

Victorian Audit of Surgical Mortality (VASM)

Case Note Review Booklet

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ROYAL AUSTRALASIAN
COLLEGE OF SURGEONS



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COLLEGE OF SURGEONS



The Victorian
Surgical Consultative Council



The Royal Australian
and New Zealand
College of Obstetricians
and Gynaecologists



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Introduction

The Victorian Audit of Surgical Mortality (VASM) is a systematic peer-review audit of deaths associated with surgical care. The audit reviews all surgical deaths that occurred in Victorian hospitals following a surgical procedure or while the patient was under the care of a surgeon, even though no procedure was performed. The audit process is intended as an educational exercise, whereby causes of avoidable mortality and morbidity associated with surgery can be identified, and lessons for the medical profession can be disseminated. A number of specific cases that reflect trends from the recent audits have been selected for inclusion in this booklet to serve as topical and timely lessons for all surgeons and clinical team members. Issues of patient management (such as delay in diagnosis and treatment, communication errors and deficiencies in postoperative management) that have been reported in previous editions of the Case Note Review Booklet are again highlighted in this edition, and it is clear that they need repeated exposure to try and reduce the recurrent pattern of these errors.

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 (RANZCOG) has been conducted for all cases included in this booklet. The detailed medical records used in the review process comprise all medical notes and records relating to the patient's care. All notes and records used in the review process are strictly de-identified.

The Qualified Privilege declaration reassures surgeons by strictly protecting the confidentiality of information gained in the audit.

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

The appropriate specialist serving on the management committee has reviewed the cases and provided a summary of their opinion with relevant literature references for each case and appended as "surgical lessons" after each case.

I encourage you to make available the important lessons in this publication to all relevant health care professionals and to include them in training programs for junior staff. Additional copies of this publication can be provided as necessary.

The VASM staff would like to take this opportunity to thank all surgeons and hospitals participating in this educational activity. We hope you find this publication of value.

Mr Barry Beiles, Clinical Director, VASM

Emerging issues and recommendations

These emerging issues and recommendations are points to be considered and executed by hospitals and health professionals. The recommendations outlined below are lessons learned from the audited surgical mortality cases. The treating surgeons involved in these cases receive detailed reports and recommendations on issues of patient management identified by the peer-review assessors.

1. Improved leadership in patient care

- In complex cases there must be clear, demonstrable leadership in patient management.
- The treatment plan for each patient should be understood by all involved in their care.
- The lead clinician must be accountable, responsive, prepared for challenges and must focus on optimal patient care.
- During lengthy operations there should be a low threshold for seeking assistance from colleagues to avoid fatigue.
- Senior surgical opinion is essential when dealing with surgical complications and should not be delayed by team hierarchy structure.

2. Improved perioperative management

- Appropriate preoperative, intraoperative and postoperative preparation and management aims to decrease operative complications and promote successful recovery. Delay in, or unnecessary preoperative investigations can have fatal consequences.
- Preparation and management should include:
 - evaluation of both physical and psychological preparation,
 - complete medical history and physical examination procedures,
 - consent for the surgery and discussion of potential outcomes,
 - appropriate documentation and communication of results with clinical and surgical teams,
 - the avoidance of futile surgery through informed discussion with the patient and family.
- The patient should be discharged to the ward with comprehensive orders.
- Preventative measures should be implemented for reducing complications.
- Instructions must be given about further management when the patient is discharged from a clinical or surgical team.
- The potential outcomes from the probable clinical diagnosis must be considered when developing a treatment plan.
- Providing that surgical postoperative care can be provided appropriately, the patient should be transferred to a medical unit if elderly and high-risk, and when medical issues have been identified as the prominent clinical factor of the admission episode.

3. Improved protocol compliance

- All hospitals should have a formal protocol for early identification of clinical management issues and immediate management plans. This protocol needs to be updated according to national guidelines and policies.
- Hospitals should follow protocols. Failure to follow hospital protocol or national clinical guidelines during all parts of patient care can contribute to errors.

4. Action on evidence of clinical deterioration

- Clinical deterioration should be monitored as it is an issue that is recognised throughout Australia and internationally.
- When clinical deterioration occurs and no clear cause is identified, consideration should be given to causes outside the treating surgeon's specialty or expertise.
- Clinical findings must be considered alongside the results of investigations.
- Clinical deterioration must be acted upon as well as recorded.

5. Futile surgery and end of life care

- A number of surgeons and assessors considered some of the surgical procedures as futile.
- These include decisions about whether to continue with active treatments and surgery can be very complex in these frail patients when the treatment has a high risk of death or the end of life is near.
- RACS has explored the topic of futile surgery and end of life matters and prepared a policy statement on this topic.

6. Improved awareness of surgical emergencies, transfers and sharing of care

- Patients admitted as surgical emergencies are at greater risk when care is shared. All health professionals should increase their awareness of this risk to improve the quality and safety of patient care.
- Time delays are to be minimised for elderly, frail patients transferred between hospitals due to their limited physiological reserves. Delays for these patients can significantly affect surgical outcomes.

7. Infection control

- The audit revealed that patients admitted as surgical emergencies are at an increased risk of developing infection. The risk remains high in such a comorbid group of patients therefore stringent infection control care should be considered. The Australian Guidelines for the Prevention and Control of Infection in Healthcare are designed to prevent and manage healthcare associated infection. VASM endorses the use of current hospital protocols and guidelines to reduce the incidence of infection.⁽¹⁾
- Key actions to be taken for control and management are:
 - timely recognition,
 - appropriate investigation,
 - rapid administration of treatment,
 - timely involvement of expert teams.

8. In-hospital fall prevention

- The audit revealed that patients admitted as surgical emergencies have a greater risk of falling while in hospital. All health professionals should increase their awareness of this risk to improve the quality and safety of patient care.
- The Best Practice Guidelines for Australian Hospitals, Residential Aged Care Facilities and Community Care⁽²⁾ are designed to facilitate practices that reduce falls and associated harm. The VASM endorses the use of current hospital protocols and guidelines to reduce the incidence of in-hospital falls.^(3, 4)

9. Improved communication

- All health professionals and institutions should actively collaborate and communicate to effectively support an appropriate interchange of information and coordination of patient care at all stages during the admission episode.



Cardiothoracic Surgery

Case 1: Major surgery with inadequate preoperative assessment

Clinical details:

Diagnoses: Aortic valve stenosis and coronary artery disease.

Operations: Aortic valve replacement and coronary artery bypass grafts (CABGs) and tracheostomy.

Cause of death: Pneumonia (respiratory failure).

Course to death:

An 86-year-old patient with severe aortic stenosis, rapidly progressive, was admitted for elective aortic valve replacement and triple CABGs. Surgery was unremarkable. Postoperative recovery was complicated by acute respiratory distress syndrome with ventilator-associated pneumonia, and surgical tracheostomy was performed. The patient developed acute renal impairment in the context of sepsis and progressive right heart failure, and was put onto haemofiltration.

The patient developed heparin-induced thrombocytopenia, treated with danaparoid. There were no overt signs of bleeding. The filter for renal replacement therapy clotted off but otherwise there were no overt signs of clotting. The patient developed ventricular arrhythmias (torsade de pointes treated with electrolyte replacement only) and failed to improve on appropriate antibiotic and respiratory/circulatory support. Further treatment was thought futile after meetings with cardiothoracic surgeons, intensive care physicians and the family.

Active treatment was withdrawn and the patient died within 24 hours of that decision.

Assessor's comments:

There were insufficient included investigations available, therefore my opinions were based on recorded findings; in particular whether an echocardiogram (ECHO) was ordered or performed.

The death concerns an 86-year-old patient with a past history of only chronic atrial fibrillation (AF) and diverticular disease. The patient had been, until recently, active and independent although limited by cardiac symptoms. The patient was found to have severe aortic stenosis and triple vessel coronary disease, with normal left ventricular (LV) function and mild LV hypertrophy. This profile made the patient a good surgical candidate with reversible pathology, albeit an elderly patient with the risk profile that advanced age provides.

The patient was seen in the preadmission clinic one month prior to surgery, and was found to have signs and symptoms of cardiac failure including significant pulmonary oedema. Unfortunately these findings were diligently noted but were not treated, perhaps reflecting the conveyor belt of preadmission clinics where forms were filled in by junior staff, rather than the premise of assessing and treating a patient. Nonetheless, this was the beginning of this patient's demise as they were sent home to await surgery with a worsening clinical condition.

A month later the patient presented on the day of surgery in florid cardiac failure with severe orthopnoea and shortness of breath (SOB). The patient was in rapid AF (rate 130), significant pulmonary oedema and right heart failure. The patient was seen by the anaesthetic Fellow who felt that there would be no value in preoperative admission and optimisation due to the likelihood that the patient's failure was due to "LV outflow obstruction with or without ischaemia". There was no evidence of either and no request or investigations to confirm this.

