



Royal Australasian College of Surgeons
Victorian Audit of Surgical Mortality

Case note review booklet

Lessons learnt from the audit

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CONTACT DETAILS

Victorian Audit of Surgical Mortality (VASM)

Royal Australasian College of Surgeons

College of Surgeons' Gardens

250–290 Spring Street

EAST MELBOURNE VIC 3002

WEB: www.surgeons.org/VASM

EMAIL: vasm@surgeons.org

TELEPHONE: +61 3 9249 1153

FACSIMILE: +61 3 9249 1130

POSTAL ADDRESS:

Victorian Audit of Surgical Mortality

GPO Box 2821

MELBOURNE VIC 3001

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VPCC Introduction

I congratulate VASM on another collection of cases reviews, compiled to inform the perioperative sector on opportunities to improve the safety and quality of the care in Victoria.

The Victorian Perioperative Consultative Council (VPCC) was established in October 2019 to oversee, review and monitor perioperative care and to improve processes and outcomes for patients before, during and after surgery.¹ It was born out of a significant review² and sector reform, replacing the former, somewhat siloed consultative councils for anaesthesia and surgery. Like our predecessors, we maintain strong protective powers under Victoria's Public Health and Wellbeing Act 2008³ and report to the Minister for Health.

Another aspect that is unchanged is our support for the Victorian Audit of Surgical Mortality (VASM), which succeeds in engaging surgeons and hospitals to provide peer review and feedback to individual surgeons on case management. The VPCC also wants to address what a recent review found to be a disconnect between the VASM process and the information provided to the former Councils and health services.⁴ While hospital reports over the past three years made a start in responding to this disconnect, we aim to further improve protected information sharing between VASM, VPCC, Safer Care Victoria (SCV) and health services to promote education and quality improvement.

The case reviews published in this and the previous 11 annual reports provide clinical scenarios and peer review to illustrate some opportunities for improvement. This year these address issues such as delayed intervention or delayed return to theatre, transfers for complications of care, timely management of sepsis, multi-organ failure, futile or too-great-a-magnitude surgery, and mesenteric ischaemia.

The procedures or conditions that provide the highest number of perioperative deaths in Victoria are emergency laparotomy and fractured neck of femur. The VPCC encourages participation in the Australian and New Zealand Emergency Laparotomy Audit – Quality Improvement, as well as the Australian and New Zealand Hip Fracture Registry. The international and local evidence confirms that multidisciplinary care, prompt preoperative optimisation, preoperative risk assessment and senior surgical, radiological and anaesthesia input and participation in quality craft group registries improve outcomes.

This year's report is well aligned with what the VPCC plans to address in the future. For instance, the VPCC will enable review and reporting of cases with multidisciplinary issues and morbidity, particularly perioperative cardiovascular events (cerebrovascular accident, myocardial infarction, pulmonary embolism) which often occur after discharge from hospital. We will also address health service reporting of unplanned returns to theatre, and transfers requiring ICU or further surgery for complications.

We look forward to continuing to work with VASM, as part of our multidisciplinary approach to improve the safety, quality, and outcomes of perioperative care in Victoria.

Professor David A Watters

Chair Victorian Perioperative Consultative Council

VASM Introduction

Welcome to the 12th (and final) edition of the Victorian Audit of Surgical Mortality (VASM) case note review booklet. Here, you will find 17 selected cases, covering most surgical specialties, from the hundreds that have crossed my desk over the last year. I hope they will encourage debate, some empathy and sympathy, and help prevent such issues happening again. These booklets are the most popular and educational of the various VASM publications. I encourage you to include them in training programs for junior staff and make available the important lessons in this publication to all relevant healthcare professionals.

VASM is a systematic peer review audit of deaths associated with surgical care. The audit reviews all surgical deaths that have occurred in Victorian hospitals following a surgical procedure, or while the patient was under the care of a surgeon, even if no procedure was performed (as with one case included here). The audit process is intended as an educational exercise whereby causes of avoidable mortality and morbidity associated with surgery can be identified and lessons can be disseminated.

A detailed case review (second-line assessment) by a Fellow from either the Royal Australasian College of Surgeons (RACS) or the Royal Australian and New Zealand College of Obstetricians and Gynaecologists has been conducted for all cases included in this booklet.

The Qualified Privilege (QP) declaration reassures surgeon participation by strictly protecting the confidentiality of information gained via the audit. Should you require more information on QP there is an information leaflet on the VASM website and links to discussions from 2018 and 2020 VASM seminars.

Feedback from the peer review is sent to the treating surgeon. Hospital management do not receive direct feedback on cases involving patients who died in their hospital. They must rely upon the reports produced by VASM, including this booklet, to identify emerging issues. Surgeons can elect to share the outcome of their assessment(s) with relevant hospital staff and, where systemic issues are identified, I would encourage such disclosure.

For selected cases, the appropriate specialist serving on the VASM Management Committee has provided a summary opinion to cases in this booklet, and they have provided relevant literature references in the Surgical Lessons section when necessary. I am grateful for the expertise and support these colleagues provide.

Future case note reviews will be produced by the Australia and New Zealand Audit of Surgical Mortality (ANZASM). This will allow selection of cases from a bigger pool, which will reduce the possibility of identification, particularly for the smaller states and territories. It will also allow messages from the audits to be disseminated throughout the country as currently happens with our popular Case of the Month.

The success of VASM is dependent upon participating surgeons and hospitals, the support of SCV at the Department of Health and Human Services, and the highly efficient, motivated and hard-working staff members at RACS. I am confident about the future impact of VASM.

I hope you find this publication of value. Please take care in these difficult, Coronavirus-induced strange times.

Associate Professor Philip McCahy

Clinical Director, VASM

Emerging issues and recommendations

We have been highlighting emerging issues and producing recommendations in every booklet since 2011. The same topics come up time after time. We have reduced the number of issues reported and linked them to the cases that follow, with each area appearing multiple times. There is rarely one event that leads to a surgical death and many factors may be involved in a single case.

Delays

This can be delay in diagnosis, delay in treatment or delay in transfer.

Transfer and shared care

The VASM assessment of patient transfers will be changing during 2020 to include both preoperative and postoperative transfers. There will also be increased scrutiny of transfers by the new VPCC.

Infection management

Early involvement of the infectious diseases team must be considered and documented.

Missed diagnosis

Involving senior clinicians, often across disciplines, at an early stage will help prevent problems.

Perioperative management

Intraoperative complications are almost unavoidable, but thorough preoperative workup, often involving multidisciplinary teams, can help predict problems that may arise. Major operations require the most experienced surgeons and the importance of dedicated teams cannot be underestimated. Medical assistance in complicated postoperative patients should be considered more frequently.

Inappropriate hospital facilities

Elective operations are still being performed in hospitals without the personnel or facilities to deal with predictable issues. This should not be occurring in an advanced healthcare system such as Victoria's. Patients with life-threatening emergencies may not survive transfer and such cases are mostly dealt with appropriately.

Inadequate notes

Poorly written or absent notes is a persistent issue. All healthcare workers must document their interactions with patients and/or family including date, time and role of worker. Whilst electronic medical records in some health services have improved legibility, there are issues with 'data dumps' that are making assessment of notes very difficult and time consuming. Some help from the program developers would be appreciated.

Inappropriate surgery

In many cases an operation may hasten an inevitable death. Informed discussion with the patient and family can lead to a better death without the falsely raised hope and major resources associated with surgery.

Communication issues

There have been several cases where the goals of care have not been clearly conveyed between various teams. As far as possible, decisions should be made by the most senior members of teams and communication should occur between the team leaders, not left to junior staff.

1 Cardiothoracic Surgery

Lack of adequate monitoring during a well-recognised period of risk

Clinical details:

Diagnosis: Mitral regurgitation and coronary artery disease.

Operation: Coronary artery bypass graft x 3.

Cause of death: Widespread ischaemia to brain and legs.

Course to death:

A patient aged early-70s with a history of lateral ST-elevation myocardial infarction was treated with a drug eluting stent to OM2 at another hospital seven months before the current admission. The patient re-presented to the same hospital two weeks later with cardiac failure. Echocardiography showed moderate to severe primary mitral regurgitation due to a flail P2–P3 segment of the posterior leaflet. Left ventricular function was well preserved. The patient subsequently presented to the current hospital with increasing exertional dyspnoea. Coronary angiography confirmed the presence of two vessel disease in a right dominant circulation, together with a patent stent.

Elective coronary bypass grafts were performed (left internal mammary artery to left anterior descending artery, saphenous vein to diagonal, radial artery to posterior left ventricular artery) together with a mitral valve repair (Gortex neochordae x 2, division restricted P1, closure P1–P2 cleft, 32mm annuloplasty ring and closure of left atrial appendage). Myocardial protection was with antegrade and retrograde cardioplegia. Bypass was discontinued without difficulty and the chest was closed routinely.

As the patient was being moved from the operating table to an ICU bed there was a loss of cardiac output and hypotension culminating in a ventricular fibrillation (VF) arrest. Treatment with inotropic support and CPR for 10–15 minutes restored circulation. The transoesophageal echocardiogram (TOE) probe was re-inserted, confirming satisfactory left ventricular contractility, an intact mitral valve repair and no evidence of a pericardial collection or tamponade. The chest was not re-opened. The patient was transferred to ICU on noradrenaline and dobutamine infusions.

