



ROYAL AUSTRALASIAN
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AUSTRALIAN AND NEW ZEALAND
AUDIT OF SURGICAL MORTALITY

NATIONAL CASE NOTE REVIEWS

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Contents

CHAIRMAN'S REPORT	4
ANZASM CLINICAL EDITOR'S REPORT	4
OVERALL RECOMMENDATIONS	6
Case study 1: the deteriorating patient and communication	7
Case study 2: deterioration while awaiting transfer	7
Case study 3: the importance of Consultant handover	8
Case study 4: narcotic analgesia in the elderly	9
Case study 5: omission of routine medication	10
Case study 6: keep an open mind	11
Case study 7: Boerhaave Syndrome	12
Case study 8: headache plus cerebral aneurysm requires urgent treatment	14
Case study 9: no apparent plan of management	15
Case study 10: a young patient with stab wounds to the neck	17
Case study 11: poor immediate postoperative communication in a bleeding patient	17
Case study 12: colonoscopy perforation—delay after perforation	18
Case study 13: a cardiac and vascular spiral	19
Case study 14: possible acute cholecystitis delays with fatal outcome	21
Case study 15: unrecognised small bowel injury during laparoscopic inguinal hernia repair	22
Case study 16: severe abdominal pain with negative imaging —think dead gut	24
Case study 17: bleeding after total laryngectomy	26
SHORTENED FORMS	28

Chairman's report

This is the second national case note review booklet of the Australian and New Zealand Audit of Surgical Mortality (ANZASM). It provides important lessons for all surgeons that, if learnt, can lead to better outcomes for our patients.

The cases come from both the private and public systems across Australia. ANZASM is proud of the expansion of the audit into the private hospital system and is pleased that the forward-looking hospitals see this as a useful tool in their quality control systems. Many cases come from the public hospital system as this is where many of the elderly patients with acute surgical problems are treated.

A theme that is common to many of these cases is the need to have in place systems that provide adequate handover of care, as well as prompt notification of problems or change in the condition of the patient.

ANZASM now covers all states and territories in Australia, and New Zealand seems close to also embracing the concept. Each state has its own audit office to keep the process local however cases from each state are pooled in this national case note review booklet. The Royal Australasian College of Surgeons (RACS) has now mandated participation in the audit (where it is available) as a part of the Continuing Professional Development (CPD) requirements for all surgeons.

The Medical Board of Australia similarly requires that all registered medical practitioners participate in an appropriate CPD programme. The RACS CPD scheme is such a programme. The Commonwealth Qualified Privilege legislation ensures the data can only be used for the purposes of the audit so contributions from treating surgeons and from assessors are absolutely confidential and privileged.

I trust you find this case note review booklet an educational opportunity and welcome any constructive feedback.



Professor Guy Maddern
Chairman, ANZASM Steering Committee

ANZASM Clinical Editor's report

Last year the first national case note review booklet was published with cases from all states and territories. This is a part of the feedback process that was seen as essential for quality improvement processes of the audits of surgical mortality. In 2011, in addition to the national case note review booklet, there were also state-based publications. We soon realised that there were three important matters:

- smaller states had trouble producing a sufficient volume of cases to publish more than once a year.
- some cases were well-known in a particular state and were difficult to de-identify.
- valuable learning material was being lost by each state distributing its booklets only within its own borders.

With these issues in mind it became evident that a more frequently-published national case note review booklets would assist in all of the above three matters. This is the first of two planned volumes for 2012. Depending on those results, in 2013 we may publish even more often.

Some of the smaller states will not publish their own case note review booklets as the cases that they would have published are produced in this publication; some of

the larger states will continue to publish their own case note review booklets as well as contributing to the national case note review booklet.

As the Australian and New Zealand Audit of Surgical Mortality (ANZASM) office is in the same building as the South Australian Audit of Perioperative Mortality (SAAPM) office, it seemed logical that the final clinical editing process would be done by the Clinical Director of SAAPM on behalf of ANZASM.

I must emphasise that I did not write this booklet. The real authors are the Clinical Directors of all the states and territories, and the first and second-line assessors of the various states and territories. To them we all owe a debt of gratitude.

Glenn McCulloch
Clinical Director
SAAPM
Clinical Editor
National Case Review Booklet
ANZASM

Overall recommendations

- In complex cases, there needs to be clear demonstrable leadership in patient management. There should be regular team meetings with all disciplines involved to ensure the treatment plan is understood by all.
- Communication is one of the most essential points in good patient care. This includes communication between surgeons and their junior staff, between various disciplines and between nursing and medical staff (and vice versa). If you do not tell others what you are thinking or what is happening everyone will end up functioning in their own silo.
- The surgical case form (SCF) record must contain good, accurate documentation . It should be filled out by a team member who was involved in the care of the patient and has sufficient experience to contribute in a useful fashion to the audit process. If junior staff members complete these reports, they must be checked by a consultant or the junior staff must be informed in advance on the salient points to record.
- Where clinical deterioration occurs in a patient and where there is no clear cause, it is important to remember that the cause may be related to something outside of your specialty knowledge base.



Case study 1

The deteriorating patient and communication

Case Summary

An elderly, previously independent patient was admitted with severe upper abdominal pain and no other bowel symptoms. There was a prior history of an abdominal hysterectomy for fibroids 40 years earlier and the patient was taking warfarin for atrial fibrillation. Physical examination was unremarkable, but an abdominal computed tomography (CT) scan showed a complete distal small bowel obstruction. The surgeon on call was not immediately notified, and the patient was transferred from the emergency department (ED) to the surgical ward with non-operative management of intravenous (IV) fluids and a gastric tube.

Management by junior medical staff did not adequately replace fluid losses. The next day the surgeon saw the patient, who had signs of acute peritonitis. The patient's anticoagulated state and fluid imbalance were then treated appropriately. Surgery was further delayed by the need to use the emergency theatre for an emergency caesarean section. When the patient eventually came to surgery, a band across the ileum had caused infarction of most of the small bowel, which required resection.

Despite intensive treatment, the patient required a further bowel resection and died two weeks after the first operation.

Clinical lessons

For management of an ill patient, it is imperative that all members of the surgical team, particularly those in charge, are informed of the patient's condition and any changes in the clinical state. Similarly, consultants on call for emergencies must be available to provide appropriate, experienced backup to junior surgical staff and timely consultation.

If earlier surgery had been performed, it may have been limited to simple division of adhesions and the infarction of bowel and subsequent death may have been avoided.