The decision was made to proceed with surgery, though there was no record of a consultant anaesthetist or surgeon being consulted. This was the incorrect decision and set this patient on their terminal path. Even an otherwise robust 86-year-old patient carries an increased risk profile to surgery, and must have all factors optimised to ensure the best chance of success. This patient was sent to theatre acutely unwell when they should have been admitted, treated for heart failure, and undergone an ECHO and chest x-ray (CXR) to reassess their status prior to surgery.

The patient became cyanotic on induction but the aortic valve replacement and triple CABGs were otherwise uncomplicated, with good bypass and cross clamp times. The patient came off cardiopulmonary bypass on a small amount of support with noradrenaline and milrinone. There was a single shot of cardioplegia. On return to intensive care unit (ICU), the next few days were significant for dealing with the patient's instability - labile blood pressure, sudden hypotensive episodes, hypoxia, flash pulmonary oedema, recurrent ventricular tachycardia and delirium.

The patient also had hepatitis with coagulation disturbance that was either due to right heart failure and/or ischaemia. Despite this, there was no record of an ECHO examination until day 4, when a bedside transthoracic echocardiography was performed and showed normal atrioventricular function and normal LV. There was the suggestion of right ventricular (RV) dilatation and pulmonary hypertension; however, this finding was not pursued despite the patient's ongoing "failure to thrive". On day 8 the possibility of a transoesophageal echocardiogram (TOE) was raised but the cardiology registrar felt this was unwarranted and the matter was left. There was no mention, throughout this patient's stay, of another ECHO assessment. The lack of urgency in pursuing causation of this patient's gross instability was concerning. The patient's symptoms and signs were treated with an increasing list of interventions and yet the right heart was never assessed by TOE or posterior lead electrocardiograms. It was assumed the patient was an elderly patient struggling to overcome a large operation – this should be a diagnosis of exclusion.

The patient's heart failure symptoms should have been addressed given the normal LV and renal function, yet were resisted and possible aetiologies were not pursued. Over the next 10 days the patient continued to struggle, requiring two reintubations and eventually a tracheostomy. The patient inevitably tipped into multiple organ failure from which there was no recovery.

This patient's path was disappointing. From the beginning the patient was not properly treated, either in the preadmission clinic or reassessed and optimised on the day of surgery. This failure continued into their postoperative course, in which critical diagnoses were not aggressively pursued. The cardiac surgery team, though recording and making notes every day, had little input into the patient's postoperative care, with only passive reiteration of ICU notes and blood tests.

It was also pertinent to note that the patient's postoperative course occurred over the Christmas period, which may have affected availability of services such as ECHO.

Surgical lessons:

The preoperative workup of the cardiac surgical patient is critical in achieving a successful outcome for the proposed surgery. It is essential that all individuals involved in the assessment and management of these patients have a basic understanding of the disease processes that are being treated. Junior doctors are often assigned to the preadmission clinic; however, they should have a low threshold to defer to their more senior colleagues if there is any deviation in the patient's condition compared with when they were last seen by a consultant. Any acute deterioration in cardiovascular status should alert the treating doctor in the preadmission clinic that admission for medical optimisation could be required.⁽⁵⁾

Reference:

5. Bojar R. *Manual of Perioperative Care in Adult Cardiac Surgery*: Wiley-Blackwell; Fifth edition, 2010.



Cardiothoracic Surgery

Case 2: Unnecessary postoperative pleural drainage after successful surgery leading to catastrophe

Clinical details:

Diagnoses: Acute pulmonary oedema, severe mitral regurgitation and coronary artery disease, impaired LV function.

Operations: Mitral valve repair (Gore-tex chord to P2, cleft closure, 34 mm Physio II annuloplasty ring) and two CABG (left internal mammary artery left anterior descending artery [LAD] sequential).

Cause of death: RV injury during intercostal drain insertion.

Course to death:

An 84-year-old patient was admitted to hospital for an elective coronary angiogram. This was being performed for investigation of symptoms of SOB on exertion and at rest. The patient had SOB on minimal exertion, was short of breath at night time and was unable to lie flat (required five pillows to sleep).

The patient had a past history of recently diagnosed AF, hypertension and gastro-oesophageal reflux disease (GORD). The patient also had known cardiac symptoms, with a previous investigation 10 years ago demonstrating ischaemia in the anterior territory. This was not further evaluated. At the time of the angiogram the patient was found to be in acute pulmonary oedema and was therefore admitted to hospital for the management of decompensated heart failure. The coronary angiogram demonstrated significant stenosis in the LAD and diagonal system and was managed medically with diuretic therapy. A TOE was performed on day 2 and this demonstrated severe mitral regurgitation with left atrial and LV dilatation.

The medical management resulted in a significant improvement in the patient's clinical condition. After discussions at the cardiac case conference regarding the patient's suitability for cardiac surgery, the decision was made for the patient to have mitral valve and coronary artery bypass surgery. In view of the patient's age and comorbidities it was recognised that the surgery held higher than normal risk. The patient was assessed by the cardiothoracic surgical team and the procedure discussed. The operation was performed on the morning of day 6.

The operation proceeded in the standard fashion. A repair of the mitral valve was performed, placing Gortex chords to the posterior leaflet, closing the clefts and the A3 P3 commissure. A 34 mm annuloplasty ring was implanted. The operation was successful, with an excellent mitral valve repair and no residual mitral regurgitation. The patient was returned to the ICU in a stable condition on low dose inotrope support.

The patient made a satisfactory recovery in ICU with a slow wean off the inotropes. The intercostal drain tubes were removed on day 8. The patient was also discharged from the ICU on the same day. In the ward the patient made a satisfactory recovery. The patient had pre-existing AF and was commenced on oral anticoagulation. There was ongoing management for the patient's heart failure. The oxygen saturations were satisfactory (94% to 95% on room air).

There were small residual pleural effusions that were managed with ongoing diuretic therapy. The patient was assessed and felt to be suitable for discharge from hospital to a supported care facility, and was discharged from hospital on day 13. The plan was for a follow-up appointment in the outpatient clinic two weeks from the date of discharge.

The day after discharge the patient experienced increasing SOB and attended the emergency department (ED). A CXR demonstrated what was thought to be a left pleural effusion. A pigtail catheter was inserted in the ED and this drained a quantity of dark blood. The tube was clamped. Shortly after the patient arrested and could not be resuscitated. The case was referred to the coroner and reported to the hospital review committee. The postmortem showed an injury to the right ventricle caused by the catheter.

Assessor's comments:

The patient's presentation on day 14 was for increasing SOB and right sided chest pains. A number of investigations were undertaken, including a CXR that showed no significant change in the pleural effusion than when discharged. Later that morning a decision was made (although it is unclear as to who made the decision and what discussion was had) to drain a left sided pleural effusion by process of insertion of an intercostal pigtail catheter using a Seldinger technique. It appears this procedure was carried out in the ED, and shortly after the insertion of the catheter the patient became unresponsive with low blood pressure. The patient responded partially to an intravenous (IV) infusion, and a larger than expected amount of blood drained out of the intercostal catheter (ICC). The patient subsequently arrested and was given external cardiac massage, and a clinical decision was taken not to attempt further resuscitation by way of exploratory thoracotomy. The patient had a cardiac ECHO during the resuscitation period that demonstrated no significant pericardial effusion, some ascites and no significant pleural effusion. The patient was declared deceased on day 14 at around 11.30am.

The main concerns associated with this case were the decision to insert the ICC and the efficacy and care with which the catheter was inserted. Based on the information in the medical records, it remained unclear as to why insertion of the left sided costal catheter would be beneficial in treating a patient with a right sided chest pain and SOB, when no investigative imaging identified any significant pleural effusion.

While a retrospective note suggested that a reasonable technique was employed, the catheter was deployed in an inappropriate direction and depth, as the autopsy indicated it was entering the RV. This could only have occurred if the inserting practitioner was either inexperienced or impaired at the time of insertion. The level of experience of the practitioners that made the decision to insert the ICC was also unclear. Given the information available, it is probable that an experienced cardiothoracic surgeon would not have recommended such catheter insertion, but would have considered medical management and perhaps further investigation to exclude a more likely diagnosis of pulmonary embolisation or pericardial effusion.

In summary, this 84-year-old patient, while having a significant cardiac illness and confronting significant risks of surgery, underwent a successful operation and was discharged home from hospital. Unfortunately, early re-presentation to the ED with a questionable cause for insertion of an ICC and incorrect placement of the catheter, led to a premature and avoidable death.