The following day, the patient was noted to have bilateral lower limb ischaemia and possible evidence of neurological injury. CT brain scan showed multi-focal cortical and basal ganglia infarcts involving both anterior and posterior circulations, consistent with a history of arrest. Bilateral lower limb arterial Doppler ultrasound showed high-grade stenosis below the knee in both legs with only trickle flow in the right perineal artery and left anterior and posterior tibial arteries. A heparin-induced platelet antibodies screen (due to progressive thrombocytopenia) was negative, but a vascular surgical opinion considered that revascularisation would be difficult and unlikely to be successful. Anticoagulation with a non-heparin agent was recommended, but not implemented because of concern about intracerebral haemorrhage. Palliative treatment only was initiated after a family meeting and the patient died on postoperative day four.

Assessor's comments:

The first-line assessment sought detailed information about the VF arrest and the reasons for its late diagnosis, and also clarification regarding the aetiology of peripheral and cerebral emboli. According to the surgeon's operation report, "a lot of the monitoring had apparently been disconnected" during transfer from the operating table to the ICU bed, so there is no discrete knowledge of the cause of the arrest or the period to recognition of VF. Considering that CPR was conducted for 10–15 minutes before circulation was restored, any additional but unrecognised loss of cardiac output would certainly have been a contributing factor to the cerebral injury, which is consistent with a watershed type infarction—the ultimate cause of death.

Regarding the peripheral lower limb ischaemia, the Doppler study suggests that the patient had pre-existing peripheral vascular disease. But a prolonged period of lost cardiac output, as well as the need for a noradrenaline infusion during the initial period in ICU, could well have been responsible for the ischaemic limbs.

In considering why VF occurred in the first place, there is no satisfactory explanation, particularly since the patient was not monitored for a relatively prolonged period. It would normally be mandatory to exclude acute graft failure, which would require re-opening the chest and possibly re-doing or replacing a graft thought to be occluded. In this situation, the decision not to re-open the chest was reasonable given that the TOE appearance following resuscitation and re-establishment of the circulation confirmed normal left ventricular contractility and an intact mitral valve repair, and the time period that the patient had inadequate circulation was uncertain.

Clearly, the main issue in this case is the lack of adequate monitoring during transfer of the patient from the operating table to the ICU. This is a well-recognised period of risk during which continuous monitoring is mandatory. If the loss of cardiac output had been recognised immediately, it is expected that adequate resuscitation and restoration of cardiac output would have avoided a severe watershed cerebral injury. Similarly, although the patient clearly had bilateral peripheral vascular disease, the problem of ischaemic limbs would likely not have occurred. This problem clearly needs to be addressed by the anaesthetist, nursing staff and surgical team to avoid the possibility of recurrence of such an event.

Surgical lessons:

Monitoring the cardiac surgical patient begins once the lines are inserted when the patient is being prepared for surgery and ends when the patient is discharged from hospital. During this time there are critical moments when close study of the monitors is imperative, such as at the induction of anaesthesia, running on and off bypass, and transfer of the patient to the ICU bed. Monitoring continues on the ward to track any rhythm disturbances or blood pressure variations, and is particularly important when pacing wires are removed.

Responding to abnormal monitoring parameters is critical to the successful outcome of cardiac surgery in all patient groups.

2 Cardiothoracic Surgery

Inappropriate and delayed postoperative management

Clinical details:

Diagnosis: Aortic valve endocarditis.

Operations: Aortic valve replacement for endocarditis (enterococcal) and large vegetations; emergency re-do sternotomy for tamponade; re-do sternotomy for suspected tamponade—none found; insertion intra-aortic balloon pump (IABP).

Cause of death: Lactic acidosis; multiorgan failure.

Course to death:

A patient aged mid-60s with multiple comorbidities was admitted to a peripheral hospital with *Enterococcus faecalis* aortic valve endocarditis sensitive to linezolid and ciprofloxacin. The patient was admitted to ICU because of hemodynamic deterioration. Echocardiogram (ECHO) demonstrated normal systolic function, moderate-to-severe aortic insufficiency, normal left ventricular size and function with multiple masses (presumed vegetations) up to 1.6cm x 0.5cm on the aortic valve.

The patient was transferred to a tertiary hospital, treated medically and referred to the cardiac surgery team with severe aortic insufficiency. A coronary angiogram did not demonstrate any significant coronary artery disease.

The patient underwent aortic valve replacement with a 25mm bioprosthesis and closure of the left atrial appendage. Cross-clamp time was 110 minutes; cardiopulmonary bypass time 127 minutes. The procedure was performed by the surgical education and training trainee with a consultant cardiothoracic surgeon assisting in surgery.

The patient returned to ICU for management but continued to deteriorate, receiving blood transfusion of 3 units. TOE indicated a clot behind the right atrium. The decision was made to return to theatre and re-open the site. Tamponade was identified from the aortic suture line and left ventricle (LV) apex leakage, which was repaired. Blood loss was reported as 1.4L, with 4 units of blood and fresh frozen plasma transfused. The patient was returned to ICU on decreased inotropes and improved blood pressure (BP).

Increasing acidosis (pH 7.09) occurred overnight, and poor urine output (5ml/hour), but haemoglobin (Hb) was stable and there was little drainage. The patient returned to theatre the next morning for suspicion of cardiac tamponade. Exploration was unsatisfying, revealing only a small volume posterior clot unlikely to cause clinical deterioration. Biventricular function appeared to improve with ongoing resuscitation and insertion of an IABP.

Soon after returning to ICU, the patient deteriorated further. Extensive discussions between the ICU and cardiothoracic teams determined that all treatment options had been exhausted. Active therapies were withdrawn, and the patient passed away comfortably.

Assessor's comments:

The main issues were inappropriate and delayed postoperative management of bleeding, tamponade and low cardiac output state.

In most patients undergoing aortic valve replacement there is no need to stab the LV apex. In this case, this was done for de-airing and multiple stabs were applied. The heart could be easily de-aired via the aorta and the vent placed via the right upper pulmonary vein, if required. If stabbing of the LV apex is performed, all stabbing points must be sutured, regardless of initial bleeding or not. The suturing of the stabs is best accomplished while the patient is still on bypass.

It is unclear if the consultant was present at the time of chest closure if haemostasis was thoroughly secured. Two drains (28 Fr) were placed and were of an appropriate size. Even if everything had been

perfect, the patient should not have returned from the operative theatre (OT) with Hb 58, lactate 15, borderline BP, large doses of inotropes and in low cardiac output. The patient should have remained in the OT. The ECHO should have been performed in the OT and the cause of the low cardiac output state determined and dealt with there, prior to returning to the ICU. If tamponade was discovered while in the OT, chest exploration should have been done. If the patient had poor systolic LV function, IABP should have been inserted then.

The chest was re-opened about four hours after the initial operation finished, during which time the patient was in low cardiac output state. This represents an unreasonable delay in diagnosis and treatment. Significant bleeding is indicated by 1.4L of intraoperative blood loss, and massive transfusion of packed red blood cells (4 units) and fresh frozen plasma (4 units). Bleeding from the aortic suture line and LV apex was subsequently found and secured. The intraoperative ECHO demonstrated poor biventricular function. One wonders why the IABP was not inserted in the OT prior to return to ICU.

Upon return to ICU, the patient again developed low cardiac output, had high lactate and required inotropes and vasoconstrictors, leading one to ask why the IABP was not inserted in the ICU.

The patient was brought to OT again the next day in low cardiac output state to explore for cardiac tamponade. About 150ml of blood and clot was evacuated and the IABP finally inserted. The patient developed multiorgan failure and died later that day.

Surgical lessons:

States of low cardiac output need to be aggressively managed and a cause sought immediately. Cardiac tamponade is a common reason for this and should be considered postoperatively in all cases, unless proven otherwise.

Once tamponade is diagnosed, the only treatment is evacuation of the blood and clot, usually performed via repeat sternotomy as an emergency procedure. If there are unstable haemodynamics, the chest can be re-opened outside the OT, in the ICU, for example, or even on the ward in some situations.

Delays in the diagnosis and treatment of cardiac tamponade with low cardiac output state can increase morbidity and mortality secondary to end-organ malperfusion and its consequences.

3 General Surgery/Gynaecology

Low-risk surgery spiralling out of control and leading to death

Clinical details:

Diagnosis: Peritonitis – Sepsis from small bowel leak.

Operations: Laparoscopic bilateral salpingo-oophorectomy; laparotomy jejunal resections; three exploratory laparotomies post-complication.

Cause of death: Multiorgan failure.

Course to death:

A fit patient aged late-60s had a laparoscopic bilateral salpingo-oophorectomy for an ovarian cyst. The procedure was difficult due to intra-abdominal adhesions from previous trauma laparotomy. The patient had severe abdominal pain postoperatively and developed hypotension and tachycardia on postoperative day 2. A CT scan showed free fluid and 12 x 6cm collection. The patient was returned to theatre urgently where a jejunal perforation was identified. A length of 30cm of bowel was resected (re-joined with a stapled anastomosis), producing a total small bowel length of 85cm. The patient was transferred from ICU at hospital A, to an ICU at a larger hospital (hospital B) with better support.

On day 8, the patient had a re-laparotomy for clinical deterioration and suspicion of anastomotic leak. The anastomosis was found to be intact, however the terminal ileum and gallbladder were dusky. The wound was not fully closed, and vacuum-assisted closure dressing was applied due to ongoing clinical concerns. The planned re-look and formal closure of the abdomen was performed on day 9. The patient was on haemodialysis, and unable to be fully weaned off vasopressors or ventilation support. The patient had low Glasgow Coma Scale (GCS) and was diagnosed with critical illness myopathy.

On day 14, the patient had fevers and faeculent discharge from the wound. A CT scan showed significant fluid and gas collections from probable anastomotic breakdown. The family were consulted, and options of surgery and palliation discussed. It was emphasised that surgery may not be successful, and even if successful, the patient would require high levels of care and a protracted recovery. A second surgical opinion agreed with the above. The family felt that a protracted course of recovery would be inconsistent with the patient's wishes and decided on palliation. The patient passed away the next day.