Case study 2

Deterioration while awaiting transfer

Case Summary

A patient in their fifties was admitted to hospital A, with lower abdominal pain and tenderness evident several weeks prior to admission. There was a history of diabetes, obesity and coronary artery disease. Examination revealed mild abdominal tenderness. An abdominal x-ray showed dilated large bowel, with fluid levels in the small bowel.

Sub-acute large bowel obstruction was diagnosed. The patient was treated appropriately with IV fluids and subcutaneous heparin and was transferred to the High-Dependency Unit (HDU). A CT scan suggested that the obstruction was in the sigmoid colon, possibly due to a cancer. Transfer to hospital B was ordered.

Transfer did not occur until the morning of the following day. The patient had deteriorated overnight with hypotension, tachycardia, oliguria and large volumes of nasogastric (NG) aspirate. The Consultant at hospital A was unaware of the delay in transfer and of the patient's deterioration. On arrival at hospital B, the patient deteriorated further. A cardiac arrest occurred and the patient was unable to be resuscitated. The autopsy revealed myocardial ischaemia and large bowel obstruction, due to a diverticular stricture.

Clinical lessons

For management of an ill patient, it is imperative that all members of the surgical team, particularly those in charge, are informed of the patient's condition and any changes in the clinical state. Similarly, consultants on call for emergencies must be available to provide appropriate, experienced backup to junior surgical staff and timely consultation.

If earlier surgery had been performed, it may have been limited to simple division of adhesions and the infarction of bowel and subsequent death may have been avoided.

Case study 3

The importance of Consultant handover

Case Summary

A patient in their thirties was admitted to hospital A with abdominal pain, under surgeon one. Radiological investigations identified gallstone pancreatitis, which was treated conservatively. It was planned that once the pancreatitis improved, the patient would undergo laparoscopic cholecystectomy. Generalised abdominal pain developed with no evidence of an exacerbation of pancreatitis.

Care was transferred to surgeon two over the weekend. On the Sunday, the patient deteriorated, with colicky lower abdominal pain and complete constipation. A chest x-ray revealed gas under the diaphragm. The patient was then transferred to hospital B under the care of surgeon three and, on admission, was moribund with peritonitis, shock and multiorgan failure.

An emergency laparotomy was performed after resuscitation. The operative findings were faecal peritonitis and a perforation of the sigmoid colon. A Hartmann's procedure was performed. The patient was managed in the Intensive Care Unit (ICU), but did not improve and died.

Clinical lessons

The patient was transferred among several wards, with different medical and nursing staff. Discontinuity in care was a factor. Try to avoid frequent ward changes, and optimise communication between teams when change is necessary.

The blood investigations suggested a worsening infective process. When the patient deteriorated with abdominal pain on the second occasion, the abdominal pain was colicky and the serum lipase did not rise. A further CT scan or abdominal x-ray would have identified the free gas in the abdomen.

There was a delay in diagnosis, because of inappropriate interpretation of the results, investigations and management, largely by junior staff and a lack of senior clinical review. It may have been desirable to perform the operation at hospital A and then transfer for ICU management. There was an eight-hour delay between the diagnosis of a perforated viscus and the operation at hospital B.

A handover policy from Consultant to Consultant is mandatory where clinicians are not able to review their patients when on leave.

Case study 4

Narcotic analgesia in the elderly

Case Summary

A patient in their seventies was admitted to hospital A, following a fall and complaining of pain in the thigh. The patient was taking medications for hypertension and chronic airway disease. An initial x-ray showed possible undisplaced fractures of the left ilium and pubic bones. Orthopaedic opinion was that the patient should have bed rest and mobilisation when the pain improved. A CT scan of the pelvis, however, was said to show 'significant fractures'. Skeletal traction was applied.

After admission, pain management was difficult, and the patient required large doses of narcotic analgesics. The patient then received oral oxycodone. The patient was given a total of 30 mg on day two, 40 mg on day three, 50 mg on day four and 35 mg on day five. In the evening of day five, the patient was found to be unrousable, with pinpoint pupils and vomit on the sheets. The patient was managed in the ICU for aspiration pneumonia and septic shock. Treatment was unsuccessful.

Clinical lessons

Oral oxycodone is approximately twice as potent as oral morphine. This elderly patient received an excessive dose over the four days.

Care is required when prescribing narcotic analgesics in general, and particularly in elderly patients. This should be considered when prescribing oxycodone. Alternative strategies to reduce narcotic dosage might include patient-controlled analgesia (PCA) or a multimodal approach, using regular paracetamol and/or non-steroidals, if appropriate. Skeletal traction effectively immobilises a patient. The risk of inhalation of vomitus, particularly in the elderly, is increased. Gastric emptying is inhibited by narcotic analgesia, leading to an increased risk of aspiration.

A reference for further reading follows:
Liukas A, Kuusniemi K, Aantaa R, Virolainen P, Neuvonen M, Neuvonen PJ, Olkkola KT. Plasma concentrations of oral oxycodone are greatly increased in the elderly. *Clin Pharmacol Ther* 2008;84(4):462-467.

Case study 5

Omission of routine medication

Case Summary

An elderly patient, with a history of lung cancer, was admitted for removal of a basal cell carcinoma (BCC) from the right leg using a skin graft. There was a prior history of a cerebral metastasis from the lung cancer having been removed at a craniotomy three months earlier, followed by five cycles of chemotherapy.

The surgical procedure, performed under general anaesthesia, was

uncomplicated. On day one postoperatively, the patient had an epileptic seizure and several more followed, with progressive loss of consciousness. Despite treatment with anti-convulsants, the patient did not improve and died. On review of the documentation, it seemed likely that the evening dose of anticonvulsant prior to surgery was omitted.

The preadmission questionnaire listed 'lung problems' only. The patient's regular medications of phenytoin and dexamethasone were not included. The pre-anaesthetic assessment form listed an incomplete set of medications and similarly omitted phenytoin and dexamethasone.

Clinical lessons

It is likely that the treating staff were not fully aware of the comorbidity and the patient's regular medications which, in this case, were most important. Omission of the medication may have contributed to the patient's deterioration.

Comprehensive preoperative documentation is important, particularly in cases of epilepsy, where patients are receiving regular anticonvulsant medication and, in this case, corticosteroids.

An alternative plan may have been to obtain an estimate of life expectancy from the oncologist managing the lung cancer and to observe the rate of growth of the BCC, if expectancy was limited. The question must be asked whether in this situation surgery for the BCC was indicated at all.