The surgical team associated with this patient's care need to review the decision-making process that led to the use of an ICC in this clinical setting, as well as the experience and training of those clinicians inserting the catheter.

Surgical lessons:

ICC insertion is a common procedure in the postoperative cardiothoracic surgical patient and is often performed by more junior staff. Nevertheless, it remains an invasive procedure and can result in harm to patients if strict adherence to general surgical principles is not practiced. Careful consideration should be given to the indication and location for ICC insertion. Adequate supervision is required if the insertion is to be performed by someone who is inexperienced with ICC management.⁽⁶⁾

Reference:

6. Dev SP, Nascimento B Jr., Simone C, Chien V. Videos in clinical medicine. Chest-tube insertion. *N Engl J Med.* 2007 Oct 11;357(15):e15.



Cardiothoracic Surgery and Radiology

Case 3: Unnecessary postoperative pleural drainage after successful surgery leading to catastrophe

Clinical details:

Diagnosis: Type A aortic dissection.

Operations: Type A aortic dissection repair, thoracotomy and clip intercostal artery.

Cause of death: Exsanguination causing hypoxic brain damage.

Course to death:

Pleural effusion causing breathlessness and oxygen requirement in the postoperative period after Dacron graft repair of a type A dissection. An ICC was inserted on the ward at 6.30pm on day 7 for drainage of a pleural effusion. Initially good drainage of the pleural effusion was seen on CXR at 6.55pm; however, the patient developed massive haemorrhage from a lacerated intercostal artery at 8.30pm while in ED radiology (seen on CXR). Haemorrhagic shock developed and the patient went into cardiac arrest. They were resuscitated with cardiopulmonary resuscitation for 1 minute; blood products and adrenaline were used in the ED. The patient was transferred to the operating theatre for thoracotomy to repair the bleeding intercostal artery. As a consequence of the bleeding, low blood pressure and cardiac arrest, the patient sustained a severe (hypoxic ischaemic) brain injury that was nonsurvivable. There was no significant past medical history prior to the type A aortic dissection.

The patient received 80 mg of enoxaparin at 2.00pm on day 7 postsurgery for suspected pulmonary embolus, which was ruled out on subsequent computed tomography (CT) scanning of the chest. Initial surgery for type A aortic dissection proceeded smoothly, with very good progress postsurgery. The patient was almost ready to go home when the above event occurred. ICC insertion was performed by a resident under registrar supervision without any prior discussion with the consultant.

Assessor's comment:

This was truly a most tragic case of a patient surviving a life-saving operation for a condition that is almost universally fatal if left untreated, who then undergoes a 'minor' procedure on the eve of their discharge from hospital 1 week later and dies as a result. Mortality for the condition of aortic dissection is high, with less than 40% of patients making it to a hospital with the appropriate surgical facility, and up to half of those who do make it not surviving. The mortality for those who are able to be operated on can be as high as 40%, depending on the experience of the individual surgical units involved. This patient received prompt diagnosis, management and early surgical correction of the dissection and both initial management and documentation were exemplary. The patient was in the operating theatre within a couple of hours of confirmation of the diagnosis, survived the surgery despite the usual complication of postoperative coagulopathy, woke without neurological deficit and was able to be extubated within 24 hours. The issue in this case revolves around the decision making regarding the treatment of a postoperative right pleural effusion and the communication with the consultant surgeon.

Firstly, there was the decision to drain at all - the bilateral pleural effusions were not that large in the first place (radiologically estimated at 690 mL on the right and 450 mL on the left). It seemed from the notes that the patient was sent to radiology for ultrasound examination

and drainage of the effusions should they have been significant enough. The patient had been sent for a CT pulmonary angiogram earlier that day to exclude pulmonary embolism as the cause for exertional dyspnoea and had received a therapeutic dose of subcutaneous enoxaparin prior to the scan. The radiologist correctly declined therapeutic thoracentesis due to the presence of the anticoagulation, and this should have been like a red flag to the medical officers involved. Thus, secondly, there was the poor decision to insert the ICC in an anticoagulated patient. The medical officers were obviously aware of this potential complication as the consent form acknowledged the possible complication of haemothorax. The thoracentesis was apparently undertaken by the resident medical officer under registrar supervision, and appears to have been done following the appropriate protocol and caution. The result (720 mL haemoserous fluid initially) and the postprocedure CXR seemed to indicate that the drainage had been successful.

The third breakdown in good management was the slowness in recognising the evolving blood loss and haemothorax. The clinical indicators were all there, such as worsening dyspnoea and severe pain, including shoulder tip pain. Even the patient's partner, in the open disclosure dialogue document, felt that they "were not listened to", that the response to the patient's severe pain was "too casual" and that the medical staff were too slow to recognise something was wrong. These are all valid and pertinent points. The fact that the patient developed haemorrhagic shock while having the confirmatory CXR in the ED radiology, just 2 hours after the ICC was inserted (and subsequently removed for pain and dyspnoea) points to a lack of good clinical assessment of the patient. Surely the indications of massive haemothorax and blood loss would have been obvious. Finally, failing to discuss the proposed thoracocentesis with the consultant surgeon was the other major issue. It is almost certain that the consultant would not have approved such a procedure, particularly as the effusion was not large and the patient was anticoagulated.

In summary, death in this case was preventable and the issues were:

- decision to drain the effusions
- decision to insert an ICC in an anticoagulated patient
- poor clinical assessment of a patient experiencing a major complication (haemothorax and incipient haemorrhagic shock)
- failure of communication with the consultant surgeon.

The hospital had excellent documentation and the openness with which they conducted their dialogue with the patient's partner is to be commended, particularly the use of the open disclosure dialogue document. This is an excellent tool and well serves the interests of transparency and accountability.

Surgical lessons:

Communication is one of the nine RACS competencies that all surgeons and trainees should be familiar with.⁽⁷⁾ Good communication is essential across all levels of surgical care to ensure the delivery of the highest standards of care to patients. Failure to communicate can often lead to poor outcomes.

Reference:

7. Royal Australasian College of Surgeons. Nine RACS Competencies. East Melbourne: *Royal Australasian College of Surgeons*; 2016 [cited 2016 7 December 2016]; Available from: <http://www.surgeons.org/becoming-a-surgeon/surgical-education-training/competencies/>.

General Surgery

Case 4: Poor postoperative communication with the treating surgeon despite repeated MET calls and a leaking anastomosis

Clinical details:

Diagnoses: Rectovaginal fistula with dysfunctional loop ileostomy.
Operations: Closure of loop ileostomy and laparoscopic formation of end colostomy.
Cause of death: Gross systemic sepsis: possible anastomotic leak.

Course to death:

An 81-year-old patient was admitted for planned closure of loop ileostomy (dysfunctional) and conversion to end colostomy. The patient had a past history of anterior resection for rectal cancer with postoperative radiotherapy. The patient also had a colovesical fistula that was biopsy-negative for local recurrence. Comorbidities included diabetes, cardiac failure and dementia. All investigations were negative for local recurrence and it was presumed to be as a result of radionecrosis. Lung and liver metastases were diagnosed. Palliative loop ileostomy had resulted in poor local stoma control, which was revised. This final admission was an elective admit for closure of the ileostomy.

A laparoscopic mobilisation of the left colon with side-to-side stapled anastomosis of small bowel after resection of ileostomy was carried out. All staple lines were oversewn and an end colostomy formed. It was an uneventful recovery until day 7.

The patient went into urinary retention on day 3 postoperatively, the indwelling catheters were removed on day 5 and a urinary tract infection with *Escherichia coli* was documented. A medical emergency team (MET) call was made on day 6 at 11.59am for rapid AF. The patient's condition was discussed with the medical registrar regarding anticoagulation. Electrolytes were replaced due to low magnesium, nausea and vomiting. The patient was febrile and tachypnoeic and deemed to be septic. Blood cultures were taken and bloods were sent with full septic screen initiated. CXR was performed revealing free gas and a CT abdomen showed increased possible air leak. Subsequent multiple MET calls were made due to increased respiratory rate, tachycardia and sepsis.

Discussion with family regarding resuscitation limitations and patient not deemed appropriate for ICU on day 7 at 4.00am. Over the course of the day the patient continued to have multiple MET calls. Gastrograffin was given, revealing extravasation at the anastomosis. The patient was planned for surgery but this was cancelled due to low blood pressure, leading to discussions with the patient's family. The patient continued to deteriorate throughout the day and a decision was made to palliate. The patient passed away on day 7 at 9.00pm.

Assessor's comments:

This 81-year-old patient was admitted for elective surgery because of a difficult to manage ileostomy that was performed to control a rectovaginal fistula resulting from treatment of rectal cancer. The patient had low volume metastatic disease known for several years, in addition to mild vascular dementia, biventricular heart failure and type 2 diabetes. The patient had been transferred after unsuccessful refashioning of a loop ileostomy at another hospital.

