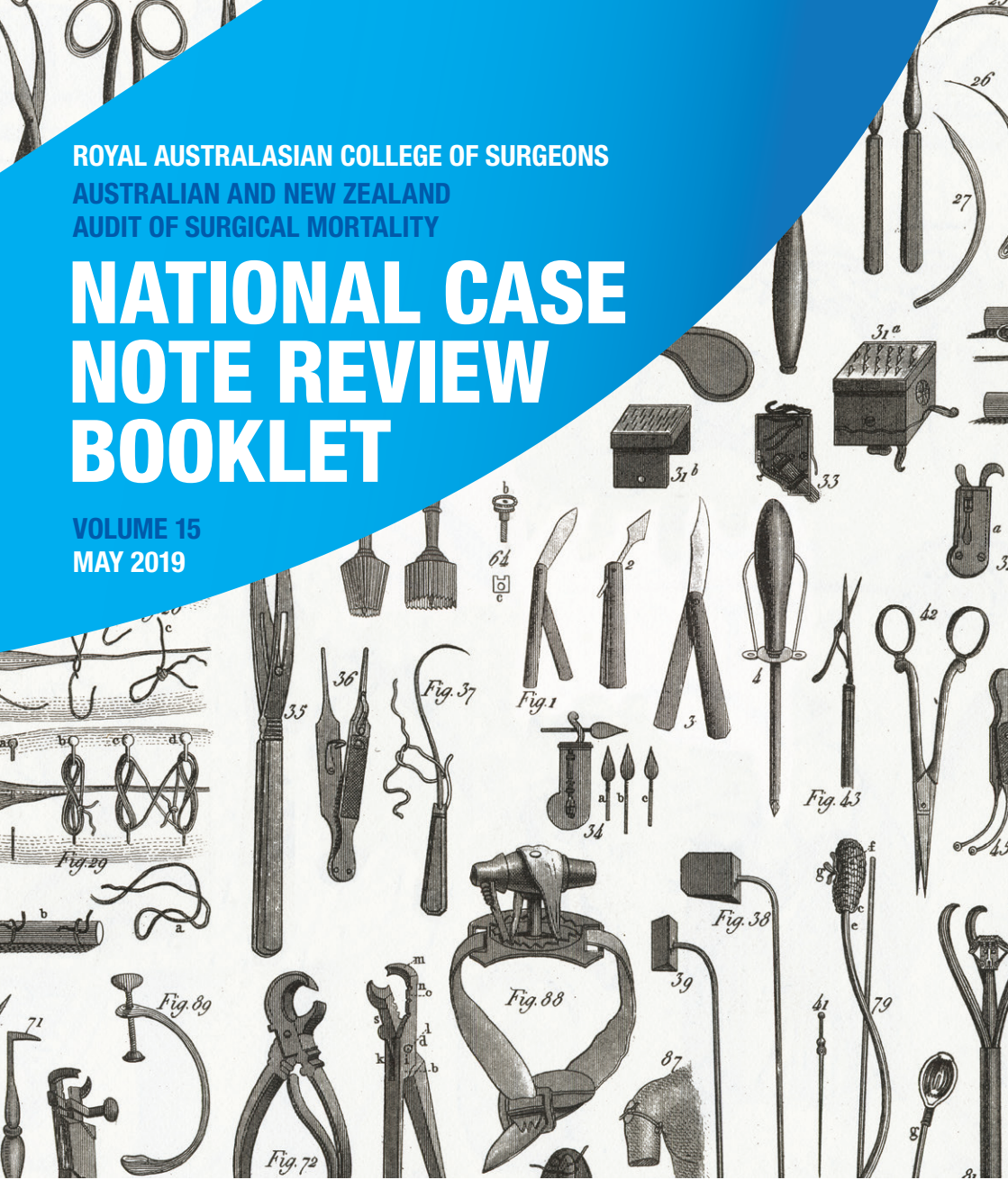


ROYAL AUSTRALASIAN COLLEGE OF SURGEONS  
AUSTRALIAN AND NEW ZEALAND  
AUDIT OF SURGICAL MORTALITY

# NATIONAL CASE NOTE REVIEW BOOKLET

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ROYAL AUSTRALASIAN  
COLLEGE OF SURGEONS



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



Australian and New Zealand  
Audit of Surgical Mortality





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# Chairman's report

This latest edition of the ANZASM Case Note Review Booklet again highlights areas where surgical care can be improved and, in particular, problems with infection and communication.

ANZASM has also been providing cases for *Surgical News*, which have certainly generated considerable feedback and comments from a number of surgeons and specialty societies. It should be noted that these cases are edited from the first- or second-line assessments that have been generated by expert surgeons in the field. The editorial task is predominantly devoted to shortening the feedback and ensuring that cases are de-identified, so that no individual surgeon or patient can be identified from the information provided in these reviews.

One specialist society has recently expressed concern that the case had been looked at only by a nonspecialist surgeon. The society has been reassured that this is definitely not the case and that at all times expert reviewers are sought for both the first- and second-line assessments to ensure that high quality feedback can be provided.