Assessor's comments:

This is an unfortunate case of a patient having what was expected to be low-risk surgery, which spiralled out of control after a complication, leading to death. The FLA commented that perhaps the first laparotomy should have been damage control. This is a popular approach in trauma or critically ill patients, but this case demonstrates that damage control and planned re-look had minimal benefit. The patient had three re-looks, which did not ultimately foresee or prevent the development of an anastomotic leak. Having said that, no faults were seen with the care given at hospital B.

Unfortunately, no information was provided from hospital A where the original gynaecological operation and first laparotomy occurred. It is unknown if the original gynaecological surgery was indicated when weighing up the risks, whether there was a delay in diagnosis, adequate resuscitation preoperatively, or anaesthetic issues in relation to this case. Bowel perforation is a well-recognised complication of laparoscopic operations. It is advisable for hospital A to consider whether this occurred in isolation or was one of several recurrent events. If the latter, then the institution could consider combined general and gynaecological lists for surgery anticipated to be difficult. The general surgeon can help with bowel handling and advise on the state of the bowel intraoperatively, increasing safety for the patient.

Surgical lessons:

Consider the need for surgery in a patient with increased risk factors. While a postmenopausal cyst is suspicious, a benign diagnosis is still likely and a conservative approach could be considered in consultation with a gynae-oncologist.

Consider a team approach for a complex patient and the most appropriate hospital for postoperative care.

Monitor a complex case carefully postoperatively. Early diagnosis of a complication can prevent mortality.

4 General Surgery

Significant septic shock should not be overlooked

Clinical details:

Diagnosis: Perforated bowel.

Operations: Laparotomy; hemicolectomy.

Cause of death: Multiorgan failure – cardiac.

Course to death:

A patient aged early-70s was admitted with septic shock resulting in clinically significant atrial fibrillation. Despite presenting hypotensive with lactic acidosis, band forms were noted on white cell count and a grossly elevated C-reactive protein (CRP) of 238. All medical interventions were directed at restoring cardiac function. Grossly inadequate investigations on the basis of septic shock were undertaken. Blood cultures were obtained. Both the aerobic and anaerobic bottles subsequently returned negative results post-mortem. Chest x-ray confirmed bilateral basal pleural effusions. Abdominal examination confirmed a soft, non-tender abdomen. Rectal examination showed no blood. There had been no diarrhoea or change in bowel habits, although some vomiting was reported.

Hypotensive and dyspnoeic, the patient was admitted to ICU where aggressive medical management resulted in a normal ECHO and better cardiac function. The patient was then transferred to the general medical ward and was noted as being 'alert and conscious'. CT scan revealed a right iliac fossa retroperitoneal collection of some 150ml and the possibility of either a perforated appendix or carcinoma of the caecum. The patient agreed to have surgery the next day. A midline laparotomy was undertaken with mobilisation of the ascending colon, and pus under pressure evacuated from over the right iliopsoas region. A right hemicolectomy was then undertaken using a stapled anastomosis because 'fat wrapping' of the terminal ileum prevented handsewn anastomotic techniques.

The histopathology of the right hemi-colectomy specimen was subsequently reported as showing a transmural perforation of the caecum lined by organising granulation tissue, indicative of the relative chronicity of the perforation. There was no acute appendicitis; the appendix wall was intact with no evidence of perforation. There was no evidence of dysplasia or malignancy involving the caecum itself.

It appears that this was a perforation of a solitary caecal diverticulum with resultant pericolic abscess formation. On the day after surgery there was a sudden deterioration in the patient's clinical status, with secondary myocardial ischaemia associated with a left bundle branch block, metabolic acidosis, and hypotension that failed to respond to vasopressor treatment. Discussion between ICU, general medicine and general surgery teams, reached a joint decision that the patient's deterioration was too rapid for a trial of haemodialysis and a possible return to theatre. A family meeting concluded that the patient be extubated and no further treatment given.

Assessor's comments:

This patient was unfortunate in that he presented with dramatic features of cardiac dysfunction, which appeared initially to respond to appropriate interventional therapy such that 48 hours later he was 'alert and conscious'. Unfortunately, what was overlooked, was that this patient had all the clinical parameters suggesting significant septic shock. This was very inadequately investigated, bringing to mind the old adage stressed in early surgical textbooks: "pus somewhere, pus nowhere, pus under the diaphragm".

Surgical lessons:

The source of any sepsis should be sought aggressively. Multi-disciplinary care, or early cross referral is often in a patient's best interest.

5 General (Colorectal) Surgery

Grossly distended loops of small bowel due to apparent partial volvulus of small bowel

Clinical details:

Diagnosis: Colo-vaginal fistula due to diverticulosis.

Operations: Emergency laparotomy for sepsis; anastomosis taken down and end colostomy fashioned; lavage of entire peritoneal cavity.

Cause of death: Multiorgan failure.

Course to death:

A patient aged mid-60s was admitted to hospital A with a previous medical history which included chronic neck and back pain treated with pregabalin and prn oxycodone, and diverticulosis. The patient had an elective repair of vesico-colic fistula before returning to theatre 6 days later for laparotomy and Hartmann's procedure for anastomotic leak with left pelvic contamination.

Hospital A lacked ventilation facilities so the patient was transferred to hospital B for intubation and ventilation. The patient was stable throughout the early morning arrival. On the day of transfer, the patient was extubated and there was an episode of atrial fibrillation (AF). Electrolytes were optimised and amiodarone commenced. The patient reverted to sinus after initial 150mg bolus. Amiodarone infusion continued into the evening with rapidly escalating pressor requirements (noradrenaline to ~50mcg/min) and lactate elevated to 8. Vascath was inserted and continuous renal replacement therapy (CRRT) commenced. The patient was intubated and ventilated early the next day, and returned to OT for laparotomy. Ischaemic terminal ileum (resected) was noted and new stoma formation; also peritoneal soiling with washout. CPR performed on induction for approximately 2 minutes with return of spontaneous circulation. Rapidly progressing multiorgan failure occurred upon return to ICU despite antibiotics, fluids, blood products, ventilation, high-dose pressors, inotropes and CRRT (unable to clear potassium and lactate). Multiple episodes of broad complex tachycardia occurred requiring cardioversion and episodes of bradycardia requiring CPR (short duration). After an additional three or four episodes of broad complex tachycardia with loss of output and cardioversion with potassium of approximately 10 and lactate of greater than 20, it was discussed with the family to withdraw treatment and make the patient comfortable. The patient was extubated with family consent, infusions ceased (except morphine and midazolam) and the patient died very soon after.

Assessor's comments:

The consultant surgeon who completed the surgical case form (SCF) appropriately identified that the patient died with a clinically significant infection and that there was an anastomotic leak after the first operation. There are no areas of concern regarding the timing and decision to take the patient back to theatre after the original operation, prior to transfer. However, the SCF only details the two operations performed at hospital A. The final operation at hospital B is not listed. This is concerning, as there appears to be a delay to theatre for this final procedure, with the patient described in the anaesthetic assessment as 'in extremis'.

The patient's medical record details a deterioration in perfusion, with increasing lactate, worsening metabolic acidosis, and acute renal failure after transfer. There were multiple discussions with a surgeon (unclear if this was the original operating surgeon or a second surgeon), but there is no documentation that the patient was reviewed directly by a surgeon until transfer to the OT, some 10 hours after notable deterioration. This delay is significant. Rising lactate and worsening pH with a distending abdomen warrants surgeon review as a minimum. Despite maximal medical support, the patient continued to deteriorate.

The description of 'grossly distended loops of small bowel due to apparent partial volvulus of small bowel' is an area of concern. This is an unusual finding at re-look laparotomy and may be the result of

a technical error. The SCF indicates that the surgeon did not think that there could have been an improvement in the technical management of surgery. The left external iliac vein injury was a significant intraoperative complication at the second operation that was not documented in the original SCF.

Surgical lessons:

Features of raised intra-abdominal pressure were documented—worsening cardiac output, abdominal distension with mottling of the lower abdomen and perineum—but there was no record of intravesical pressures being measured. While these symptoms and signs may also be secondary to the multiorgan failure associated with intra-abdominal sepsis and gut ischaemia, raised intra-abdominal pressure presents a second physiological insult. Intra-abdominal compartment syndrome is a condition seen in clinical practice much less frequently now compared to the late '90s and early 2000s. It has virtually been eliminated in trauma patients and is now classically seen after major intra-abdominal sepsis and/or bleeding. It should still be considered in patients who develop major intra-abdominal sepsis or have had a major vascular injury repaired who then develop multiorgan failure. It requires urgent treatment by laparostomy.

This case demonstrates the importance of timely surgical review and the quality of the handover from surgeon to surgeon.

Regular surgical review of postoperative patients in ICU is important. Measurement of intrabdominal pressure in ICU may have helped in this case. Consideration should have been given to intra-abdominal hypertension/compartment syndrome as a contributing factor.

6 General (Colorectal) Surgery/Urology

Decision to operate after continuing deterioration

Clinical details:

Diagnosis: Bladder carcinoma.

Operations: Completed cystoprostatectomy with ileal conduit reconstruction; re-look laparotomy following damage control resection; re-look laparotomy with lavage and small bowel resection; re-look laparotomy with lavage and small bowel resection with primary anastomosis.

Cause of death: Renal/multiorgan failure secondary ischemia of bowel.