The laparoscopic assisted ileostomy resection and formation of colostomy proceeded uneventfully. Three days later there was some vomiting, the patient was noted to be in AF and there was minimal stoma output. On postoperative day 6 progress was satisfactory, and the patient was reviewed by the rehabilitation team and deemed ready for transfer to rehabilitation.

At midnight on day 6 there was a MET call with heart rate 130 beats per minutes (bpm) and rigors. A CXR showed significant free gas and a subsequent CT scan confirmed increasing free gas and intra-abdominal fluid. After a second MET call criteria were modified to allow a heart rate of up to 140 bpm.

The overnight plan was for palliation including antibiotics and fluids, and not for resuscitation in light of known metastatic cancer, but these instructions were only documented at 8.00am the following morning. The patient continued to deteriorate with a total of seven MET calls (although the documentation was unclear, so a couple of the MET call entries may actually refer to the same episode). The surgical registrar considered an anastomotic leak and ordered a Gastrografin follow through, which occurred at 11.30am but was unhelpful. The ICU consultant reviewed the patient at 3.00pm and requested a surgical consultant review. The consultant documentation was at 4.30pm and the plan was to take the patient to theatre for laparotomy for peritonitis. The patient's condition deteriorated and it was felt that surgical intervention would be futile. Palliation was instituted and the patient died later that evening.

Documentation in the progress notes was patchy. There was no indication of goals of care, or of advanced care planning. At the time of being made palliative it was documented that there was no advanced care plan. There was no documentation of any surgical consultant review, or of postoperative discussions being held with the consultant, until the day of death.

It was surprising (and disappointing) that, despite seven MET calls for this desperately unwell patient in the space of 12 hours, a surgical consultant was not notified. The patient's only chance of survival would have been early recognition of anastomotic leak and return to theatre. The covering team overnight had no written indication of advanced planning, and did not appreciate the significance of free intraperitoneal gas and clinical deterioration.

Documentation of the goals of care and advanced care planning are important in elderly patients with significant pathology and comorbidities. The responsible consultant should be kept informed of progress and this should also be documented. A MET call indicates significant clinical concern and should mandate notification of the consultant who can advise appropriate investigations or care limitations.

General Surgery

Case 5: Communication failure in the deteriorating patient

Clinical details:

Diagnosis: Adenoma right colon, no malignancy.

Operations: Laparoscopic right hemicolectomy and diagnostic laparoscopy.

Cause of death: Aspiration/respiratory failure.

Course to death:

An 85-year-old patient who was independent with a history of AF, hypertension, asthma and transient ischaemic attack, underwent elective laparoscopic right hemicolectomy for a large tubulovillous adenoma. The patient was admitted the day before for bowel preparation with IV hydration. There was consideration for postoperative ICU but the patient was sent to the ward after a stable procedure.

On day 1 postsurgery a MET call occurred at 3.30pm for rapid AF. Medical treatment was instituted but the pulse rate remained around 100 to 150 overnight. By the evening of day 2 the patient had developed marked oliguria despite positive fluid balances. At this time the jugular venous pressure was noted to be between 4 and 6 cm on separate medical reviews. Over the course of day 2 the patient was also nauseated and had “several large vomits” but oral intake was continued.

The second MET call was in the early hours of day 3 for oliguria and hypoxia. The patient was also noted to have patchy consolidation on CXR but remained on the ward. Later in the morning complete anuria was noted and acute renal failure diagnosed. Discussion with the medical registrar by overnight staff did not lead to an escalation of care. The third MET call was in the morning of day 3 postoperation for oliguria and hypoxia and the patient was eventually transferred to ICU with anuric renal failure with rising lactate as well as pneumonia. The patient was intubated and investigated with CT to rule out abdominal catastrophe. The scan did not show any obvious surgical calamity but there was evidence of ileus. A diagnostic laparoscopy to rule out ischaemic gut was negative. The patient continued to deteriorate further over the next 12 hours, with renal and respiratory failure, before passing away postoperatively on day 4. It had been agreed after discussion with the family that the patient was not for haemofiltration.

Assessor's comments:

The documentation in this case was adequate. However, there was no indication of any involvement or discussion with the surgical consultant in charge over the period of the patient's deterioration until the relaparoscopy was performed.

It appears that the patient died essentially from acute renal failure with contributions from poor cardiac output (uncontrolled rapid AF) and uncertain fluid balance in the setting of surgical ileus. Pulmonary oedema, abdominal distension and pneumonia may have all had a part in the progression of respiratory failure.

The most pertinent issue here is early recognition of the deteriorating patient.

Transferring this elderly patient to the ward to manage a rapid AF with deteriorating urine output, ileus and declining respiratory function was incorrect. The evidence of deterioration was present from day 1 and an escalation to ICU with central line monitoring was indicated on, at very latest, day 2 postoperation. Unfortunately multiple reviews by medical, surgical and intensive care staff failed to lead to an appropriate escalation of care, which raises the question of whether the surgical consultant was informed and involved in the decision making over the first few days. Poor communication with senior staff may have been an issue here.

In conclusion, elderly patients with comorbidities can deteriorate quickly and there should be a low threshold for escalating the level of care, particularly after MET calls have been attended. Communication with senior staff in the event of deterioration of the surgical patient is essential and consultants must ensure that junior staff (who change jobs regularly) are aware of their expectations. The consultant in charge should always be informed if a MET call is instituted on one of their patients.



General Surgery

Case 6: Difficult prolonged surgery should use two surgeons. Missed enterotomy after adhesiolysis

Clinical details:

Diagnosis: Small bowel obstruction.

Operations: Laparotomy for small bowel obstruction and laparotomy twice to relook laparotomies.

Cause of death: Septic shock.

Course to death:

A 61-year-old patient was admitted with a small bowel obstruction. The patient was transferred from a rehabilitation facility following a recent intracerebral haemorrhage from which the patient was now bed bound. The patient also had significant comorbidities, including ischaemic heart disease, type 2 diabetes, hypertension and multiple previous laparotomies for small bowel obstruction. The patient had a history of a total colectomy and ileorectal anastomosis many years ago for inflammatory bowel disease. The patient also appeared to be difficult to assess due to a history of chronic abdominal pain.

The patient was treated conservatively for 3 weeks with total parenteral nutrition and nasogastric tube (NGT). The patient developed recurrent small bowel obstruction and peritonism after an initial response and was clinically assessed to have probable dead bowel. A laparotomy was performed after extensive discussions with the patient about the high operative risk. It took approximately 6 hours, with dense adhesions and multiple enterotomies made and repaired. The patient developed severe sepsis. Second-look laparotomies were performed on each of the two following days, which revealed a missed enterotomy and two other leaking repaired enterotomies. At the second relook, most of the patient's small bowel was infarcted secondary to shock and inotropes, and this led to the discontinuation of active treatment.

Assessor's comments:

The patient was a high risk for laparotomy given the comorbidities and multiple previous laparotomies, and this was recognised. There was no immediate indication for laparotomy on admission and a period of conservative management undertaken. This included the use of water soluble contrast follow-throughs. The obstruction appeared to resolve and discharge plans were made for rehabilitation 12 days after admission.

The patient then appeared to re-obstruct. Eleven days later laparotomy was performed. Documentation in the patient history was lacking as to the reason for operating at this time, rather than earlier following re-obstruction. It was reported in the case record form that the patient developed peritonism with concern for ischaemic bowel.

It was uncertain as to whether the patient was given total parenteral nutrition during the period of re-obstruction. Albumin levels were 22 g/L at the time of initial laparotomy. There were no records of preoperative total parenteral nutrition being administered even though this was reported in the case record form (these may be missing).

Poor nutritional status may have adversely affected the patient's ability to recover from surgery.

Laparotomy, adhesiolysis, small bowel resection and repair of enterotomies were performed. The patient was in the operating room for around 6 hours and extensive, dense adhesions were noted. Small bowel was noted to have herniated behind the superior mesenteric artery. A preoperative note was made in the patient's history that two consultant surgeons would likely be required for a laparotomy. The seniority of the assistant was not recorded in the case record form.

At the second laparotomy the missed enterotomy was repaired, as were two previously repaired enterotomies that were leaking. These would appear to represent technical errors. The patient continued to deteriorate and at a third laparotomy performed the next day, one metre of infarcted bowel was present along with global ischaemia of the entire small intestine. The situation was determined to be non-salvageable.