Case study 6

Keep an open mind

Case Summary

A middle-aged patient with significant comorbidities including chronic renal failure and hypertension and with a history of renal transplantation, presented to ED with sudden onset of headache and mild right-sided abdominal pain, radiating through to the back. Prior to presentation the patient had vomited and had faecal incontinence and collapsed, striking their head but with no loss of consciousness. On admission, hypotension and acidosis were noted and a diagnosis of septic shock was made.

Appropriate rapid and aggressive resuscitation was commenced in ED with insertion of femoral arterial and venous lines, and administration of parenteral broad spectrum antibiotics. Clinical input was gained from the surgical, intensive care and renal units. Ultrasound of the abdomen, chest x-ray and CT scan of the head were performed. Acute cholecystitis was diagnosed by the radiologist who reported a 'necrotic gall bladder'.

The patient was noted to be moderately obese, anuric and acidotic with pH levels below 7.35. A focused assessment with sonography looking for trauma did not demonstrate any obvious free intra-abdominal fluid. The patient was intubated, ventilated, commenced on inotropes and admitted to ICU. The initial abdominal examination mentioned no mass or significant abdominal guarding, only mild right upper quadrant (RUQ)

tenderness. A presumptive diagnosis of septic shock due to acute cholecystitis and/or cholangitis was made. 'Dark bile' was obtained from a percutaneous cholecystostomy performed by a radiologist on the day of admission.

As there was no clinical improvement and the patient remained anuric, a laparoscopic cholecystectomy was planned for the following day. At operation an oedematous, but not gangrenous, gallbladder was described. The laparoscopic cholecystectomy appeared to be uneventful.

The patient did not improve despite ongoing support following surgery. The day after cholecystectomy, echocardiogram (ECG) and CT scan demonstrated a dissecting abdominal aortic aneurysm (AAA) with pericardial effusion and some degree of tamponade. This was considered inoperable by the specialist vascular surgeon and, once diagnosed, the patient's treatment was palliative.

Clinical lessons

There was a delay in making the correct diagnosis, which probably did not significantly contribute to the outcome, but did result in an unnecessary surgical procedure. Had this diagnosis been made earlier, appropriate palliative care could have been implemented from the outset.

Whilst sepsis with hypovolemic shock is an appropriate differential diagnosis in a patient presenting with peripheral collapse and peripheral circulatory failure, the presentation of headache, faecal incontinence with sudden

collapse and minimal abdominal signs, make it important to consider other differential diagnoses including aortic catastrophes. It is not clear whether the original ultrasound commented on the abdominal aorta. It was also not clear from the notes at which level of consultation the diagnosis of acute cholecystitis was made but, once made, it appears not to have been questioned despite the lack of support from clinical signs and the lack of response to percutaneous cholecystostomy. This case study is a good illustration that a provisional diagnosis must always remain just that until confirmed and must always be subject to revision and change. It would have seemed prudent to attempt to confirm the diagnosis of acute gangrenous cholecystitis by further imaging prior to subjecting this exceedingly high-risk patient to surgery. Unless there is pericholecystic gas to suggest gas-producing organisms, an ultrasound cannot reliably diagnose necrosis of the gallbladder. This diagnosis should have been viewed with circumspection. The liver function tests (LFTs) were completely normal; a necrotic gall bladder or ascending cholangitis might be expected to be associated with some abnormality of LFTs.

Surgical decision-making in the initial stages of management in this patient could possibly have been better. Quite apart from the fact that there were no records written by a senior surgical team member in the first 24 hours, there was certainly nothing written that suggested consideration of other diagnoses apart from a necrotic gall bladder. CT scans of the abdomen or chest were not considered and there was no clinical assessment to indicate differential

pulse characteristics in the upper and lower limbs, clinical signs of a dissecting aneurysm.

There are also some concerns about the choice of clinical management. If there was a necrotic gall bladder, then cholecystostomy was not appropriate and even likely to lead to complications. Drainage followed by removal of a necrotic gall bladder, by open or laparoscopic cholecystectomy, is the way to manage a patient with metabolic acidosis and septic shock secondary to that problem.

Case study 7

Boerhaave Syndrome

Case Summary

A middle-aged patient presented to ED in the evening with upper abdominal pain following an episode of vomiting some hours earlier which coincided with the onset of pain. Findings in ED were of a tachycardic patient in some distress with surgical emphysema on the right side of the neck. A CT scan with gastrografen was performed several hours after presentation, which confirmed likely perforation in the distal oesophagus with pneumomediastinum and free retroperitoneal gas. The surgical team was involved in ongoing management. A long history of heavy alcohol intake was recorded.

Shortly after the CT scan, an upper gastrointestinal endoscopy was performed and a covered stent placed over the defect. The patient was then admitted to the HDU; oxygen saturation was recorded as 94%. In the morning, shortly after perforation, the risks and benefits of

thoracotomy were discussed with the patient. The patient, who appears to have been fully conscious, was described as adamantly opposed to surgery. Further clinical deterioration and discussions with the patient finally led to consent for surgery later that afternoon, nearly a day and a half after perforation.

Thoracotomy through the left fifth interspace identified gas and fibrinous exudate in the mediastinum, but no gross contamination. Mediastinal drains were left in situ. Laparotomy findings were of free (turbid) peritoneal fluid with gas in the lesser sac and omentum. In addition to drains, a feeding jejunostomy and defunctioning gastrostomy were created.

Postoperatively the patient was transferred to ICU. After extubation there were ongoing respiratory problems with poor gas exchange. Nearly a week after surgery the patient remained febrile and acute clinical deterioration required reintubation. Clinical improvement again occurred and the patient was discharged to the ward nearly a month after admission to ICU. During this time, CT-guided drainage of retroperitoneal collection was performed on the patient. The patient subsequently died nearly a week later.

Clinical lessons

It is hard to tell if this was a preventable outcome as mortality from Boerhaave Syndrome with delay in treatment for more than 12 hours is close to 30% and rises to 50% if the delay is over 24 hours. There was a delay in diagnosis as a result of the patient's late presentation to ED some hours earlier. The patient's initial

unwillingness to undergo surgery also added to the delay in definitive treatment. As the best outcomes are associated with early diagnosis and definitive surgical management, the initial endoscopic stent may have been inappropriate.