Course to death:

A patient aged late-70s with bladder carcinoma presented to a private hospital for cystectomy. Six days post-cystectomy, the patient underwent a re-look laparotomy, lavage and small bowel resection. No features were identified of ileal conduit ischaemia, or anastomotic leak, or distal small bowel obstruction secondary to adhesions with gross distension of small bowel and patchy mid-segment ischaemia/infarction. The patient also had a 40cm mid-small bowel resection without anastomosis. Three days later, the patient underwent a re-look laparotomy, lavage and small bowel resection with primary anastomosis. There were improvements in the abdominal signs and reduction of oedema. A further 15cm of mid-small bowel was resected with primary anastomosis and tension free abdominal wall closure (previous packs removed). Following further re-look laparotomy, the patient deteriorated and the decision made for no further intervention or escalation of inotropic support/dialysis.

Assessor's comments:

The patient was appropriately managed in ICU following cystoprostatectomy and ileal conduit for muscle invasive bladder cancer. Comorbidities of autoimmune hepatitis and non-insulin dependent diabetes did not contribute.

Ward transfer occurred on the second postoperative day. A nasogastric tube (NGT) inserted at surgery was dislodged by the patient two days afterward and not reinserted. The patient received repeated bags of normal saline throughout the postoperative period on the ward without interruption by dextrose/saline to moderate sodium chloride intake.

The case notes show slow progress and increasing abdominal distension after four days, suggestive of postoperative ileus or small bowel obstruction. Progress appeared satisfactory with passage of wind and a functioning ileal conduit until the patient deteriorated on the fifth postoperative day with worsening abdominal distension and respiratory compromise.

Reinsertion of an NGT failed despite multiple attempts by several nursing and medical staff. Prompt attendance and performance of this task by a surgeon may have been successful, however by this stage, the patient had deteriorated to such an extent that exploratory laparotomy was inevitable for management of abdominal compartment syndrome.

Damage control revealed the possibility of kinking just distal to the anastomosis, suggestive of adhesive obstruction. Hinchey 3 sepsis (purulent peritonitis) was evident, perhaps arising from initial contamination or an early anastomotic leak that had since sealed. The small bowel anastomosis appeared intact. Postoperative blood tests were unavailable for review.

Progression to surgical decompression and damage control laparotomy was inevitable, with correct management being undertaken. A third operation for further small bowel resection and abdominal closure was appropriately performed however further deterioration continued despite aggressive treatment. Palliation was then appropriate.

Case note documentation by nursing staff was clear, providing a detailed account. However, entries by surgical and medical staff on some occasions was poor with no staff designations or time of day

noted. Fluid orders charted on the ward in the postoperative period should be reviewed by senior staff each day as some junior staff members may not review charts appropriately when deciding on ongoing fluid replacement.

Surgical lessons:

Replacement of the NGT was important. Decompression of postoperative small bowel distension by an NGT can be a life-saving procedure when this complication develops after surgery due to causes such as ileus, adhesive obstruction or intra-abdominal sepsis from a collection or anastomotic leak. Relief of distension via this method deflates the stomach and minimises the risks of gastric aspiration when bowel function is slow to return after surgery. If left untreated the patient becomes exposed to the eventual course of abdominal compartment syndrome which then requires urgent surgery.

This is another case that raises the potential benefit of monitoring intra-abdominal pressure in ICU.

7 General Surgery

Catastrophic re-bleed that could have been avoided

Clinical details:

Diagnosis: Bleeding duodenal ulcer.

Operations: Upper gastrointestinal endoscopy with adrenaline injection to base of duodenal ulcer; upper GI endoscopy and clipping of vessel; laparotomy, under-running gastroduodenal artery in bleeding duodenal ulcer, distal gastrectomy with Roux-en-Y reconstruction; washout and drainage subphrenic abscess.

Cause of death: Multiorgan failure.

Course to death:

A patient aged late-60s presented to a public hospital ED with three weeks of increasing lethargy and dizziness. He had a history of heavy alcohol use and obesity, hypertension, and osteoarthritis on regular non-steroidal anti-inflammatory drugs. He was awaiting a hip replacement on an elective list. He was found to have anaemia (Hb 69).

Two days after admission to a general medical unit for investigation and treatment of anaemia, he had a large upper gastrointestinal (GI) bleed and a pulseless electrical activity (PEA) arrest requiring resuscitation. An urgent gastroscopy showed a large bleeding duodenal ulcer (DU), which was treated with adrenaline and coagulation for haemostasis. He was admitted to ICU for ongoing resuscitation and vascular support. A planned re-look gastroscopy three days later showed no active bleeding, but a vessel seen in the base of the ulcer was clipped endoscopically.

Gastroenterology and general surgical units involved in care of this patient agreed there was high risk for rebleeding and advised angio-embolisation of the offending vessel (patient consent for the procedure was obtained). A request for interventional radiology to embolise the gastroduodenal artery (GDA) was refused, due to “concern or risk of bowel ischaemia and not able to accurately embolise the vessel”. The seniority of those on the gastroenterology, general surgical and interventional radiology teams who engaged in these discussions and reached this conclusion is unclear.

One day later, the patient suffered a repeat major upper GI bleed with asystolic arrest and acute resuscitation requiring intubation. This led to an urgent laparotomy with distal gastrectomy and Roux-en-Y reconstruction and control of the bleeding vessel. The patient developed septic complications in the abdomen and may have acquired brain injury due to ischaemia from the cardiac arrest. The patient deteriorated significantly over the following month leading to palliation.

Assessor’s comments:

If the catastrophic rebleed six days after admission could have been avoided, mortality after significant morbidity would most likely have been avoided. The appropriate opportunity for prevention of this occurrence was via angio-embolisation of the bleeding vessel in the base of the DU and the GDA. Both clinical units (gastroenterology and general surgery) agreed that embolisation was indicated to avoid rebleeding, but the request was denied by interventional radiology, quoting concerns about some (questionable) risks.

Ideally, a consultant gastroenterologist, a consultant general surgeon and a consultant interventional radiologist should have discussed this difficult clinical situation in collaboration. Together, they could have come to a more considered decision on the appropriate course of action—which should have been angio-embolisation. This is especially important when discussions between more junior doctors on each team led to an inappropriate outcome. This level of communication and interaction was not documented in the clinical notes, and hence is assumed not to have occurred.

Surgical lessons:

If a referral for a procedure or test is refused, but the referrer clearly believes a course of action should occur, there should be the ability to communicate further about the issue with the possibility of overturning the initial decision if appropriate. It is too common that after a single discussion and decision people do not follow up with further important discussions, which is recommended when a clinical situation or decision is difficult.

8 General Surgery/Otolaryngology

The need to actively look for postnasal bleeding

Clinical details:

Diagnosis: Tuberculosis, fungal pneumonia and sinusitis.

Operations: Endoscopic bilateral sphenoidotomy for bilateral sphenoid sinusitis (ENT surgeon); bilateral temporal artery biopsy (general surgeon).

Cause of death: PEA arrest in the context of Hb drop secondary to severe epistaxis and reports of melaena, followed by aspiration pneumonia.

Course to death:

A patient aged early-80s was admitted for investigation of right-sided parietal headache persisting for two weeks. Past medical history included myelodysplastic syndrome, non-ST-segment elevation myocardial infarction, hypertension, gastro-oesophageal reflux disease, osteoarthritis and bronchiectasis.

The patient was investigated via the rheumatology unit. After having undergone negative temporal artery biopsies, a CT scan of the sinuses was performed, revealing opacity in the right sphenoid sinus.

A decision was made to perform an endoscopic biopsy of the right sphenoid sinus, which occurred 19 days later. Surgical findings showed a fungal mass in the right sphenoid sinus. The nose was packed with Nasopore dressing. There was no mention in the operation notes of excessive bleeding.

Diathermy to the postnasal space was noted, however, there was no documentation regarding arterial bleeding.

Evidence of fresh bleeding in the post-anaesthesia care unit was noted and the ENT registrar was contacted. The registrar was satisfied with the situation and the patient returned to the ward. The patient was seen by the night resident medical officer as oxygen saturations were difficult to maintain. Mild active bleeding was documented.

Early on postoperative day 1, a PEA occurred with 18 minutes downtime leading to the patient being intubated. Fibre-optic bronchoscopy aspirated a mucus plug from the left main bronchus and revealed blood staining in the right main bronchus. Rapid rhino packs were inserted; Hb noted to be 52g/dl. The patient was transferred to ICU, where resuscitation continued with transfusion.

No note was made by the ENT team at ward rounds 12 hours postoperatively. Infectious diseases ward round confirmed pulmonary tuberculosis and *Aspergillus scedosporium* in bronchial washings. Plans for active treatment were made.

Epistaxis after packing was slight. Noradrenaline was needed to maintain circulation, decreasing oxygen saturations. In view of the new diagnoses and difficulty maintaining oxygenation and circulation, the family was consulted and the decision made to withdraw active treatment. The patient was extubated and died shortly afterwards.

Assessor's comments:

This is a case of a high-risk patient undergoing endoscopic sinus surgery on the sphenoid sinus complicated by unrecognised ongoing postnasal bleeding with probable aspiration, culminating in cardiac arrest, followed by significant hypoxaemia and hypotension.

The operation notes are merely adequate; no mention of topical vasoconstriction and technique. There is no contemporaneous note following the ENT ward round. There are no notes to say that the pharynx was examined.

A specific postoperative note should be made to observe for postnasal bleeding following any nasal operation, especially one involving the sphenoid sinus.

Surgical lessons:

This case illustrates the need to actively look for postnasal bleeding, especially in high risk patients.

Concealed bleeding following nasal surgery can be easily missed unless a specific inspection of the pharynx is made. Anterior oozing may receive attention, whilst a constant postnasal ooze and clot formation can occur unrecognised, even in a healthy patient. The fact that the Hb fell to 52g/dl indicated significant blood loss.