Appropriately, a consultant general surgeon performed all three of the patient's laparotomies. Once the patient re-obstructed, laparotomy was indicated and it was unclear why a further 11 days of conservative management was undertaken. The high risk the patient posed, and the likely technical difficulties, were acknowledged - as they were by the treating surgical team. The use of a two surgeon team may be useful in such difficult laparotomies. The patient's death was, however, not directly attributable to any delay in operating. Ultimately the patient died from an unrecognised enterotomy and leaking repaired enterotomy sites. These represent technical errors, and were reported as such in the case record form by the operating surgeon. Once again, perhaps the presence of a second consultant at such a difficult operation may have recognised these technical errors at the initial laparotomy and possibly prevented the patient's death.



General Surgery and Gynaecology

Case 7: Major surgery in a complicated patient should be performed at a major hospital

Clinical details:

Diagnoses: Liver failure (decompensated hepatitis C cirrhosis) and vaginal haemorrhage.
Operations:
Hospital A- Hysterectomy and bilateral salpingo-oophorectomy, laparotomy and haemostasis.
Hospital B- Laparotomy for haemostasis, liver transplant, laparotomy and splenectomy.
Cause of death: Multiorgan failure, disseminated *Candida glabrata* infection.

Course to death:

A 59-year-old patient with a known history of hepatitis C cirrhosis and some evidence of decompensation (international normalised ratio [INR] 1.6 preoperative, and evidence of portal hypertension – dilated intra-abdominal veins and ascites noted at laparotomy) presented with bleeding per vaginum that failed to respond to embolisation. Other significant comorbidities were type 2 diabetes, hypertension, chronic obstructive airways disease, bipolar affective disorder and gastro-oesophageal reflux.

The patient underwent elective total abdominal hysterectomy and bilateral salpingo-oophorectomy at Hospital A. This was complicated by large volume bleeding, for which repeat laparotomy was performed the following day. At laparotomy, 3 to 4 L of blood was evacuated and a bleeding ovarian pedicle was underrun. Liver and renal failure subsequently developed.

Haemofiltration was instituted, the patient was intubated and the patient was transferred to the ICU at Hospital B, under the care of the liver transplant unit on day 4 postsurgery. Ongoing support of renal, respiratory and circulatory systems was undertaken. Broad spectrum IV antibiotics (vancomycin and piperacillin [Tazocin]) and IV fluconazole were given. Fourteen days postsurgery, bleeding into the rectus sheath and peritoneal cavity were identified in the lower abdomen. The patient underwent laparotomy and evacuation of haematoma. Bleeding from the inferior epigastric vessels was identified and haemostasis was performed.

Consideration was given to liver transplantation, with assessments regarding the patient's fitness for the procedure, in view of the patient's high operative risk, made on a daily basis. Cardiology assessment was performed and the patient was deemed fit for transplantation. A suitable, standard criteria (i.e. good quality) liver donor became available and liver transplantation was performed on day 16. The native liver was small with evidence of micronodular cirrhosis. Haemoperitoneum of 1.5 L was noted and evacuated at the start of the procedure. Liver transplantation was performed expeditiously, with a cold ischaemia time of only 4.4 hours. During the transplantation, following implantation, there was evidence of right heart failure with rapid swelling of the liver. This was managed by off-loading volume via the haemofilter and administration of milrinone.

Following transplantation, despite good liver function, the patient remained critically unwell, with ongoing need for haemofiltration. Disseminated *Candida glabrata* infection was identified. Maximal medical therapy was continued with the assistance of the infectious diseases unit. CT abdomen revealed low density throughout the spleen and there was concern that the spleen might be a source of ongoing candidaemia.

Therefore, laparotomy and splenectomy were performed. *Candida glabrata* was grown from the spleen, confirming this as a site of *Candida* infection. Unfortunately candidaemia continued despite the medical and surgical management and aortic valve endocarditis was identified.

The treating surgeon was on annual leave from day 45, therefore knowledge of the patient's subsequent course was based on review of the notes. The patient continued to deteriorate and did not recover from multiorgan failure. After consultation with the patient's family, life sustaining therapy was withdrawn and the patient died 75 days later in ICU since the transfer.

Assessor's comments:

General surgical perspective

There were no concerns regarding the management of this patient at Hospital B where she was treated by a surgical unit. The records regarding the treatment at the regional Hospital A were not available.

The area of concern in this case was the decision to proceed with a necessary operative procedure at a regional hospital in the setting of Child's C cirrhosis with a known preoperative clotting disorder (INR 1.6) and portal hypertension. This patient may have been better managed in a major metropolitan hospital, where there were more available resources and the opportunity to consult rapidly with appropriate specialists. However, the outcome may have been the same given the underlying disease processes and comorbidities.

Gynaecological perspective

There were several areas of concern with this case. The first area of concern was the decision to proceed with major surgery in the presence of liver failure secondary to hepatic cirrhosis. This was a significant risk factor for a bleeding disorder, especially in a regional centre without an ICU experienced in managing such cases or the back-up of a liver unit. Consideration should have been given for transfer to a tertiary centre with stabilisation prior to surgery and planned postoperative ICU admission.

The second area of concern was the postoperative care in the first 24 hours, with long delays in diagnosing the postoperative intraperitoneal bleeding and delays in returning to theatre. They contributed to the patient's deterioration following the second procedure and the multiorgan failure that necessitated an urgent liver transplant. This patient was anuric overnight, with no senior clinical input into the patient's care and delays in returning to theatre to manage postoperative bleeding.

Finally, there were significant comorbidities existing in this patient that significantly increased the risks of surgery. The final result may have occurred regardless of the patient's intraoperative and postoperative care.

Surgical lessons:

High-risk patients have a higher risk of bleeding and should have laparotomy earlier. Negative laparotomy is better than a long delay before complications are diagnosed, with no capacity to recover from physiological insult.

1. Hysterectomy should be considered only where other treatment options have failed or are contraindicated.
2. Preoperative assessment and stabilisation should be planned for any patient with a medical comorbidity.
3. Surgical cases likely to require postoperative ICU care should be managed in centres where those facilities are easily accessed.
4. Early return to theatre in an unstable patient should be considered.⁽⁸⁾

Reference:

8. National Institute for Health and Care Excellence. Heavy menstrual bleeding: assessment and management. UK: *National Institute for Health and Care Excellence*; 2007 [updated Aug 2016; cited 2016 16 Dec 2016]; Available from: <https://www.nice.org.uk/guidance/CG44>.



Neurosurgery

Case 8: Deal with subarachnoid hemorrhage in one procedure rather than multiple episodes involving delay in decompression

Clinical details:

Diagnosis: Subarachnoid haemorrhage.

Operations: External ventricular drain (EVD), digital subtraction angiography, coiling anterior communicating artery and decompressive craniotomy.

Cause of death: Subarachnoid haemorrhage.

Course to death:

A 47-year-old patient driving a car had a seizure secondary to subarachnoid haemorrhage and drove into a fence (at low speed). Glasgow Coma Scale (GCS) 3 at the scene improved to 12 once ambulance arrived. A CT demonstrated subarachnoid haemorrhage from anterior communicating artery aneurysm with a large left lobar/frontal haemorrhage. An EVD was placed and the patient was taken to the interventional suite for coiling. The patient was extubated in ICU by the next day. The patient was found to have arm weakness. A repeat CT brain scan showed evolution and expansion of the haematoma in the right frontal lobe. Repeat digital subtraction angiography showed a small second aneurysm. Intracranial pressure (ICP) from EVD was not elevated. The patient was kept sedated for the next 2 days then slowly woken with ICP now elevated. Repeat CT scan showed increased mass effect from right frontal haematoma. Frontal craniectomy was undertaken on day 4 but the patient continued to deteriorate despite intra-arterial vasodilators between days 8 to 11, and was unable to be extubated. There was no meaningful neurological recovery. A decision to palliate resulted from family meetings and the patient died on day 20.

Assessor's comments:

The medical notes do not show the reasoning behind the decision to proceed to coiling rather than immediate evacuation of the haematoma. They also do not explain why, following repeat CT demonstrating more mass effect from the haematoma on day 1, the decision was not made to evacuate the haematoma at that time.

Why did the initial management involve a three-stage procedure after the diagnosis of intracerebral haemorrhage and aneurysm? Instead of EVD, digital subtraction angiography and coiling, it would have been more appropriate to have proceeded straight to craniotomy, evacuation of intracerebral haemorrhage, clipping of aneurysm and placement of EVD. This would have dealt with the aneurysm, intracerebral haematoma and hydrocephalus under a single procedure, and would likely have obviated the subsequent requirement (4 days later) for decompressive craniectomy.