Expert opinion

The best outcome will be achieved by early surgery and repair. A gastrografin swallow or swallow combined with CT are still worthwhile. This will determine the level and the best side for surgical approach. For the surgeon who is used to video-assisted thoracoscopy a thoracoscopic approach is reasonable, but otherwise a formal thoracotomy should be performed. A thoracoabdominal approach is a bad incision – very painful with an unstable costal margin. Any defect should be closed with fine interrupted sutures. A pleural flap is an optional extra. Where there is a delay in treatment, primary closure may not be appropriate or feasible.

Under those circumstances T-tube drainage into the defect plus intercostal drains are best. The contralateral side usually requires a drain, ideally inserted thoracoscopically, but if there is minimal fluid on CT this side can be treated expectantly.

For patients with intra-abdominal free gas and/or fluid, laparotomy with lavage, draining gastrostomy and feeding jejunostomy are required. If a stent has been placed in the oesophagus then an absorbable suture should be placed full-thickness through the wall of the oesophagus or stomach to anchor it into

position (much like the old fashioned Celestin tubes). The problem with stenting is that there is no stricture and therefore nothing to hold the stent in position. Migration and all the ensuing problems are frequent. It may be that stenting was performed in this case because of the patient's refusal to accept surgery.

Case study 8

Headache plus cerebral aneurysm requires urgent treatment

Case Summary

A young patient with a past history of hypertension and hypercholesterolaemia presented to a general practitioner (GP) with unusually severe headaches for a fortnight and with unspecified visual disturbance. The patient was referred to an ophthalmologist, who arranged magnetic resonance imaging (MRI) of the brain. The MRI demonstrated a large cerebral aneurysm (15–25 mm) with mural thrombus. At a follow-up appointment with the GP, a neurology outpatient clinic was arranged for the patient to be seen within a week. The patient then returned home, apparently fell asleep and became unrousable. An ambulance was called and on attendance recorded an initial Glasgow Coma Scale score of 5 with symmetric and reactive pupils. The ambulance officers intubated the patient and issued a trauma call before transportation to a hospital ED. By this time, which was late evening, the left pupil was several

millimetres larger than the right. CT of the brain revealed a diffuse subarachnoid haemorrhage with intraventricular blood and early hydrocephalus. The neurosurgery registrar successfully inserted an external ventricular drain in ED and the patient was transferred to ICU where it was noted that the pupils were not reacting to light. The external ventricular drain became blocked by a blood clot and could not be flushed with recombinant tissue plasminogen activator, as suggested by the neurosurgery Consultant. A repeat CT of the brain demonstrated further bleeding and more 'mass effect'. The neurosurgery team advised that the patient was to be palliated. When the intracranial pressures rose to the extreme range, no action was taken by ICU.

Clinical lessons

The quality of the hospital documentation was quite adequate. It would be of interest to read documentation from the GP or the ophthalmologist.

The main concern in this case is why a person with severe headaches, visual disturbance and MRI evidence of a large aneurysm containing mural thrombus was not sent to hospital for urgent admission and management, rather than told to attend an outpatient clinic several days later. Failure to refer the patient to hospital immediately almost certainly cost the patient their life and hence qualifies as an adverse event.

There were other issues, such as the time involved in preparing the patient for transport to hospital, time before

obtaining a CT and time before inserting an external ventricular drain, each of which might not amount to much when considered separately but collectively amounted to a delay that could have made the difference between life and death. In a young patient with no significant comorbidity, it could also be debated that urgent clipping or endovascular occlusion of the aneurysm on the night of presentation might have led to a good neurological outcome, as it was clear from the notes that the ultimate deterioration was the result of a re-bleed. This was perhaps potentiated by the use of tissue plasminogen activator in the ventricular drain. Many neurosurgery units have a policy of not operating on aneurysms after hours, arguing that the operating conditions are suboptimal and do not favour the patient, but it can equally be argued that some patients will die because of such policies.

Case study 9

No apparent plan of management

Case Summary

A frail, elderly person with a known history of transitional cell carcinoma of the bladder was admitted with acute renal failure and displaying high levels of creatinine. Comorbidities included chronic obstructive airway disease, diverticular disease and urinary tract infections. There had been a recent cystoscopy prior to admission. There was no information apparent in the notes about events prior to this admission. It was implied that the

carcinoma of the bladder was muscle-invasive disease, although no pathology report was available.

A CT scan on admission demonstrated bilateral hydronephrosis with an obstructed left system due to a large distal ureteric calculus and obstructed right system of uncertain cause, possibly related to known carcinoma of the bladder. An attempt was made to gain access to both ureters in a retrograde fashion but failed due to technical reasons. It is unclear whether this procedure was performed by a Consultant urologist or a Trainee. Bilateral nephrostomies and antegrade double-J (JJ) stents were inserted over the subsequent weeks of the patient's admission. The patient ultimately died of multiorgan failure.

Clinical lessons

The case notes were reasonably adequate. More information about events leading to this admission would have been helpful, such as details of the original cystoscopy and underlying pathology. Most of the doctors' entries into the notes failed to state the time of entry, leading to possible confusion. This is an area which requires improvement. There was no reference to any Consultant urologist input throughout the case.

The patient had problems with fluid balance issues throughout the admission. After the insertion of the right nephrostomy tube, the resident medical staff seemed to fail to understand the significance of the poor urine

output through the nephrostomy tube, particularly in the context of a patient with acute renal failure. It was not until two days later that the first medical note was made about this issue. It took nearly a week for this to be addressed with insertion of an antegrade double “J” stent.

The residents’ assessments and responses to the poor urine output were of variable quality with some being substandard. The fluid charts would suggest that the patient was in a significant positive fluid balance throughout the admission and this was not commented on. It was over two weeks after presentation before any attempt was made to relieve the obstruction to the left kidney.

The significant delays between recognising clinical issues and responding appropriately in this frail, elderly patient with multiple comorbidities must almost certainly have contributed to the ultimate demise.

Some examples of areas of concern include:

- Although the patient was admitted with acute renal failure and evidence of bilateral ureteric obstruction, it took 48 hours from the time of admission until the original procedure was performed.
- It may have been more advisable to place a nephrostomy tube in the left rather than the right kidney. It is likely this would have been the best option given the history of an obstructing calculus compared with malignant obstruction of the right kidney. No notes were made

discussing the rationale for placing a nephrostomy tube in the right kidney initially. It took 48 hours for the medical staff to note that the inserted nephrostomy tube was not draining. The implications of this in terms of either a misplaced nephrostomy tube or reflecting poor function was never expressed and possibly not understood by the medical staff. It was not until nearly a week later that an antegrade JJ stent was inserted.