9 General Surgery

Diagnosis was missed and not considered until too late

Clinical details:

Diagnosis: Ischaemic bowel.

Operations: Exploratory laparotomy.

Cause of death: Ischaemic small bowel.

Course to death:

A patient aged early-80s, died during the third of a series of hospital admissions for severe abdominal pain. The patient was living independently with early Alzheimer's dementia, had diabetes and a long smoking history.

The first admission was at night to the ED. Two days later, the patient was re-admitted under a surgical bed card with abdominal pain, high inflammatory markers and gastrointestinal symptoms. CT scan of the abdomen showed small bowel dilatation. The patient was managed as likely ileus or small bowel obstruction and discharged after six days. There was no clear discharge diagnosis for either admission.

At around midday two days later, the patient re-presented with severe abdominal pain. There was a long delay in ED so the patient was not seen by a doctor until 11 pm. CT scan of the abdomen at this stage showed progressive non-specific small bowel dilation, with no evidence of ischaemia. A later addition to the CT report noted atherosclerotic narrowing of the mesenteric vessels. The patient had raised inflammatory markers, CRP, white cell count (WCC) and lactate levels. The patient was reviewed by the surgical registrar soon after midnight. The registrar noted generalised tenderness without guarding and diagnosed non-specific abdominal pain. On the morning ward round, the patient was reviewed by a consultant surgeon who recommended laparotomy.

Laparotomy occurred more than 24 hours after arrival at hospital and six hours after the decision to operate. The laparotomy findings were widespread small bowel ischaemia inconsistent with life. The operation was abandoned and the patient palliated. The patient died 48 hours later.

Assessor's comments:

This patient presented on multiple occasions with undifferentiated abdominal pain, which had persisted for at least 13 days before surgery occurred. There were numerous markers suggesting significant pathology (very high inflammatory markers on multiple occasions), but the patient never received a clear diagnosis. It is likely that the patient was discharged twice while experiencing the early stages of ultimately fatal small bowel ischaemia. In retrospect, the individual actions of medical staff were reasonable at each point, but it seems clear that the diagnosis was missed, and not considered until too late.

At the final admission, the patient was noted on admission to be unwell, with a high WCC and high lactate. Despite ischaemic gut being flagged as a possible diagnosis in the ED, the patient did not progress to laparotomy until 15 hours after being admitted by the surgical service. It is likely that the statement of "no evidence of ischaemia" on the CT report falsely reassured the surgical staff and prevented serious consideration of a differential diagnosis.

Management of the patient in this final admission seems delayed. The patient was evidently fatally unwell. This was recognised late and there was a lack of urgency in progressing to theatre, leading to unacceptable delays. It is likely the patient's ultimate ischaemic event occurred on the morning prior to presenting to the ED, resulting in more than 24 hours of ischaemia before laparotomy. It is possible that the patient's condition was salvageable at an earlier point in that admission.

It is also possible that the condition might have been salvaged if it was recognised in a previous admission. It seems likely that mesenteric ischaemia was never considered as a possible diagnosis for this patient. If this had occurred, revascularisation may have been possible in the prior admission, which could have prevented this patient's death. Because the patient improved at each admission before deteriorating at home, it is possible that the patient was not seen by a senior surgeon until the day of the surgery. With no documentation of surgeon review or discussion provided, surgeon involvement cannot be established.

Surgical lessons:

One system improvement that may have helped earlier diagnosis would be formal recognition of persistent symptoms without diagnosis, particularly with red flags like advanced age, very high inflammatory markers and renal impairment. Patients in this situation should be formally reviewed by senior staff to allow earlier recognition of subtle but serious conditions.

The diagnosis seems not to have been entertained during the patient's earlier admissions. Review by senior doctors of all emergency admissions is likely to improve diagnostic yield, reduce hospital stay, reduce costs of unnecessary investigations and result in better patient outcomes.⁵

Reference:

5. Chana P, Burns EM, Arora S, Darzi AW, Faiz OD. A systematic review of the impact of dedicated emergency surgical services on patient outcomes. *Annals of Surgery*. 2016 Jan 1;263(1):20-7.

10 Neurosurgery

‘Very aggressive’ surgical treatment in the context of a fragile, elderly patient

Clinical details:

Diagnosis: Left C6/7 perched facet.

Operations: C2–T2 posterior instrumented fraction and internal reduction of fracture; left hemilaminectomy and posterolateral fusion.

Cause of death: Postoperative clinical decline and sepsis.

Course to death:

A patient aged early-90s suffered a fall at home and presented to hospital. The patient was confused but had no obvious neurological deficit. CT C-spine showed a left C4/5 facet joint fracture/subluxation and the patient was treated with a cervical brace (Philadelphia collar). The patient had a positive blood culture for Staph coagulase negative and a urinary tract infection (UTI) and E. coli.

Four days later, the patient was transferred to a second hospital for further management. Delirium and chronic osteomyelitis with purulent discharge in the right arm were documented. The next day, antibiotics were provided for the UTI. The patient was noted to be delirious, but no pain issues were documented.

On day 6, the patient consented for surgery. The plan was to perform posterior cervical decompression and fusion (levels not specified in the consent forms).

On day 7, the patient underwent C2–T2 open reduction and internal fixation, posterior decompression instrumentation/fusion (decompression at C4/5 only). The postoperative period was complicated by sepsis, haemorrhage in the cervical wound, and loosening of the instrumentation. The patient was palliated five days later.

The treating team found no management issues, areas for consideration or concern, or adverse events. Upon reflection, the team would not have done anything differently.

Assessor’s comments:

This patient died as a result of ‘very aggressive’ surgical treatment in the context of a fragile, elderly patient.

The treating team believes that nothing could have been done differently. ‘Non-operative treatment’ was an option not considered, even in retrospect, after this terrible outcome. Furthermore, the mortality form was completed by a service registrar, who clearly had no understanding of the case and, in fact, made several mistakes including the level of the injury and the nerve root involved by the C4–5 fracture.

Elderly patients with spinal fractures are acknowledged to have high mortality rates, but in this case, the outcome was clearly linked to the extensive surgical operation. One wonders if such an extensive intervention in this elderly patient was necessary, and why conservative management with a cervical brace or a close reduction under general anaesthesia was not considered before committing to a “7-level fusion”. There is no documentation providing a rationale to offer surgical treatment and the rationale to choose this particularly extensive 7-level fusion. Perhaps a less extensive posterior fixation (C4–6 or C3–6) or a combined anterior and posterior approach addressing the unstable level (C4–5) would have sufficed. Even though there were spinal processes fractures below, they did not seem serious enough to require surgery.

It is to be hoped that this assessment encourages discussion at unit/hospital level or, better yet, an audit of the surgical outcomes of spine trauma surgery in the elderly. The combination of old age and an extensive spine operation is, more often than not, associated with poor outcomes and unnecessary suffering.

Surgical lessons:

This case is illustrative of an issue faced often in all fields of surgery: the balance between surgical intervention and conservative management. All treatment should strive to achieve goals that are patient-driven and not surgeon-driven.⁶ In this case, irrespective of whether the surgery could be successfully achieved technically, the treating team should have fully considered the age of the patient, the intermittent delirious state of the patient (making informed consent dubious), and the presence of the UTI, before deciding to proceed with the extensive surgery. Even for a younger patient, the presence of these other factors should lead one to pause and reconsider. One should not miss the forest for the trees.

Reference:

6. Ferguson Jr TB. Off-pump coronary artery bypass grafting versus conventional coronary artery bypass grafting: What we don't know. *The Journal of Thoracic and Cardiovascular Surgery*. 2016 Mar;151(3):893.

11 Orthopaedic Surgery

Smaller hospitals rely on larger centres to provide advice and accept patients that are beyond their scope of treatment

Clinical details:

Diagnosis: Right hip infected hemiarthroplasty resulting in sepsis.

Operations: Right hip arthrotomy and washout.

Cause of death: Sepsis and multiorgan dysfunction.

Course to death:

A patient aged early-80s underwent a hip hemiarthroplasty after sustaining a fractured neck of femur from a fall at regional hospital A. The patient was subsequently transferred to local hospital B for general medical care and rehabilitation.

A month after the primary surgery, the patient had started to feel unwell and developed wound cellulitis with the development of a small sinus growing methicillin-resistant staphylococcus aureus (MRSA) on culture. Four days after the onset of the wound issues, the patient was transferred back to hospital A. Upon admission, the patient was afebrile but tachycardic with a heart rate of 130 (irregular with a known history of AF), WCC of 18 and CRP of 42; mental state was alert but confused. The patient was diagnosed with a deep prosthetic joint infection and taken to theatre within 24 hours of admission for a washout of the hip joint.

Postoperatively, the patient had significant hypotension in the post-acute care unit, requiring IV fluids and vasopressors for maintenance of BP. The patient was admitted to ICU with a GCS of 10. Limitations of care were discussed with the family in view of continued deterioration and the resulting poor prognosis. The decision was made to palliate the patient and death occurred the next day.

Assessor's comments:

Case notes from both hospitals show the sequence of events leading to transfer and surgical management. Prior to the wound problems, the patient had been progressing relatively well with plans to see the aged care team for placement. The deterioration in the patient's medical status coincided with the discovery of wound issues. Initial treatment was directed towards cellulitis based on an ultrasound showing no collection, but it was the formation of a sinus and a rising CRP that prompted a discussion with the orthopaedic and infectious disease team at hospital A. The notes indicate communication difficulties in obtaining a timely response and clinical advice. The orthopaedic team agreed with oral clindamycin treatment (despite swabs growing MRSA) and asked for an infectious disease opinion, perhaps unaware of the previous communication difficulties with this unit. Treatment of the wound infection with clindamycin continued for three days before an infectious disease consultant was contacted and transfer back to hospital A was suggested, where the ultimately unsuccessful surgical treatment was performed.