Why, on day 4, was a craniectomy performed, rather than evacuation of intracerebral haematoma or a combination? It should be stated that in the setting of significant intracerebral haematoma and anterior communicating artery, aneurysmal subarachnoid haemorrhage, the standard of care was to evacuate the haematoma and clip the aneurysm. In today's era of subspecialisation, whereby some on-call general neurosurgeons do not have sufficient experience in surgically clipping such aneurysms and therefore revert to referring for coiling procedures, it is recommended that the treating surgeon ring a colleague who is experienced in such surgery.

Most experienced surgeons are only too willing to attend and supervise the junior surgeon, or manage the case him/herself. Ringing for help when required is a sign of clinical insight, not a sign of weakness.

Surgical lessons:

The management of aneurysmal subarachnoid haemorrhage has been recently aided by rapid advancements in endovascular treatment approaches. In many centres the primary intervention has been via the endovascular route. However, as illustrated in this case, the primary neurosurgical management, as with many other surgical fields, is still to consider removing a space occupying lesion in order to afford less detrimental impact upon the surrounding healthier tissues. As described in the assessor's comments, a more timely and integrative approach could have resulted in a better outcome for the patient, as opposed to multiple "standalone" procedures as illustrated.

Finally, as borne out in this case, seeking intra- or inter-departmental assistance when dealing with conditions beyond the scope of each surgeon may have resulted in a significantly different outcome to the one described.⁽⁹⁾

References:

9. Cooper DJ, Rosenfeld JV, Murray, L, Arabi YM, et al. Decompressive Craniectomy in Diffuse Traumatic Brain Injury. *New Eng J Med* . 2011;364(16):1493-502.



Neurosurgery

Case 9: Cerebral event in the anticoagulated patient that required better preoperative control and early insertion of a pressure monitor and intubation

Clinical details:

Diagnosis: Right hemispheric infarct.

Operations: Right decompressive hemicraniectomy with durotomy, evacuation of right extradural haematoma and insertion of ICP monitor.

Cause of death: Right hemispheric infarct with mass effect.

Course to death:

This 62-year-old patient presented with left hemiparesis and dysphasia on a background of mitral valve disease and warfarin anticoagulation for AF. The patient's INR on admission was subtherapeutic at 1.8. The first CT brain showed low attenuation in the right insula, posterior frontal and parietal lobes but no haemorrhage or midline shift. CT perfusion scan showed luminal filling defect in proximal right internal carotid territory with associated extensive perfusion abnormality in the right hemisphere, and also segment of occluded left vertebral artery. It was decided to admit to neurology ward, withhold (but not reverse) warfarin and observe the patient. The patient was given 40 mg enoxaparin (Clexane) subcutaneously on admission for thrombosis prophylaxis as well. On day 2 the GCS deteriorated on the morning ward round, so the patient was intubated for a second CT brain scan. This showed significant oedema in the right hemisphere with significant mass effect. Comment was also made by the radiologist about an abnormality suspicious for infarct in the right cerebellar hemisphere.

The patient underwent right frontotemporal decompressive craniectomy at about 11.30am after administration of fresh frozen plasma, Prothrombinex and vitamin K. The patient was extubated and nursed in ICU postoperation. By 8.30pm the patient deteriorated neurologically to decerebrate posturing with pupil dilatation, so had to be taken to radiology for a third CT. The main changes were the presence of the craniectomy and a new 1.5 by 1.0 by 1.3 cm haematoma in the right temporal lobe and mild increase in midline shift. Only after return from that CT was the patient intubated. The patient was then returned to theatre for reopening of craniectomy and evacuation of extradural and intraparenchymal haemorrhage, but apparently the dura was not tense and the ICPs were low. An ICP monitor (EVD) was inserted at this time. The patient was taken back to ICU and given maximal medical therapy but showed no neurological recovery. On the morning of day 3 a further CT was performed due to an increase in ICP. This fourth CT showed ongoing oedema and midline shift with increasing entrapment of the left lateral ventricle, but there was no change in management after the CT result. On morning the patient's ICPs drifted higher so the patient was again taken to radiology for another CT, however the patient arrested and died while in the CT room.

Assessor's comments:

As noted above, the patient was administered a 40 mg dose of enoxaparin (Clexane) on the day of admission, which was significant as warfarin was not reversed until the next day and the patient was already at high risk of haemorrhagic conversion of the infarct. The operation reports neglect to mention that the temporal lobe was resected on both occasions.

The extradural haematoma was not actually mentioned as a significant cause of mass effect in the third CT scan result. The radiologist actually mentioned the right intraparenchymal haematoma as more significant. It was incongruous that the second surgery findings were said to show no impression of raised ICP as the surgeon noted that the dura was not tense.

From the assessor's perspective, it was probably inappropriate to give the patient 40 mg Clexane when admitted. The warfarin was not reversed on the day of admission. Both these actions would have increased the risk of haemorrhagic transformation. Besides, it was a given that the patient would develop cerebral oedema the next day, as the area of infarction was so big. The patient was always going to need a decompressive craniectomy so coagulation parameters should have been normalised in anticipation of this.

The surgeon should have inserted an ICP monitor at the time of the first operation. This used to be the routine, and would have provided the ICU with a better means of assessing ICP than continually taking the patient to CT.

It was surprising that the patient was not intubated prior to the third CT, when the patient was said to have exhibited extensor posturing. Intubation would have assisted with ICP management. In the final analysis, this patient's prognosis was terrible and probably nothing would have changed the final outcome. However, this case does expose some seeming errors in management, which if corrected, may save someone else's life.

Surgical lessons:

The role of decompressive craniectomy in ischaemic cerebral events and trauma remains debated. Multicentre reports have variously resulted in presenting a good short term outcome with a poor medium to long term prognosis. Irrespective of these findings, however, once a decision is made to go down the path of decompression then all subsequent actions should aim to maximise the success of such an approach.

Several points were raised by the assessor in the review of this case. Each point of contention relates to the inability to fully commit to the success of the craniectomy. The misuse of Clexane in this setting, the lack of an ICP monitor, and the failure to protect the airway by re-intubating for transport of the patient at the time of maximum cerebral oedema, all contributed to setting the craniectomy up for failure. Although individually of minimal significance, when added together these factors certainly could have altered the outcome for this patient. The lesson here may well be that should any surgical approach be considered, then all actions must aim to give that surgical approach the best chance of success.⁽⁹⁾

Reference:

9. Cooper , DJ, Rosenfeld , JV, Murray , L, Arabi , YM, Davies , AR, D'Urso , P, et al. Decompressive Craniectomy in Diffuse Traumatic Brain Injury. *New Eng J Med.* 2011;364(16):1493-502.

Orthopaedic Surgery

Case 10: Timely involvement of a medical team in the high risk elective orthopaedic patient should be implemented

Clinical details:

Diagnosis: Osteoarthritis left knee.
Operation: Left total knee arthroplasty.
Cause of death: Brain injury.

Course to death:

This 72-year-old patient presented for elective left total knee joint replacement, undertaken the same day under spinal anaesthesia and sedation and with no immediate complications. There were comorbidities of chronic obstructive pulmonary disease, obesity (lap band), hypertension, GORD and tachyarrhythmia, and the patient was assessed preoperatively as American Society of Anesthesiologists (ASA) 3. The patient was subsequently noted to develop pseudo-obstruction/ileus of bowel by day 5 but refused NGT care. A rectal tube was placed and the lap band deflated. There were multiple MET calls for tachycardia and hypoxia, and the patient had a CT pulmonary angiogram on day 6, which excluded a pulmonary embolism. An NGT was eventually inserted for decompression. The patient required careful management of electrolytes.

Despite all measures tachycardia persisted with development of delirium, removal of the NGT and a fall on the ward. Medical review was obtained on day 7 and CT brain was negative for injury. On day 10 the patient was found unresponsive on the ward at approximately 4.25am (last seen 4.00am). The patient had an asystolic arrest when pads were applied and was transferred to ICU on inotropic/pressor support. On day 1 in ICU the patient was noted to have myoclonus. The patient failed to wake when weaned from sedation. A somatosensory evoked potential test was performed and found to be absent bilaterally suggesting unsurvivable brain injury. The decision was made to withdraw active treatment following discussion with the family. The patient died at 12.45pm on day 12.

Assessor's comments:

Hospital records show that there was appropriate documentation of the sequence of events, including the surgical procedure and immediate postoperative management. There was clear evidence to suggest that neither the surgery nor the anaesthetic event lead to this death. However, there were discrepancies in the postoperative management and a clear and strong medical intervention was lacking from the clinical notes. The surgical team were incapable of managing medical problems and it appears that there was a failure to recognise the medical complications at the appropriate time. There was a substantial delay in getting the patient to the high dependency unit (HDU) or ICU. Postoperative ileus leading to electrolyte imbalance leading to medical complications appeared to be the major cause of death for this patient.