- Most of the notes were made by junior residents, often the covering doctor. There was no clear evidence of Consultant urologist input throughout the case.
- When clinical deterioration occurred no attempt was made to clear the left ureter until nearly three weeks after admission.

The quality of care this patient received was less than desirable. Given the considerable comorbidities there was only ever going to be a short window of opportunity to reverse the processes. It took over two weeks to clear both ureters by which time multiorgan failure was established and there was little chance of reversal. More timely intervention may have altered the outcome. However these comments must be taken in the context of an elderly patient with multiple comorbidities and possibly an advanced malignancy (although absolute evidence for that was not provided in the notes). In such circumstances a poor outcome was always a strong possibility.

Case study 10

A young patient with stab wounds to the neck

Case Summary

A young patient with multiple stab wounds to the left hand side of neck was admitted to hospital and was intubated. No drugs were administered. Initially the blood pressure (BP) was stable at 130/60. A decision was made by a senior vascular Registrar to take the patient immediately to theatre; the patient decompensated on the way. A clamshell thoracotomy was performed and cardiac massage commenced. There was a near total transection of the brachiocephalic vein, which was manually compressed. On arrival of the Consultant vascular surgeon the thoracic aorta was clamped and the brachiocephalic vein oversewn. Extensive resuscitative measures were carried out with no response.

Clinical lessons

This difficult case was very well handled by the treating vascular unit who did everything one could expect from them; no criticism of any steps in their management of this patient were raised. The timelines indicated by the first ambulance entry, the trauma call at the treating hospital and the time when the patient was in the operating theatre, are all appropriate.

The treating surgeon mentioned in the SCF that a suitable sternal saw and rapid infusion system were lacking; however, there is no mention of these difficulties in the case notes. It is important for the surgeon to take up these concerns with their hospital administration as they are important pieces of equipment in any hospital receiving urgent cases such as this.

Case study 11

Poor immediate postoperative communication in a bleeding patient

Case Summary

An elderly patient was admitted for a rigid cystoscopy and resection of a bladder tumour. There was a medical history of hypertension and an AAA repair. A transurethral resection of the bladder tumour was performed.

Postoperatively on the ward the patient had active bleeding. Continuous bladder irrigation was performed and traction applied to the indwelling catheter. The urologist was not informed of the active bleeding but did, however, notice the active haematuria and that the BP and haemoglobin levels had been low.

The patient was taken to theatre for evacuation of blood clots and control of the bleeding. A blood transfusion

was required. A cardiac arrest occurred shortly postsurgery and the patient was intubated, resuscitated and transferred to ICU. An emergency echo-cardiogram confirmed the presence of anterior wall and apical left ventricular hypokinesia. The patient received several units of blood and other blood products. Inotropic drugs were required to maintain the BP; however, further deterioration occurred and the patient required increasing inotropes. A second echo-cardiogram showed akinesia of the anterior wall and a left ventricular function of less than 20%. The patient progressed to palliative care and died soon thereafter.

Clinical lessons

The case adhered to reasonable and routine well-established clinical pathways for an elective endoscopic resection of a bladder tumour that was complicated by active haemorrhage. No communication occurred between the ward staff and the surgeon regarding the clinical deterioration of the patient in the immediate postoperative period, in regard to the clinical management of the post-active bleeding.

It is unclear as to whether the urologist reviewed the patient in recovery or on the ward during the postoperative period. There was thus no opportunity to discuss with the nursing staff the intraoperative findings and instructions about the plan of management post-operation.

The lack of communication between the surgical ward staff and the surgeon is an area of concern. With continuous active bleeding and low systolic BP, it

is imperative that the surgeon should be called. The active bleeding led to hypovolaemia, which contributed to the onset of acute myocardial infarction in an elderly patient with vascular disease, resulting in multi-system failure and the death of the patient.

Case study 12

Colonoscopy perforation—delay after perforation

Case Summary

An elderly patient presented with extensive medical comorbidities including diabetes, hypertension, diverticular disease, liver cirrhosis with portal hypertension, and ascites. The patient had previously developed necrotising fasciitis of the buttock. After initial debridement, the patient was transferred for further management and ICU admission. The patient then underwent a laparoscopic loop transverse colostomy and multiple debridement procedures to the buttock. Subsequently the patient was admitted for reversal of the loop colostomy. The patient was later readmitted for investigation of rectal bleeding. A colonoscopy was performed, which demonstrated what was thought to be a stenosis in the sigmoid colon. The colonoscope was pushed through the stenosis and into a large cavity, which was recognised as possibly being extra-colonic. The patient initially seemed well and further investigations were planned

for the possible stricture and inflammatory mass.

Post-colonoscopy, the patient rapidly deteriorated with generalised peritonitis and sepsis. At laparotomy, there was a large perforation in the rectum and extensive adjacent diverticular disease. A limited Hartmann's resection was performed and the patient was transferred for ICU admission and management. A repeat laparotomy was undertaken; there was extensive intra-abdominal blood with active arterial bleeding from the pre-sacral area. This was controlled with suture, Floseal and packing. The patient was returned to theatre twice and eventually the packs were removed and the abdomen closed. A week after removal of the packs, the patient rapidly deteriorated.

A further return to theatre resulted in a diagnosis of purulent peritonitis. This was treated with abdominal lavage and rectal stump drainage. However, the patient continued to deteriorate and subsequently died.

Clinical lessons

This patient had extensive comorbidities; once faecal peritonitis from the perforated rectum was established, there was a high likelihood of mortality. It appears that the delay in performing the Hartmann's resection may have contributed to the patient's demise. However, the perforation was secondary to the severe diverticular disease and it is possible that the stricture was in fact a diverticulum - a recognised hazard of colonoscopy in the setting of severe diverticulosis.

Case study 13

A cardiac and vascular spiral

Case Summary

A patient in their seventies with a history of hypertension and type 2 diabetes with previous coronary artery stents previously, presented with a six-month history of exertional angina and developed a non ST-elevation myocardial infarction (NSTEMI) for which they were admitted to hospital. Clinical examination indicated that peripheral pulses were present, but that 'there was decreased circulation in both feet due to diabetes'. Coronary angiography was performed two days after admission and revealed a left main stenosis 70%, left anterior descending (LAD) occlusion, 90% circumflex stenosis and 90% right circumflex artery(RCA) stenosis with an ejection fraction of 0.25–0.3. Surgery was performed several days later and consisted of a left internal mammary artery (LIMA) to LAD, saphenous vein graft to the intermediate and to the posterolateral branch of the circumflex. An intra-aortic balloon (IAB) was inserted preoperatively — the exact reasons for this were not apparent from the case notes. There also appears to have been no anticoagulation measures whilst the IAB was in place. It is acknowledged that anti-coagulation is not always used with an IAB. Initially the haemodynamic status was stable and therefore the pulmonary artery catheter and the IAB were removed within 24 hours of operation. However 48 hours after operation there was deterioration

in the haemodynamic situation, requiring reintubation and further cardiac support.