A prosthetic joint infection post-hip hemiarthroplasty has a poor prognosis and a relatively high mortality rate in the elderly age group. Whilst it may not have changed the outcome, earlier transfer and treatment may have prevented the septic sequelae during the hip washout. The medical team at hospital B was reliant on hospital A for ongoing advice, however distance made communication of a clear plan of action difficult.

Use of ultrasound to diagnose a deep prosthetic joint infection should also be considered. Ultrasound may be appropriate to detect an early wound haematoma but is unreliable for the diagnosis of deep infection.

The development of wound issues in a prosthetic joint with a previously well healed wound represents a deep infection unless proven otherwise. This information was apparently relayed to the orthopaedic

team at hospital A but no plan for transfer or wound review was made, even when MRSA was grown and a sinus noted. The advice to continue clindamycin in this setting was clearly inappropriate.

In the end, it was the infectious diseases unit that suggested the patient transfer, not the surgical team.

By the time of transfer, the patient was in rapid AF. This was most likely a manifestation of early sepsis, which should have prompted a more urgent procedure.

Surgical lessons:

Prosthetic joint infection (PJI) is one of the few complications following total joint arthroplasty that can risk the survivorship of the prosthesis and threaten life if not diagnosed and treated in a timely manner. Any orthopaedic unit performing joint replacement surgery has a responsibility to communicate and respond to concerns from the extended team of rehabilitation and community practitioners. This is even more important in regional and rural locations where patients often travel considerable distances for surgery and subsequently transfer to a local service without surgical support. The validated criteria for PJI provide clear guidelines for surgical treatment and re-admission.⁷ Sinus tract formation is a major criteria and diagnostic for PJI. Following these guidelines would allow appropriate timing of transfer and assessment of patients needing surgical intervention, such as in this case, and may reduce morbidity and mortality.

Smaller hospitals lacking surgical services are reliant on larger centres to provide advice and accept patients that are beyond their scope of treatment. The experience of the medical teams can be variable and recognition of a serious surgical issue may not be made in a timely fashion. In this setting, the responsible surgical unit should have a low threshold for re-admission and review. Any concerns raised should be taken seriously with appropriate support given.

Reference:

7. Parvizi J, Tan TL, Goswami K, Higuera C, Della Valle C, Chen AF, Shohat N. The 2018 definition of periprosthetic hip and knee infection: an evidence-based and validated criteria. *The Journal of Arthroplasty*. 2018 May 1;33(5):1309-14.

12 Orthopaedic Surgery

The importance of communication in shared care

Clinical details:

Diagnosis: Right sub-capital neck of femur fracture.

Operations: No operation.

Cause of death: Cardiac failure secondary to atrial fibrillation.

Course to death:

A patient aged late-80s was admitted to hospital after a fall at home. There was no direct trauma to the head, and no history of chest pain, shortness of breath or dizziness preceding the fall. There was a history of AF being treated with dabigatran and digoxin, and past history of polycythaemia rubra vera, hypertension, generalised osteoarthritis, peripheral vascular disease, gout, eczema and congestive cardiac failure.

X-rays taken in the ED showed a displaced sub-capital fracture of the right neck of femur (NOF). Chest x-ray showed cardiomegaly and signs of interstitial oedema. CT scan of the brain showed no intracranial haemorrhage.

The patient was noted to be in rapid AF and was desaturating, requiring oxygen treatment via intranasal prongs. The patient was accepted for admission following discussions between the ED and an on-call orthopaedic registrar, but was not seen by the orthopaedic registrar until the following day. The orthopaedic registrar requested a medical registrar review in the ED.

The patient continued to have tachycardia and desaturation to 77% on 2L of oxygen by nasal prongs. Naloxone was administered because of opioid overdose (20mg IV morphine had been given prior to admission on the ward). Medical emergency team (MET) call criteria were adjusted to a heart rate greater than 150 and oxygen saturation less than 88%, although the reason for this is unclear. The patient was transferred to the ward about midnight. The medical review did not occur until the following morning.

At the orthopaedic ward round in the morning, the patient was considered unfit for surgery due to poor oxygen saturation, rapid atrial fibrillation and fluid overload. A regional block by an anaesthetic registrar was recommended. At orthopaedic-geriatric ward round the same morning, the patient had signs of fluid overload and was fluid restricted. The patient was given furosemide and metoprolol. A further MET call was made because of a decreased GCS and rapid AF. Patient care was discussed with family members and a decision made for ward management and no resuscitation. The patient was transferred to a cardiac ward for IV amiodarone and cardiac monitoring. Another MET call was made later in the day because of hypotension; further deterioration occurred and the patient died within two hours.

Assessor's comments:

Several different issues of this case cause concern. Communication between the ED doctors, the orthopaedic registrar and the medical registrar was poor. The patient was not seen on the night of the injury by either the medical registrar or the orthopaedic registrar. Documentation by doctors was unsatisfactory and at least one entry in the progress notes was made retrospectively. Notes should be in chronological order with date, time, reason for entry and future treatment plan.

There were several episodes of narcotisation. A documented dose of morphine 20mg IV given in ED is excessive in an elderly patient. Recommended opiate doses for elderly patients with a fractured NOF should be reviewed.

There was continued hypoxia, uncontrolled AF, and signs of fluid overload which were not adequately treated prior to discharge from ED to ward.

The changing of the MET criteria occurred without appropriate medical review. The MET call criteria should be reviewed and not changed without a clearly documented and valid reason.

The patient should have been admitted to a monitored bed in the high dependency unit following a medical assessment in ED. The orthopaedic registrar should have visited the patient in ED after finishing in the operating theatre and made sure that a referral was made to the medical registrar. Responsibility for the patient's care was with the ED doctors initially. When the patient was admitted to the ward, responsibility shifted to the orthopaedic and medical registrars and ultimately the two consultants. The pathway for treatment of patients with a fractured NOF should be reviewed, beginning with assessment and management in ED. This updated pathway should be sent to all ED, medical and orthopaedic teams.

Surgical lessons:

Care of the comorbid elderly patient with a fractured NOF requires multidisciplinary care and communication. Best practice guidelines have been documented in the Hip Fracture Care Clinical Care Standard⁸, designed to improve outcomes associated with hip fractures. The first "quality statement" relates to care at presentation, which involves the ED team performing timely assessment and management of medical conditions, in this case, AF and fluid overload. The second "quality statement" recognises the importance of pain management, which could have been optimised in this case by the use of a nerve block to minimise opioids.

Reference:

8. Australian Commission on Safety and Quality in Health Care. Hip Fracture Care Clinical Care Standard. Sydney: ACSQHC, 2016.

13 Urology

The importance of proper assessment of obstructing stones

Clinical details:

Diagnosis: Right renal colic.

Operations: Cystoscopy, right retrograde and insertion of right JJ stent for 12mm right upper ureteric stone; cardiac stent.

Cause of death: Acute myocardial infarction.

Course to death:

A patient aged early-70s with right renal colic was admitted to hospital via emergency. The patient had no fever and was haemodynamically stable on admission. CT scan showed an obstructing 12mm x 6mm right upper ureteric stone. The patient had several comorbidities including nine recent knee operations complicated by staphylococcus aureus, obstructive sleep apnoea, peripheral vascular disease, morbidly obese, hypertension, and diabetes mellitus. Preoperative bloods and urine were: creatinine 59umol/L, heavy growth of coliforms in urine only, WCC 13x10⁹/L. Preoperative assessment by a physician the next day showed a normal electrocardiogram. It was decided that the patient would have a stent inserted because the stone was too big to pass without intervention.

In the ward, preoperatively, the patient became febrile (38°C), with a heart rate of 110, BP of 144/65 and a respiratory rate of 20. The patient was taken to theatre for stent insertion that evening. Intravenous cefazolin was given intraoperatively. The patient collapsed in recovery post-extubation, was re-intubated and went to ICU postoperatively. Acute myocardial infarction was diagnosed leading to percutaneous transluminal coronary angioplasty performed the following day with bare metal stent to right distal right coronary artery.

Positive blood cultures for Staphylococcus aureus and Candida were recorded on postoperative day 2 and the patient was reviewed by the infectious disease team. The patient was dependent on inotropic support and developed multiorgan failure. After discussion with family, a palliative course was decided. The patient died soon afterwards.

Assessor's comments:

Good documentation was available from the ED, ICU and consulting physicians.

It is unclear if the surgeon was aware that the patient was septic prior to the stent being inserted. The operative notes do not indicate any appreciation of sepsis and make no mention of any postoperative antibiotics. The notes state that the patient was due for discharge the next day, which would be unusual for a patient with urosepsis. The ward notes also do not mention that the patient was febrile or that any doctors were informed. However, the observations chart and anaesthetic notes document that the patient was febrile and tachycardic prior to the procedure.

The patient was clearly septic before the operation. There is no record regarding possible consideration of insertion of a percutaneous nephrostomy, which would have avoided an anaesthetic and manipulation of a stone in an infected system. Perhaps it would have made no difference to the overall outcome and may have been technically impossible.

The operation notes, combined with Medicare Benefits Schedule (MBS) code 36857, suggest that the stone was manipulated during the stent insertion. This may merely reflect the stone being moved by the guidewire during the procedure (in which case the rarely used MBS code should not have been claimed), but if the stone was genuinely manipulated in the presence of sepsis, then this may have worsened the patient's condition and contributed to the subsequent events.

Surgical lessons:

Prior to planning definitive management, urologists are advised to make relevant enquiries regarding a patient with an obstructing stone who may or may not be septic. This key information may alter decision-making in preoperative, intraoperative and postoperative patient care.