The patient had a fairly short procedure time and had been anticoagulated and treated appropriately for surgery. However, what was not recognised were the significant preoperative comorbidities, which qualified the patient for postoperative management in an HDU or ICU bed. Fluid balance had not been well documented although cardiac failure (implying overload) was not documented.

Adverse event: While the total knee replacement was uneventful, the fact that the patient required multiple MET calls in the first five days was not a good sign. There had been communications from the surgical team asking the medical team to review the patient and stating that they didn't know what the cause of the haemodynamic instability was. This resulted in a delay in management, and was suggestive of inadequate medical management by the surgical team. The patient was admitted to the ICU, but had deteriorated by that point and was beyond recovery. This admission to ICU should have been initiated much earlier.

Area of concern: The major area of concern in this case was the lack of proper medical management by the dedicated medical team. There had been a number of entries by residents and registrars of the surgical team liaising with the medical team asking for support and opinions, which may have not been properly communicated. ICU admission was ineffective as it was initiated quite late. Preoperative identification of a high-risk patient and appropriate alerting of the medical team to manage this patient postoperatively could have saved the life of this patient.

Comments: This patient clearly had limited medical management in the postoperative period. Although the orthopaedic management had been adequate, medical management was suboptimal. Recognising high-risk patients and dealing with such patients in anticipation would be the correct standard of care. Multiple MET calls in an elective patient in the surgical ward should raise alarm bells, and there should have been more stringent scrutiny of the situation by the medical team.

Surgical lessons:

This case illustrates the need for orthopaedic surgical teams to liaise with their physician colleagues in the management of high-risk patients with multiple comorbidities.

Although it is unclear whether this tragic outcome could have been avoided, complex patients require a team approach to their management. Surgeons should ensure that systems are in place, both in public and private hospitals, for early involvement of physicians at a senior level to ensure that there are no delays to diagnosis, treatment and transfer to ICU or HDU. Following a MET call, it would be wise to organise joint care of patients with a local physician.

In this case there was no mention of a medical preoperative assessment which would have been helpful and it appears that medical review was only obtained on day 7, after the patient had deteriorated significantly.

Post arthroplasty ileus is not uncommon and can have a bad prognosis. It should be recognised early and senior advice obtained regarding ongoing management.

It was also unclear whether a postmortem was arranged. A postmortem should be encouraged when a patient dies following an elective joint replacement, so that we can learn as much as possible and improve management decisions for future patients.

Urology and Colorectal Surgery

Case 11: Missed ureteric injury after anterior resection

Clinical details:

Diagnoses: Hypoxaemic cardiac arrest, acute kidney injury, aspiration pneumonia, hypoxic brain injury.

Operations: Colonoscopy, anterior resection of rectosigmoidal carcinoma and exploratory laparotomy.

Cause of death: Brain injury secondary to cardiac arrest and prolonged resuscitation.

Course to death:

A 71-year-old patient with comorbidities of obesity, non-insulin-dependent diabetes and raised cholesterol, underwent a laparoscopic anterior resection for rectosigmoid cancer at Hospital A.

The operation notes were brief but describe no intraoperative problems. On day 2 postoperation the patient was in considerable pain, and a distended abdomen was noted. On day 3 postoperation CT scan without contrast demonstrated free fluid within the abdominal cavity. The right colon was dilated to 6 cm. The patient had ongoing pain and abdominal distention. On day 6 postoperation the patient was noted to be more distended with generalised tenderness. The patient underwent a flexible sigmoidoscopy, colonoscopy and no leak was found at the anastomosis site. A laparoscopy/laparotomy was considered but not performed. On day 7 postoperation the patient remained unwell, with a pulse of up to 131 bpm and still with abdominal distention and tenderness.

On day 8 postoperatively a high white cell count, which was believed to be $>30,000 \times 10^9/L$, was documented. A CT scan demonstrated free fluid within the abdomen and right basal pneumonia. On day 10 postoperation the patient was vomiting, and a NGT was inserted. The patient's condition continued to be very poor. A CT scan was performed on day 14 which showed free fluid within the peritoneal cavity. Respiratory rate was up to 40 breaths per minute and heart rate varied between 110 and 130 bpm with oxygen saturation on 10 L/min and oxygen was 94%.

The ambulance was called and the patient was transferred to the ICU of Hospital B. It was noted around this time that the creatinine was markedly elevated at $28 \mu\text{mol/L}$ and white cells were $31,000 \times 10^9/L$. On day 15 postoperation the patient was unresponsive, bradycardic and cyanosed and underwent cardiac pulmonary resuscitation. The patient was noted to be anuric.

The patient was transferred to Hospital C and it was noted that there was cerebral oedema following the cardiac arrest, and neurological recovery was thought to be poor. On day 17 a further CT scan with IV contrast was performed, which demonstrated a pelvic collection and reduction in the small bowel dilatation. The patient subsequently underwent a laparotomy and an infected presacral abscess (urinoma) was drained. Urology input was obtained and a cystoscopy and bilateral retrogrades were performed, which demonstrated extravasation of contrast from the left ureter 4 cm from the vesico ureteric junction. A left ureteric reimplant was performed with a psoas hitch. The patient's condition did not subsequently improve and the patient died from multiorgan failure including hypoxic brain damage.

Assessor's comments:

The major issue in this case was the unrecognised left ureteric injury. This is a known complication of an anterior resection. It was unrecognised by the treating surgical team even though three CT scans had demonstrated free fluid within the peritoneal cavity. The patient's general condition was poor with tachycardia. The patient had abdominal distention, which the nurses had measured up to 127 cm, and creatinine was elevated from reabsorption of urine. The patient's death would have been prevented by timely recognition of the ureteric injury. A CT scan with IV contrast certainly would have demonstrated the leak and it was obvious when the laparotomy was performed.

Surgical lessons:

This case provides an example of the “blinkered” approach to overall patient management. In the absence of any information regarding urine output, attention to the fluid balance surely would have alerted the surgeon to the obvious positive balance this patient was in.

Issues arising are:

- The CT scan on day 3 postsurgery demonstrated free peritoneal fluid. This should have prompted questions regarding the source of the fluid.
- Given that the endoscopic examination on day 6 postoperation failed to explain the problem or the reason for not intervening with laparoscopy or laparotomy.

As the days passed the patient's condition worsened - surely a time to stand back and reconsider the present treatment. Asking for help should never be an issue. Share the management with fresh minds, look laterally and/or request a urologic review given the fact that ureteric injuries in the pelvis are so often recognised far too late.

The skills of the managing team come into question here if the fluid imbalance, worsening patient condition with cerebral oedema, increasing girth, rising creatinine, increased respiratory rate and tachycardia don't cause them to question their approach and ask for assistance. On the evidence provided, this death was avoidable had the urine leak been diagnosed early.

This case demonstrates the importance of a team approach. Preoperative involvement of a perioperative physician in those complex cases with comorbidities is more the “norm” nowadays, as is anaesthetic involvement both preoperatively and postoperatively in ICU or HDU.

When deterioration occurs in a potentially curable case, the individual or team responsible for the patient must question their management decisions more objectively and involve other specialist units sooner.

Vascular Surgery

Case 12: Femoral embolus should be treated by urgent embolectomy as thrombolysis can have fatal consequences and is not the best therapy

Clinical details:

Diagnosis: Thromboembolic occlusion left common femoral artery.

Operations: Thrombolysis and left femoral embolectomy.

Cause of death: Retroperitoneal haematoma (spontaneous, removed from operative site) and acute myocardial infarction secondary to retroperitoneal haemorrhage on heparin infusion.

Course to death:

An 82-year-old patient presented with acute ischaemic left limb with a diagnosis of a left femoral embolus from AF. The patient had a history of cerebrovascular accident, acute myocardial infarction with CABG stent, AF, hypercholesterolemia, hypertension, obesity, diabetes, obstructive sleep apnoea and gout. The patient was commenced on heparin infusion.

The patient was admitted to Hospital A on day 1 at 11.00pm with acute left lower limb ischaemia. On day 2 at 5.30am, heparin infusion was commenced and the patient was then transferred to Hospital B. At 8.30am the patient was pain free, had improved perfusion on arrival, but capillary refill was slow and had absent pulses. Day 3 an ultrasound showed a high grade stenosis at the origin left superficial femoral artery. Angiography showed complete common femoral artery occlusion and thrombolysis was commenced. On day 4, repeat angiography post 24 hours of thrombolysis showed no significant change.