One of the complicating features was that the patient developed a new problem, namely peripheral vascular ischaemia. The pulse chart suggested that the right pedal pulses were not palpable; the distal right leg became cool, the patient complained of being unable to feel the leg and subsequently complained of pain in the leg. Within a few hours the leg was pulseless and Doppler confirmed no distal flow. More than 24 hours after the deterioration in vascular function of the leg an embolectomy and thrombolysis on the right leg was performed, combined with dilatation of the superficial femoral, popliteal and posterior tibial arteries. More than 24 hours later it was suspected that a compartment syndrome had developed but no fasciotomy was performed for a further 12 hours as a vascular Registrar was not available.

At the same time that the peripheral circulation was deteriorating there was also evidence of an acute abdomen with abdominal distension and x-ray evidence of dilated proximal small bowel loops and large volumes of faeculent losses via the NG tube. By this stage it was decided that exploration of the abdomen was not indicated.

The combination of these three factors (haemodynamic deterioration, leg ischaemia and the evolving acute abdomen) resulted in a downward spiral of sepsis, cardiogenic shock and acidosis which resulted in a decision to withdraw therapy. The patient died shortly after.

Clinical lessons

1. The patient appeared to have a routine early postoperative course in ICU until the removal of the IAB when distal ischaemia was demonstrated. There is no evidence of the nature, if any, of the type of anticoagulant therapy employed during the first postoperative day, that is, whilst the IAB was in situ. There was also nothing in the notes to indicate whether IAB was placed on the same side as the leg ischaemia. The question must be raised whether these factors contributed to the lower limb ischaemia.
2. Vascular consultation was not obtained until approximately 24 hours after the development of lower limb ischaemia, and embolectomy and thrombolysis was not performed until a further four hours later. This is a significant delay.
3. Subsequently, the patient developed a distended abdomen which may well have been due to ischaemic bowel (post-mortem showed a 70% stenosis to the superior mesentery artery). In view of the two areas of peripheral ischaemia (gut and leg) one must wonder if atrial fibrillation with distal emboli was a factor but the case report is silent on this issue.
4. A late fasciotomy did nothing to lessen increasing acidosis and haemodynamic deterioration.

5. The final area of concern is why the right coronary artery or its branches were not grafted. The angiogram describes a 90% stenosis of the RCA (at post-mortem a 70% stenosis was noted), but no branch of right coronary artery appears to have been grafted. If this is the case, then this may have contributed to the patient's haemodynamic deterioration.

Case study 14

Possible acute cholecystitis delays with fatal outcome

Case Summary

This middle-aged patient was admitted with a short history of severe right upper abdominal pain. Initially the patient was admitted to a medical ward; no radiological investigations of the acute abdomen were undertaken. A Medical Emergency Team call was made about eight hours after admission when there were findings of hypotension and a temperature of 38.9 °C and ongoing right upper quadrant (RUQ) pain. Transfer to HDU occurred and two hours later the patient was noted to have a very tender abdomen with rebound tenderness. Eighteen hours after admission there is a record that the patient was in septic shock with a rigid abdomen.

Major surgical involvement did not seem to take place until 24 hours after

admission, when an ultrasound of the gall bladder was performed that showed no gall stones but indicated pericholecystic fluid. A percutaneous cholecystotomy was performed. A decision was made that the patient was too unstable for a CT scan and that a 'blind laparotomy' should not be performed. By 24 hours after admission the patient was septic, anuric and hypotensive. By 36 hours after admission the patient was able to give a clear directive that further aggressive measures should cease. A CT scan of the abdomen was performed 48 hours after admission and showed possible ischaemic colitis affecting the ascending and transverse colon. There was no pericholecystic fluid (in contrast to the ultrasound findings). The patient died shortly after the withdrawal of supporting measures.

Clinical lessons

My opinion is that a potential opportunity to correct the intra-abdominal pathology was missed on the day of admission. I believe this patient should have had a surgical assessment and an early CT scan of the abdomen. If the patient had sepsis from an intra-abdominal source, which seemed to be the working diagnosis, then the only opportunity for this patient to survive was to deal with the sepsis (or the ischaemia) early. If the patient was too sick to go for a CT scan, then the only chance was a laparotomy.

I find the pace of surgical decision-making rather slow, with a lack of direct Consultant involvement. I think the surgical team should review who decided what and when, and what communication

occurred with the on-call Consultant. I cannot say that the patient could have been saved, as they had several comorbidities (hypertension, previous peptic ulcer surgery, acute tubular necrosis, atrial fibrillation, osteopenia, rheumatoid arthritis and depression). However, the patient may have had an acute embolus to the gut or, less likely, a gangrenous gall bladder (it seems that bile was aspirated from the gall bladder during the percutaneous cholecystotomy but not pus or blood according to the radiology report). There is no curative conservative treatment for ischaemic gut and one has to make a positive diagnosis.

Case study 15

Unrecognised small bowel injury during laparoscopic inguinal hernia repair

Case Summary

An elderly patient underwent an elective right recurrent inguinal hernia repair via a preperitoneal approach. The past medical history included intellectual disability (consented by a Public Advocate), schizophrenia, and most importantly, a prior midline laparotomy for a small bowel obstruction in 2009. The operation itself, performed by an Advanced Surgical Trainee with a surgeon assistant, seems to have been straightforward as it only took 38 minutes to perform. The operation note states that “Extensive scar tissue of

previous repair dissected” but no other information was given. A Parietex mesh was inserted and secured with Protacks, and the patient was discharged home the following morning.