14 Urology

Too many “red flags” to pass this off as unavoidable

Clinical details:

Diagnosis: Renal cancer.

Operations: Open right radical nephrectomy.

Cause of death: Intraoperative blood loss.

Course to death:

A patient aged late-60s was admitted to hospital with renal cancer. The patient had previously undergone a lap partial nephrectomy with subsequent locally recurrent tumour, plus failed radiofrequency ablation, due to large liver haematoma caused during saline hydrodissection.

The patient was listed for laparoscopic approach but the treating surgeon opted for open loin supra 11th rib approach. Dense fibrotic reaction was found, particularly between the liver and the region of the kidney tumour, also surrounding the renal vein and suprarenal IVC. Finding a plane anteromedially between the kidney and peritoneum was unsuccessful. Posterior dissection was found to be easier and the artery was taken, but the vein could not be easily dissected out and further dissection was attempted supermedially. During dissection of medial adhesions between liver and kidney and of upper pole, sudden brisk venous bleeding arising posteriorly was noticed.

Rapid final dissection and removal of the specimen was performed. Anaesthetists were notified of the heavy bleeding and the IVC injury was controlled with a Satinsky clamp. A further injury to the IVC lower down was also noted and repaired. The massive transfusion protocol was activated but it became apparent that large amounts of blood products were not easily accessible. Once the initial IVC injuries were repaired, haemostasis appeared to be obtained, but bleeding was then noted much lower down and a hole was seen at the confluence of the right iliac vein and IVC. This was repaired but not well controlled. At this point, a vascular surgeon was called, who, unfortunately, was only available from a distant site. Manual pressure was applied while awaiting vascular help. However, the lack of blood products meant that coagulopathy was setting in and generalised bleeding was noted, including from those areas already repaired. The vascular surgeon arrived after approximately 45 minutes, but the ongoing lack of blood products prevented anything further being done. Efforts ceased after agreement by all team members. The patient had exsanguinated.

Assessor’s comments:

This case is concerning as it raises many issues. There appears to be a lack of appreciation—some may say a lack of insight—by the surgeon that the outcome could have been different.

This case was a re-do surgery and should have had more discussion at a multidisciplinary meeting or surgical planning meeting. The operation should have been done at a larger facility with an ICU and more surgeons and blood products available. To be booked by a different surgeon as a laparoscopic +/- open surgery was optimistic and this probably should have been reviewed well before surgery day; changing to an open approach by the eventual treating surgeon was wise.

Regarding the operative approach: flank incisions are largely historic. A re-do surgery using the flank incision gives poor access to the renal hilum, which is where the trouble would be. An extended sub-costal, midline or reverse “L” in the supine position would have afforded better access to the hilum.

The operative technique raises concern. Once the first major bleed occurred the surgeon should have stopped and pushed with a sponge stick or pressure/packs until anaesthetics caught up with intravascular loss. Help (i.e. vascular or other specialist) should have been summoned early. The patient could have been stabilised and perhaps consideration given to opening further and making a thoraco-abdominal approach or other improved access. It is unclear how multiple injuries to major

vasculature occurred but as “hand retraction” was raised as an issue it means it was preventable. Bleeding from pelvis to thorax speaks to ploughing on instead of consolidating.

Access to blood products was terribly inadequate. The surgeon could have elected not to operate unless adequate products were available or even stopped until blood products were available before large losses occurred. As pointed out by the surgeon, communication with the anaesthetic team was also at fault for inadequate access to product.

It is a mistake to believe that this outcome was inevitable. Deaths are terrible for all concerned but we must learn. If this operation had been done at a large medical campus with an appropriate incision and staff and blood products available, with planning and communication there is a very, very good chance that this patient would be alive.

With acceptance comes the opportunity to change. Such cases should not be done at the same facility or the same mistakes will be repeated. A two-surgeon approach is often wise, or at least proceeding with the knowledge that a colleague or other appropriate units are available at very short notice. Availability of vascular surgery support means conducting the operation at a facility with vascular surgeons on site, having a vascular surgeon in attendance or calling for such support early, none of which happened in this case.

Everything is easier in retrospect, however, there are simply too many “red flags” to pass this case off as an unavoidable death.

Surgical lessons:

Detailed planning is recommended, preferably with the assistance of a multidisciplinary team approach, when urologists are considering complex open and especially re-do surgical procedures. Advance planning for unexpected intraoperative and postoperative events should consider factors including surgery location, surgery site, hospital resources such as ICU availability, involvement of other specialty surgeons, and availability of equipment. Following these recommendations will ensure that patient safety and outcomes can be optimised.

15 Vascular Surgery

Choice of stent and a missed opportunity resulted in a catastrophic outcome

Clinical details:

Diagnosis: Acute mesenteric ischaemia.

Operations: Bypass, right common iliac artery to superior mesenteric artery; bowel resection; further bowel resection plus graft thrombectomy and re-look laparotomy.

Cause of death: Ischaemic bowel.

Course to death:

A patient aged early-70s was admitted with acute superior mesenteric artery (SMA) stent thrombosis following recent semi-urgent SMA stent insertion for acute on chronic mesenteric ischemia.

The stent insertion had been an uneventful procedure (SMA was stenosed >70%—not occluded), although subsequent review demonstrated high technical error (V12 stent protruding from SMA ostium to contact posterior wall of aorta i.e. gross over-length, with stent lumen almost occluded by aortic wall). The patient was discharged, but re-presented to the ED six days later with recurrence of pain. CT scan showed a patent stent and the patient was discharged. (This presentation was managed by the general surgical registrar without vascular team notification. Review of computed tomography angiography [CTA] demonstrated partial thrombus within SMA stent).

Four days later, the patient presented with recurrence of abdominal pain under a second vascular surgeon. CTA confirmed SMA stent thrombosis. Abdominal pain was worsening, however lactate was normal with no significant acidosis. The patient was urgently transferred to theatre for a right common iliac artery (CIA) to SMA bypass using 6mm PROPATEN Reinforced Graft. The patient was admitted to ICU postoperatively. Severe pain 3–4 hours post-surgery settled with analgesia and lactate improved from 4 to <2 during this period. Good clinical improvement was observed over the next 48 hours and the patient was discharged to the ward.

On day 3 on the ward post-bypass, MET was called for severe pain and distress. CTA confirmed graft thrombosis. The patient was immediately transferred to theatre and found to have ischaemic gut with only 60cm of small bowel viable due to gangrenous small bowel to caecum, which was resected.

Short gut syndrome post excision of ischaemic gut where graft thrombectomy was considered and discussed at this point. The discussion considered that previous stent occlusion and bypass graft occlusion made the likelihood of further thrombosis extreme with the high probability of 'taking-out' remaining collaterals to remaining bowel.

A re-look laparotomy 48 hours later involved resection of a further 10cm of small bowel leaving only 50cm of viable bowel remaining. The patient underwent graft revision and at the end of the revision the remaining small bowel and anastomoses were dusky and of questionable viability. A graft thrombectomy was performed with SMA anastomosis revised. Heparin infusion commenced.

The patient underwent re-look laparotomy and closure with a good SMA bypass graft and pulse. Total parenteral nutrition (TPN) commenced and the patient was considered for lifelong TPN. Ongoing large NGT outputs led to NGT being kept on. The patient was extubated four days later and commenced on ketamine for pain.

MET was called one week later due to increased respiratory rate and decreased GCS with possible seizures. The patient was started on keppra. The patient's abdomen was distended and guarded with no bowel sounds. Clinical assessment at this time strongly indicated the patient had further bowel infarction or anastomosis breakdown. Given the poor prognosis, further surgery was not offered and after lengthy family discussion, palliation was undertaken.

Assessor's comments:

Notes for the previous admission (SMA stent insertion by vascular surgeon A, presumably for chronic intestinal ischaemia) were unavailable, so it is impossible to determine if the indications were appropriate. The procedure notes indicate that a 7mm by 39mm V12 stent was inserted, which would likely to be too long. Subsequent CT angios proved this concern to be justified.

The reporting surgeon (vascular surgeon B), first became involved with the patient when he presented to the ED with acute abdominal pain. The CT angiogram demonstrated thrombosis of the SMA stent and the patient was transferred to the operating theatre for emergency laparotomy. A reinforced prosthetic graft was used to create a bypass between the right CIA and the SMA.

It is noteworthy that the patient had presented to the ED four days earlier with abdominal pain and was managed by the ED with general surgical involvement but no vascular surgical input. A CT angiogram at this time demonstrated a poorly positioned SMA stent with partial thrombosis, but no action was taken. It is surprising that a patient presenting with abdominal pain after a recently inserted SMA stent did not prompt a vascular surgical referral. Unfortunately, this represented a missed opportunity to achieve a favourable outcome for this patient.

After a torrid postoperative course involving multiple re-operations for graft thrombosis and bowel resections for infarctions, the final deterioration resulted in a decision for supportive care only and the patient succumbed.

Surgical lessons:

The choice of stent deployed by vascular surgeon A created what was to become a catastrophic outcome. One hopes that this surgeon has been made aware of the outcome and has acquired some insight that would be useful in the management of future patients.

The ED failed to realise the significance of partial thrombosis of a recently deployed stent and therefore missed the best opportunity to prevent subsequent events. The CT angiogram performed by the ED contained vital information, however this was under-appreciated and not acted upon.

The reporting surgeon (vascular surgeon B) attracts no criticism and appears to have acted appropriately and in a timely fashion. Achieving a good outcome in the acute setting of non-embolic mesenteric ischaemia is uncommon.

By way of suggestion, one could consider using autogenous vein as the bypass conduit in the acute situation—to avoid the risks of prosthetic graft infection—and running the vein graft “in-line” with a supra-coeliac aortic proximal anastomosis, passing the graft retro-pancreatically to the left of the aorta.