The patient remained pain free on heparin infusion. On day 5 the decision was made to book the next available dedicated theatre list and continue heparin infusion until then. The patient was booked for open femoral embolectomy on day 12. Note: between days 5 to 11 the patient remained pain free on heparin infusion. On day 11 the patient was pain free on the morning round, but at 10.15am there was a sudden return of severe left lower lobe pain. At 11.45am the patient had an open left femoral embolectomy, which resulted in a return of good pulses and warm limb postoperatively. Initially well in recovery but on return to the ward:

- Became anuric with low eGFR/high creatinine.
- Developed right flank/abdominal/thigh pain, although the timing of onset was not documented.
- Multiple reviews/MET calls.
- Multiple fluid boluses. Heparin infusion continued then slowed, but not ceased, because of suprathreshold activated partial thromboplastin time.
- No further investigation/imaging.
- On the morning round on day 12 (day 1 postoperation), the patient was in extreme pain with a globally tender abdomen and right flank pain radiating to right thigh.
- Urgent CT (noncontrast), blood cross-matched, heparin ceased (not reversed as concern about ischaemic gut as a differential) showed a large retroperitoneal haematoma (on right side, near kidney – i.e. far removed from angiogram and operative sites). Lactate was high.
- CT reviewed on consultant morning round.

- As the patient was stable, an urgent ultrasound was performed to assess the superior mesenteric artery patency or flow before complete reversal of heparin was given. There were still concerns about possible ischaemic gut.
- After the ultrasound the patient had a MET call for near arrest. After discussion with the ICU, vascular surgeon and family the patient was palliated and died soon afterward.

Assessor's comments:

Ultimately the patient died due to a complication associated with the attempt at thrombolysis – a recognised complication. The decision for thrombolysis rather than femoral embolectomy has to be questioned. An embolus originating from the atrium is not a recognised indication for thrombolysis, while a past history of haemorrhagic stroke is a recognised contraindication for thrombolysis. No doubt the surgeon was trying for a “less invasive” solution to the problem in a patient with multiple medical comorbidities. However, thrombolysis is not an insignificant intervention and is associated with complications. In this case it was predictable that it would have limited benefit. An initial decision for femoral embolectomy would have likely led to a better outcome. The assessor does not know of any randomised trials comparing lysis to operative embolectomy and doubts that such a trial would ever gain ethics approval.

The surgeon is critical of the time delay associated with diagnosing the retroperitoneal haemorrhage. However, the time sequences in this case indicate a general lack of urgency – thrombolysis was not commenced for 2 days, and the operation was planned for 11 days after an acute admission. This “relaxed” approach to an emergency admission can translate to junior staff also taking a more relaxed approach.

On reviewing the case, the assessor came to conclude that the best management of this patient would have been early femoral embolectomy after appropriate medical work-up. The failure to do this led to the conclusion that this was an avoidable death.

Surgical lessons:

This case illustrates that an initial incorrect management decision can adversely affect the ultimate fate of the patient. It is not a usual decision to institute thrombolysis for acute ischaemia resulting from femoral embolism. Surgical embolectomy is often performed under local anaesthetic and in a previously normal arterial tree should result in complete return to normality with restoration of pulses. Thrombolysis is not as effective and does not deal with propagated thrombus in the profunda femoris, which was removed at the time of surgery (on review of the case notes). Moreover, thrombolysis is associated with double the incidence of haemorrhagic complications, and these were the initiating factor in the demise of this patient.⁽¹⁰⁾

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Vascular Surgery

Case 13: Smaller aneurysms in older high-risk patients should be treated conservatively

Clinical details:

Diagnosis: Abdominal aortic aneurysm (AAA).

Operation: Endovascular AAA repair.

Cause of death: Renal failure.

Course to death:

An 83-year-old patient was admitted electively for endovascular AAA repair. A 70 mL contrast dose was used during the procedure. The patient had a background of chronic renal failure with a baseline creatinine of 23 $\mu\text{mol/L}$, hypertension, osteoarthritis, gout, AF (on warfarin) and GORD. The patient was admitted the day prior to surgery for IV hydration. Vitamin K was given for INR reversal with an uncomplicated endovascular stent graft. Postoperatively, the patient developed right iliac fossa pain. General surgery was consulted. Eventually the patient underwent two colonoscopies (first one inadequate preparation), which showed no evidence of ischaemic colitis. The patient also had a severe drop in renal function postoperatively, and a vascath was inserted for temporary dialysis despite the patient not being a candidate for dialysis.

The patient had persistent and ongoing abdominal pain of unknown aetiology for which a CT abdomen was performed. The CT demonstrated mucosal thickening of the caecum, ascending and feasibly transverse colon infective colitis. Superior mesenteric artery and coeliac trunk filled normally. The patient developed respiratory failure and was made not for resuscitation. The patient died within one month of the procedure.

Assessor's comments:

There was no comment or record about the size of the aneurysm, but in one CT report it stated it was 56 mm in maximal diameter. No comment in the inpatient notes was apparent about a risk-benefit discussion. Baseline renal function was severely impaired, and one would think very carefully about subjecting a patient to a procedure that would likely require significant amounts of contrast medium, as this would certainly cause significant deterioration in renal function, even in light of renal protection measures.

This patient was obviously not a candidate for haemodialysis (long term), and as such the very high likelihood of causing significant renal failure should have been apparent. The relatively small size of this aneurysm and the risk of rupture beg the question of why the operation was performed in a patient who was otherwise living a fairly reasonable quality of life at home. The cause of the gut colitis is not fully known, and was unlikely to be related to the procedure directly, but may have been precipitated by this event. One should apply the 'family test' to all patients in decision making: if this was your mother or father, with identical risk factors, would you recommend they have the procedure in light of a significant risk of death, compared with the small risk of rupture with conservative management?

Surgical lessons:

Small AAAs have a low incidence of rupture. This was initially shown in the United Kingdom small aneurysm study.⁽¹¹⁾ A subsequent study confirmed that endovascular aneurysm repair compared with surveillance showed no difference after a mean 54 months follow up, despite a very low (0.55%) perioperative mortality for endovascular aneurysm repair.⁽¹²⁾ In an elderly patient with multiple comorbidities and a 56 mm AAA, the decision to treat was not supported by the evidence.

Reference:

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List of shortened forms

AAA	abdominal aortic aneurysm
AF	atrial fibrillation
bpm	beats per minute
CABG	coronary artery bypass graft
CT	computed tomography
CXR	chest x-ray
ECHO	echocardiogram
ED	emergency department
EVD	external ventricular drain
GCS	Glasgow Coma Scale
GORD	gastro-oesophageal reflux disease
HDU	high dependency unit
ICC	intercostal catheter
ICP	intracranial pressure
ICU	intensive care unit
INR	international normalised ratio
IV	intravenous
LAD	left anterior descending artery
LV	left ventricular
MET	medical emergency team
NGT	nasogastric tube
RACS	Royal Australasian College of Surgeons
RANZCOG	Royal Australian and New Zealand College of Obstetricians and Gynaecologists
RV	right ventricular
SOB	shortness of breath
TOE	transoesophageal echocardiogram
VASAM	Victorian Audit of Surgical Mortality

ASM Management Committee Members

Mr Barry Beiles	Clinical Director, VASM
Mr Trevor Jones	Chair, Victorian Surgical Consultative Council
Ms Vickie Veitch	Manager, Department of Health and Human Services
Ms Hayley Hellinger	Senior Project Officer, Department of Health and Human Services
Dr Rachael Knight	The Royal Australian and New Zealand College of Obstetricians and Gynaecologists
A/Prof Rodney Judson	General Surgeons Australia
Ms Andrea Kattula	The Australian and New Zealand College of Anaesthetists
Mr Jason Chuen	Chair, Victorian Regional Committee
Mr Russell Taylor	Australasian Association of Paediatric Surgery
Ms Lee Gruner	President, The Royal Australasian College of Medical Administrators
Mr Nigel Broughton	Australian Orthopaedic Association
Dr Jocelyn Shand	Dental Practice Board
Mr Patrick Lo	Neurosurgical Society of Australasia
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Mr Ivan Kayne	Consumer Representative
Ms Claudia Retegan	Project Manager, VASM
Mr Gordon Guy	ANZASM Manager, Research, Audit & Academic Surgery Division

The information contained in this case note review booklet has been prepared by the Royal Australasian College of Surgeons Victorian Audit of Surgical Mortality Management Committee, which is a declared quality improvement activity. The Australian and New Zealand Audit of Surgical Mortality, including the Victorian Audit of Surgical Mortality, also have protection under the Commonwealth Qualified Privilege Scheme under Part VC of the Health Insurance Act 1973.

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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 Australia

Web: www.surgeons.org/vasm
Email: vasm@surgeons.org
Telephone: +61 3 9249 1154
Facsimile: +61 3 9249 1130

Postal address:
Victorian Audit of Surgical Mortality (VASM)
GPO Box 2821
Melbourne VIC 3001 Australia

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