The patient was returned to hospital by ambulance just over two hours later due to four episodes of vomiting and one episode of faecal incontinence (unusual for the patient). The patient’s temperature was 38.2 °C, they were tachycardic (heart rate 110), and discharge was noted from the lower midline port site. The cause of the vomiting was documented as being secondary to opioids although, on review of the medication record, the patient received only Paracetamol 1 gram, four times a day (last dose early in the morning of discharge) and no opioids since surgery. An abdominal x-ray was performed but no mention is made of the results in the notes until the patient was admitted to ICU the following day. It is then recorded that free air was present under the diaphragm. The patient was reviewed by a surgical resident medical officer and by the covering surgical Registrar overnight whilst in the ED, was encouraged to eat and drink, and was eventually transferred to the surgical ward at midnight.

The following morning, the patient was noted to have foul-smelling discharge from the wound and had diffuse peritonitis. Upon review by the surgical fellow (post-FRACS), the patient was scheduled for an urgent laparotomy; a 2 hour 45 minute laparotomy ensued and the relevant findings were: difficult adhesions against a lower midline incision, small bowel content in both the pelvis and right preperitoneal plane, and a small bowel injury where small bowel was

adherent to the peritoneum. The mesh was removed, a 40 cm segment of small bowel was resected, the abdomen was washed out and three drains were placed, and a double-barrel stoma was fashioned in the lower left quadrant (due to the right abdominal wall being 'too contaminated'). Crepitus was also noted in the overlying tissue but no debridement occurred. The patient was transferred to ICU postoperatively. The following morning, the surgical fellow reviewed the patient and was concerned about the increasing noradrenaline requirement and blistering over the right lower quadrant (RLQ)/scrotal rash.

The Consultant surgeon was asked to review the patient but disagreed that the rash was a necrotising fasciitis. Later, the skin was noted to look ischaemic by the surgical Fellow but, as the patient was by then extubated and off inotropes, no debridement occurred. Nevertheless, the patient's inotropes were recommenced sometime during the next nursing shift, and the skin was described as necrotic on the Consultant ward round (postoperative day two). The patient was re-intubated on postoperative day three, and underwent debridement of the necrotic tissue overlying the RLQ on postoperative day four. Inotrope requirements subsequently decreased.

The following day the wound edges were healthy, a vacuum-assisted closure dressing was placed, and a CT scan of the abdomen was performed but the results were not documented in the notes. On postoperative day six a discussion took place between ICU, the surgeon and the Public Advocate. The decision was made to extubate the patient with no possibility of reintubation. The patient deteriorated

a few hours following extubation and was declared deceased just before midnight. Both an Advanced Surgical Trainee and a Consultant surgeon were responsible for completing the audit form. Whilst they recognised the adverse event responsible for the patient's readmission, they did not think any other areas of concern existed and would not have done anything differently in retrospect.

Clinical lessons

The adverse event was an unrecognised small bowel injury, which occurred as a result of a laparoscopic recurrent right inguinal hernia repair. It is somewhat surprising that the operation itself only took 38 minutes in a patient with a prior lower midline laparotomy. One also has to wonder, knowing in retrospect the findings at the second operation, if it was the midline 5 mm port that perforated the closely adjacent small bowel upon entry into the preperitoneal space. It is easy to be wise in retrospect but it is probable that, had the patient undergone an open inguinal hernia repair, the subsequent complications would not have occurred.

There are two points worthy of discussion (the first an area of concern, and the second, an area of consideration). First, there was an 18-hour delay in diagnosis once the patient returned to hospital. Free air under the diaphragm is not an expected finding after a totally extraperitoneal hernia repair. This implies that the peritoneum was breached during the operation, something that was not mentioned in the operation note. In addition, it is unlikely that the vomiting 24 hours after surgery was related to

opiate use. This patient initially had no nausea and vomiting in the first 24 hours postsurgery when there would have been the highest opiate plasma/effect site concentration. The patient had minimal analgesic requirements and received only paracetamol, which does not usually cause nausea and vomiting. In this instance, the incorrect assumption that the vomiting was a drug side effect prevented the consideration of other causes of nausea and vomiting in the postoperative patient, such as ileus or bowel injury.

More disturbingly, there did not seem to be any effort made to contact anyone more senior, in particular the surgeon responsible for the patient's operation the prior day, to notify them of the patient's unexpected readmission to hospital. By the time the patient was reviewed by a surgeon (>19 hours after presentation to hospital), the patient was in severe septic shock requiring inotropes and intubation. Registrars working in a training hospital should perhaps be reminded that an unexpected readmission to hospital shortly after surgery deserves timely discussion with the surgeon responsible for the patient. The second point is that a blistering purple rash in a patient who is systemically critically ill and has tissue crepitation, is necrotising fasciitis until proven otherwise. This patient demonstrated many, if not most, of the hallmark signs of a necrotising infection including a rapidly advancing erythema, blistering, ischaemia, bacteraemia, hypotension, tachycardia and crepitus. Once tissue debridement eventually occurred (three days after the blistering was first noted), the patient's inotrope requirements decreased which lends further weight to this hypothesis.

It is unclear to me why there was an initial reluctance to debride the ischaemic tissue when the patient was for full supportive measures. I do not think this decision adheres to accepted surgical principles although it is unlikely that the ultimate outcome would have been altered by earlier debridement.

Case study 16

Severe abdominal pain with negative imaging—think dead gut

Case Summary

A patient in their mid-thirties with bipolar disorder and a 30-pack-year history of smoking, presented to the ED with a long history of chronic abdominal pain under the care of a gastroenterologist. There was a past medical history of Wilms' tumour treated as a child with extensive surgery, chemotherapy and subsequent radiotherapy. There had been at least two episodes of documented small bowel obstruction, one of which culminated in a small bowel resection at the age of 14. Significant recent history included an attendance to ED two months prior with stool culture-positive *Campylobacter* enteritis. The history on this presentation discussed 'ongoing pain' since that presentation. The immediate preceding history included constant pain with sharp exacerbations over the entire abdomen. The patient had vomited three to four times a day over the last three weeks.

There had been a loss of 11 kilograms of weight in the last six weeks.

On arrival observations were relatively stable apart from a pulse rate of 100. Abdominal findings were generalised with abdominal tenderness, guarding and percussion tenderness. There was a transverse paediatric laparotomy scar. Imaging including chest x-ray, abdominal x-ray and ultrasound revealed no significant abnormality. It was noted that a white cell count was elevated and a CT after arrival revealed no obstruction but made comment of a 'narrowed proximal jejunum'. A diagnosis of 'functional abdominal pain' on a background of chronic abdominal pain was made. Early progress was characterised by ongoing abdominal pain which was rated at between 'nine out of ten' and 'ten out of ten'. Treatment was focused on symptom control with analgesia and IV fluids. An indwelling catheter was placed for urinary retention.

