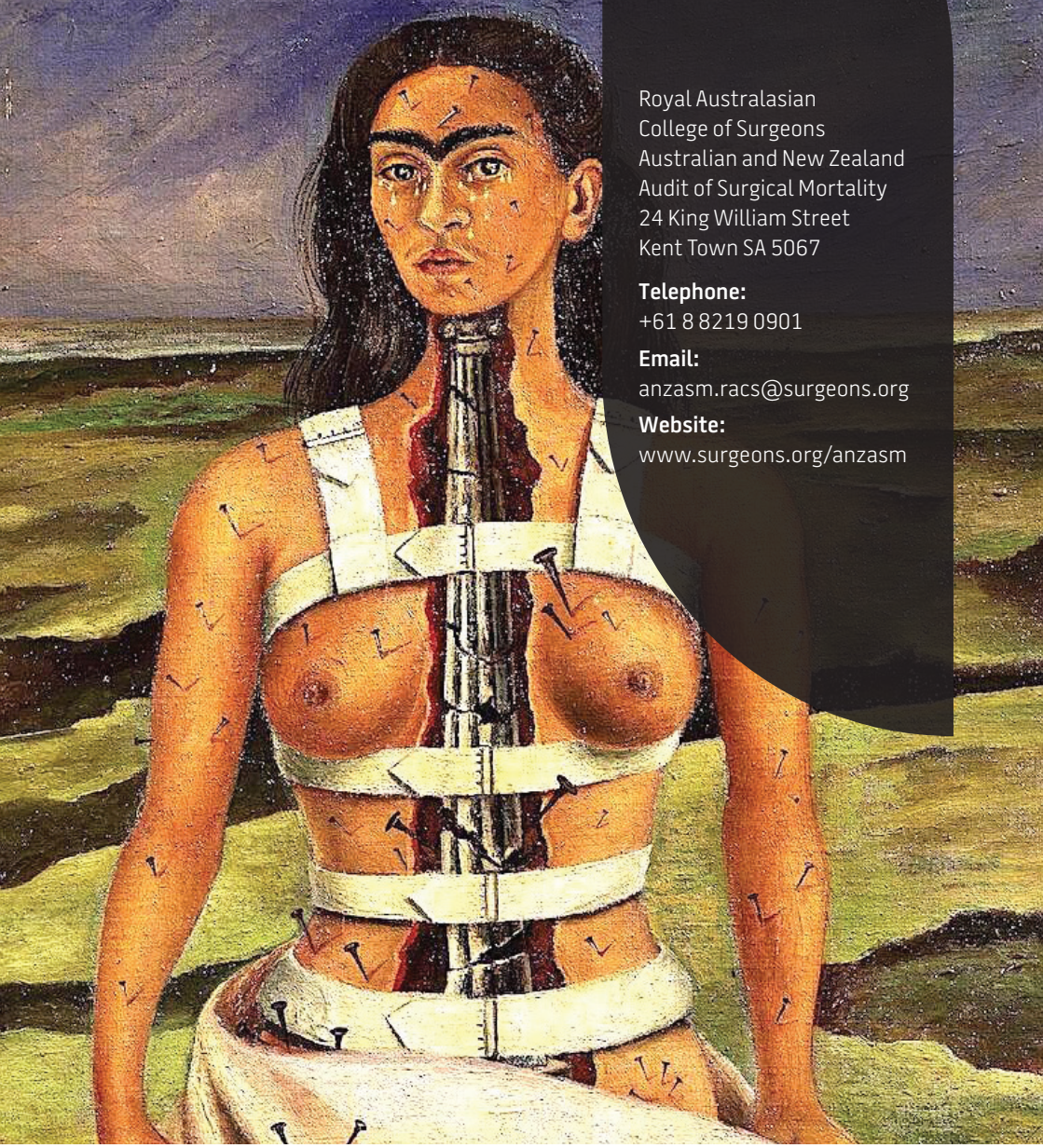
This was a highly comorbid patient with a poor prognosis, which should have been an ideal situation for discussions between the patient, his family and clinicians on goals of care and whether to have an advanced care directive in place. Such discussions concluded that only ward-based care would be appropriate. Despite this, the patient underwent transfer to a tertiary institution for optimisation of medical comorbidities prior to eventual surgery.

While surgical fixation of a fractured neck of femur should certainly be considered as a palliative procedure to optimise pain management for patients otherwise considered terminal, this particular scenario is one where more conservative management may have been appropriate.

Abbreviations

AF	atrial fibrillation
ASA	American Society of Anesthesiologists
CALS	cardiac advanced life support
CPR	cardiopulmonary resuscitation
CT	computed tomography
CXR	chest x-ray
DVT	deep vein thrombosis
ED	emergency department
ENT	ear, nose and throat
ESRF	end-stage renal failure
GCS	Glasgow coma scale
Hb	haemoglobin
ICU	intensive care unit
IV	intravenous
MET	medical emergency team
MRI	magnetic resonance imaging
NGT	nasogastric tube
PHO	principal house officer
RMO	registered medical officer
WCC	white cell count

Notes



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