16 Vascular Surgery

Justification of extensive surgery in elderly patients

Clinical details:

Diagnosis: Extent 2 thoracoabdominal aortic aneurysm.

Operations: Endovascular thoracoabdominal aortic aneurysm repair (stage 1 of 2); completion branched endovascular aortic aneurysm repair and iliac branched device; L2 laminectomy and haematoma decompression; Back wound debridement, washout of lumbar wound, dural repair, insertion of lumbar drain, lumbar spine.

Cause of death: Cerebrospinal fluid leak with wound infection.

Course to death:

A patient aged mid-80s admitted for elective repair of thoracoabdominal aortic aneurysm. The patient's preoperative American Society of Anaesthesiologists (ASA) rating was a Category 3 (patient with severe systemic disease). The patient's medical history included a previous right internal artery aneurysm repair, a total hip replacement, stenting of descending thoracic aortic aneurysm, cholecystectomy and Type II diabetes controlled with oral hypoglycaemics. The patient was an ex-smoker—one pack a day from age 11 until age 40s.

The patient underwent a 4V branched endovascular aortic aneurysm repair (bEVAR) with a bifurcate device to the infrarenal aorta and a left iliac branch device. The initial procedure was terminated at the 10th hour mark, after 11 gray radiation exposure and a total of 240mg of contrast. The procedure was performed via a femoral and axillary artery cut down. A cerebrospinal fluid (CSF) drain was inserted in anticipation of monitoring and controlling CSF pressure.

A second lengthy procedure (6 hours) was performed seven days later and a second epidural catheter was placed. This procedure did not proceed as smoothly. The patient developed neurological symptoms within 24 hours and was noted to have acute left lower limb weakness. CT scan diagnosed an epidural haematoma at the level of L2/3. A laminectomy was performed and the patient was again returned to ICU. The patient was discharged from ICU to the ward after two days because of a persistent CSF leak that grew a *Staphylococcus aureus* epidermidis.

After two weeks the patient was returned to theatre for a back wound debridement and repair of the dural leak. The procedure was complicated by a 3-second episode of ventricular tachycardic arrest and the patient was returned to ICU. Further wound cultures at this stage grew *Pseudomonas*.

Twelve days following this event, MET was called to ICU and the patient was resuscitated. The patient was referred to cardiology, but it was decided that cardiac investigation was inappropriate at this stage. It is unclear if preoperative cardiac assessment with respect to patient fitness for surgery had been conducted.

The patient suffered a further cardiac event the next day, this time a ventricular fibrillation arrest. Although resuscitation was attempted, the total time of the ventricular fibrillation arrest was 11 minutes. The patient was intubated and returned to ICU. Following a family meeting, ICU treatment was withdrawn and the patient passed away.

Assessor's comments:

The planning, level of care, expertise and response to complications cannot be faulted in the care of this patient. The timing of intervention and referral to other specialties for help was entirely appropriate.

In this case, the real question to ask is: can surgery of this size be justified and are we really offering increased survival in a patient of this age.

Surgical lessons:

The valuable lesson to learn from this assessment is whether or not a patient aged mid-80s with an ASA score of 3 and non-insulin dependent diabetes is really a suitable candidate for such extensive endovascular surgery, knowing in advance that that there will almost certainly be some compromise to renal function with the contrast load and that there is always the possibility of significant radiation dose, which is not desirable.

17 Vascular Surgery

This patient's age, comorbidities and poor general condition were clearly contraindications to an interventional procedure

Clinical details:

Diagnosis: Rest pain from multilevel peripheral arterial disease.

Operations: Right leg thrombectomy with femoropopliteal bypass using the great saphenous vein.

Cause of death: Multiorgan failure due to complications from vascular surgery.

Course to death:

A patient aged late-80s suffering from persistent right leg pain affecting mobility and function was diagnosed with severe peripheral vascular disease. The patient was admitted under the care of the vascular surgeon team and prepared for the elective procedure.

Right lower limb angiogram with stenting of the superficial femoral artery (SFA) and popliteal arteries was complicated by distal embolisation, which was managed with suction thrombectomy and selective vessel administration of urokinase. Haemostasis was by compression, but this was further complicated by a pseudoaneurysm of the right common femoral artery.

The evening following the procedure the patient proceeded to interventional radiology for a planned injection of thrombin into the pseudoaneurysm. Shortly after injection of thrombin, the patient experienced pain in the right foot and lost consciousness, requiring two minutes of CPR. The patient was subsequently found to have a complete occlusion of the superficial femoral artery.

Management at this point was via IV heparin infusion and care in ICU to investigate the possibility of significant myocardial ischaemia. Overnight progress was relatively stable, with no troponin rise. The patient had no rest pain affecting the right foot, but discussion continued with the family to determine if the patient should be managed conservatively, or undergo primary major amputation or a very high-risk bypass procedure.

It was decided that the patient would undergo an emergency thromboembolectomy and superficial femoral artery popliteal bypass the next day. Upon re-perfusion of the right leg, the patient continued to have vasopressor support and blood transfusions to maintain adequate BP.

The patient remained intubated and on vasopressor support during overnight arrival into the ICU. Requirement for inotropic support was escalating, so the following morning, after discussion with the family, support was withdrawn and the patient died.

Assessor's comments:

This is a case of an elderly patient who died in hospital after undergoing unsuccessful surgical intervention. The patient had significant comorbidities including renal disease, diabetes mellitus and advanced age, and was described as "fragile". The adult risk assessment noted that the patient had recently lost weight, had fallen in the last twelve months, and was unsteady, requiring assistance to walk or move.

According to the SCF, indication for the procedure was ischaemic rest pain of the right foot. The patient endured three separate procedures for the treatment of extensive peripheral vascular disease, which—according to the hospital radiology report—was a long occlusion of the SFA extending to the proximal popliteal artery with disease of the proximal tibio-peroneal trunk and anterior tibial artery and with small calibre crural vessels.

The first procedure was a non-urgent endovascular procedure performed by the radiology department. An angioplasty was performed with stents deployed at the adductor canal and popliteal segment and in the mid- and proximal-SFA. This was complicated by distal embolisation, which was recognised at the time, but attempts to re-canalise the distal vessels with suction thrombectomy and thrombolysis

were unsuccessful. The procedure was abandoned and the patient anticoagulated with a heparin infusion. The procedure was further complicated by the development, approximately eight hours later, of a false aneurysm at the puncture site, which was treated with an ultrasound-guided thrombin injection in the radiology department. This was complicated by a thrombosis of the superficial femoral, popliteal and anterior tibial arteries and ischaemia of the foot, and an episode of what was described as “a transient loss of consciousness”, but which required CPR to resuscitate the patient.

The patient was managed and stabilised in ICU and anticoagulated with IV heparin. Investigations showed no evidence of any recent myocardial ischaemia. The progress notes report that the patient had an ischaemic right foot. The decision was made to perform an emergency thrombo-embolectomy and femoro-popliteal bypass graft, which occurred approximately 55 hours after the angioplasty procedure. The hospital notes do not include the surgeon’s operation report, but the discharge summary reported that the procedure was complicated by blood loss. The transfusion volume is not recorded, but the discharge summary recorded that 6 units of packed red cells and 2 units of albumin were prepared.

The patient required increasing vasopressor support postoperatively and died in ICU after developing multiorgan failure, possibly due to a reperfusion injury.

Surgical lessons:

Whilst it is acknowledged that the presence of ischaemic rest pain indicated that the viability of this patient’s leg was at risk and thus there was an indication for surgical intervention, the patient’s age, significant comorbidities and poor general condition were clearly contraindications to an interventional procedure. Treatment known to have a high failure and complication rate, for very extensive peripheral vascular disease in an elderly patient unfit to survive further attempts to treat the complications of the procedure, is questionable.

The decision to treat the false aneurysm was clearly justified, but the decision to offer and perform a salvage procedure with a major vascular reconstruction where ischaemia has been present for at least 55 hours was inappropriate and should be reviewed by the surgeon and the vascular and radiology departments.

List of shortened forms

AF	atrial fibrillation
ASA	American Society of Anaesthesiologists
bEVAR	branched endovascular aortic aneurysm repair
BP	blood pressure
CIA	common iliac artery
CPR	cardiopulmonary resuscitation
CRP	C-reactive protein
CRRT	continuous renal replacement therapy
CSF	cerebrospinal fluid
CT	computed tomography
CTA	computed tomography angiography
DU	duodenal ulcer
ECHO	echocardiogram
ED	emergency department
ENT	ear nose throat
FLA	first-line assessment
GCS	Glasgow Coma Scale
GDA	gastroduodenal artery
GI	gastrointestinal
Hb	Haemoglobin
IABP	intra-aortic balloon pump
ICU	intensive care unit
IV	intravenous
IVC	inferior vena cava
LV	left ventricle
MBS	Medicare Benefits Schedule
MET	medical emergency team
MRSA	methicillin-resistant staphylococcus aureus
NGT	nasogastric tube
NOF	neck of femur
OT	operating theatre
PEA	pulseless electrical activity
PJI	prosthetic joint infection
QP	Qualified Privilege
RACS	Royal Australasian College of Surgeons

SCF	surgical case form
SCV	Safer Care Victoria
SFA	superficial femoral artery
SMA	superior mesenteric artery
TB	tuberculosis
TOE	transoesophageal echocardiogram
TPN	total parenteral nutrition
UTI	urinary tract infection
VASM	Victorian Audit of Surgical Mortality
VF	ventricular fibrillation
VPCC	Victorian Perioperative Consultative Council
WCC	white cell count

VASM Management Committee Members

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