Over the next 24 hours continued pain was documented and significant doses of narcotic analgesia were administered. Ongoing abdominal pain was noted until the early hours of the final day, when haemodynamic compromise was noted with low urine output and an elevated HR. Overnight a ward call documented generalised severe abdominal pain with distension and rigidity. The C-reactive protein was 120 and a white cell count was 14.2. Resuscitation was commenced. Early on the final day a surgical review commented that the patient was a 'difficult historian', but it was obvious there was increasing abdominal pain, vomiting and worsening observations and abdominal signs. At this point a possible diagnosis of 'closed loop obstruction with

ischaemia' was made. Within the hour the patient had become tachycardic, and had a huge haematemesis with aspiration and a loss of cardiac output. Cardiopulmonary resuscitation (CPR) was commenced. There was no response to Naloxone. CPR continued for 45 minutes before it was ceased.

An autopsy was performed and the cause of death was defined as ischaemic enteritis due to superior mesenteric artery thrombosis complicated by gastrointestinal haemorrhage and aspiration pneumonia. The pathologists concluded that isolated superior mesenteric artery atherosclerosis was accelerated by radiotherapy for Wilms' tumour, with a thrombosis of approximately 1.5 cm of the vessel. There was no bleeding point and the haematemesis resulted from generalised ischaemia. A comment was made that this was an unusual cause of death in a young patient.

Clinical lessons

A number of patient factors conspired to make the early diagnosis of mesenteric ischaemia difficult. The patient was young with a past history of chronic pain under the treatment of a gastroenterologist. Campylobacter enteritis had been diagnosed six weeks prior and it did not appear to be a symptom free interval since this episode. There were features of an underlying bipolar disorder and comment made of the patient being a 'difficult historian', not helped by large doses of narcotics. The patient ambulated outside to continue smoking until the latter stages of their admission.

Although no radiology reports are included in the case notes, as is usually the case in this setting, there were no radiological findings to support the intra-abdominal catastrophe emerging.

Despite these factors, however, it is clear that the initial diagnosis of a 'functional' cause of the patient's abdominal pain could be seen as being too hasty. This provisional diagnosis may have prejudiced subsequent surgical reviews, particularly by juniors. Despite large doses of narcotic analgesia the patient had a pain score of between nine and ten throughout their admission. There had been a loss of 11 kilograms of weight over the ensuing six weeks, and vomiting had occurred three to four times a day. An elevated white cell count was also noted. It took three days, despite the past history of abdominal surgery and previous bowel resection, for closed loop obstruction or ischaemia to be considered.

The salient features of the history remain the past history of abdominal surgery and the increasing abdominal pain despite negative imaging. The elevated white cell count and deteriorating haemodynamic observations should prompt more careful consideration of this diagnosis and an earlier assessment of the possible need for laparotomy. This scenario illustrates the deficiencies inherent in the use of CT to triage these cases. It is worth remembering that laparotomy remains the 'gold standard' investigation and its early use here just might have altered the clinical course.

Surgical cases such as this one are always difficult and it is unclear whether a laparotomy would have altered the outcome with such a proximal thrombosis

of the superior mesenteric artery. Early laparotomy may have produced equivocal findings. The massive haematemesis and aspiration precipitated a rapid demise and prevented surgical intervention and salvage of the situation. This case emphasises the importance of always being mindful of the diagnosis of mesenteric ischaemia in a patient with increasing abdominal pain in the absence of other progressive signs.

Case study 17

Bleeding after total laryngectomy

Case Summary

A patient in their late forties was admitted for an elective salvage total laryngectomy for recurrent squamous cell carcinoma. The patient's postoperative course was complicated by a fistula on day five and subsequent bleeding on day 24 due to erosion of the internal jugular vein (IJV), which led to major haemorrhage and ventricular fibrillation arrest.

The patient was resuscitated and taken to theatre, where surgery was performed to close the fistula and control the bleeding successfully. The decision eventually was made to withdraw life support due to the patient's wishes preoperatively not to be on life support.

Clinical lessons

The patient had previously received chemoradiotherapy for their primary cancer and this is well known to affect tissue healing and lead to a high rate of postoperative fistulas and other complications. Furthermore the patient was on steroids (dexamethasone) for months preceding the operation and therefore had to continue on it postoperatively due to suppression of the hypothalamic pituitary steroid axis. This would have led to an immunosuppressant effect and adverse effect on tissue healing. Consideration should have been given to place a pectoralis major flap, as the rate of fistula is high in patients postoperatively after chemoradiotherapy.

There are multiple publications and centres using pectoralis major flaps and some even using free flaps in high-risk situations. Tissue healing would have been affected by the previous chemoradiation and long-term dexamethasone, with an increased risk of fistula. The use of non-irradiated tissue to help with wound healing after salvage laryngectomy could be considered in these cases.

There could have been greater urgency to performing a radiological investigation on the day when the patient initially had signs of bleeding. A pharyngocutaneous fistula is known to cause erosion of either the internal jugular vein (IJV) or one of the carotid arteries and this could have been identified with an angiogram or venogram when the bleeding was first noted by the Registrar.

I note that the wound was packed and a discussion to perform radiological investigations was made with the Consultant but none were requested. Identifying bleeding from the IJV could have led to an earlier decision to return to theatre that evening rather than the emergency situation the following day when the patient suffered a cardiac arrest. It is uncertain if the outcome would have been different as the patient had a poor prognosis but consideration should be given to aggressive management of fistulas when 'sentinel' bleeds occur.

Shortened forms

AAA	abdominal aortic aneurysm
ANZASM	Australian and New Zealand Audit of Surgical Mortality
BCC	basal cell carcinoma
BP	blood pressure
CPD	Continuing Professional Development
CPR	cardiopulmonary resuscitation
CT	computed tomography
ED	Emergency Department
GP	general practitioner
HDU	High-Dependency Unit
IAB	intra-aortic balloon
ICU	Intensive Care Unit
IJV	internal jugular vein
IV	intravenous
LIMA	left internal mammary artery
LFT	liver function test
MRI	magnetic resonance imaging
NG	nasogastric
NSTEMI	non ST-elevation myocardial infarction
RACS	Royal Australasian College of Surgeons
RCA	right coronary artery
RLQ	right lower quadrant
RUQ	right upper quadrant
SAAPM	South Australian Audit of Perioperative Mortality
SCF	surgical case form

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