At the end of the day, the role of publishing these cases is to provide examples that could have been managed in a more efficient or effective fashion. All surgeons have cases which, in retrospect, could have had a different approach applied and the cases presented in this booklet highlight some of those.

The Audit is always open to constructive and appropriate feedback and will always respond; often the concerns will be published, particularly if they relate to cases presented in *Surgical News*.

The Editorial also gives me an opportunity to thank not only the assessors, first- and second-line, but also the Clinical Directors located in each state who put an enormous amount of time, effort and energy into ensuring the passage of these deaths is appropriately managed and feedback provided to surgeons.



Guy Maddern  
Chair, Australian and New Zealand Audit of Surgical Mortality (ANZASM)

# ANZASM Clinical Editor's perspective

The 15th booklet includes cases from various states and territories, and forms part of the feedback process that is seen as essential in the quality improvement processes of the audits of surgical mortality. A national booklet is produced to provide a wider readership for cases from various states. It also assists smaller states and territories that do not have enough cases to produce their own booklet and may have difficulty in adequately de-identifying cases. The larger states continue to publish their own case note review booklets as well as contribute to the national booklet.

The cases in this booklet do not follow one theme but are focused on a variety of patients from a broad spectrum of surgical specialties. While the circumstances of each case are different, many of the themes presented are applicable to all specialties.

Delays are seen in many different forms in these cases. The cases include delays in the involvement of an appropriate/experienced specialist or the reasons behind a delay in diagnosis or treatment. Some of the cases describe delays in anticipating, diagnosing or treating infection, anastomotic leakage of bowel or vessels and delay in early recognition of an intraoperative problem.

Infection remains a ubiquitous problem. These cases demonstrate the importance of early diagnosis of an abscess, infection or sepsis and the need for early appropriate review by an infectious diseases consultant. The possibility of multiple infective foci and the need for appropriate, earlier or better antibiotic treatment has also been raised in these cases.

Some of the cases illustrate the importance of anticipating potential complications. Examples of this include recognising the threshold for tracheostomy, or delaying the onset of nasogastric feeds in order to protect surgical anastomoses. Other cases illustrate the importance of appropriate surgical and anaesthetic preoperative assessment, or the need to ensure that the hospital has adequate facilities to manage anticipated problems.

Many of these cases demonstrate the importance of clear communication. Verbal communication is not only important between staff present in the operating theatre but also in pre- and postoperative settings. The importance of written documentation to allow effective management by the handover team has also been raised in these cases.

Some cases have been edited to focus on a few points in a complex story or to reduce the length of the report. There is variability in the writing style as the text is, in general, written by assessors and treating surgeons and not by the editor.

There may be cases where readers may not entirely agree with the assessment and comments, but if we have stimulated you to think about the case we have succeeded in our aim. Correspondence and questions about specific cases are welcome, and while the ANZASM cannot provide identifying information, we are able to provide more context and detail than we have in this booklet.

The real authors of this booklet of the treating surgeons, the clinical directors, and the first- and second-line assessors of the various states and territories. It is to them we owe our thanks. Without their contribution, this booklet would not be possible.

Our primary goal has been to promote education and peer-review through the ANZASM, for a thorough knowledge of the past provides the foundation to protect our future. Please learn from these cases.

A handwritten signature in black ink, appearing to read 'Tony Pohl', with a stylized flourish at the end.

Tony Pohl  
Clinical Director, South Australian Audit of Surgical Mortality (SAASM)  
Clinical Editor, National Case Note Review Booklet, ANZASM

# Recommendations

1. In all cases there needs to be clear, demonstrable leadership in patient management. There should be regular team meetings involving all disciplines to ensure that the treatment plan is understood by all.
2. Time delays are to be minimised, particularly for patients with comorbidities who require transfer between hospitals, due to their limited physiological reserves. Time delays for these patients can significantly affect surgical outcomes.
3. Communication remains one of the most critical factors in the delivery of safe, high quality patient care. Good communication between surgeon colleagues, other specialists, junior staff, nursing staff and allied health staff remains a cornerstone of quality care.
4. All clinicians should provide clear and relevant records.
5. Surgical patients, particularly those with certain comorbidities, are more susceptible to developing infection and stringent infection control care should be considered. Improvements can be achieved by focusing on strengthening current guidelines for infection control procedures, especially hand washing, revision of existing infection control training and adherence to patient care protocols. Consulting with and following the advice of infectious disease staff is crucial to minimising infection rates and complications.
6. Consultants should be actively involved in the care of their patients, including the decision-making process. They have an obligation to make personal entries in the case record of the reasoning behind their decisions.
7. Improved postoperative management is important for reducing complications, particularly in the detection of postoperative bleeding. The patient should be discharged to the ward with comprehensive orders, including preventative measures for reducing complications.

# Case studies

## Case study 1: Delay in identifying the source of infection following a fall in an elderly patient

### Orthopaedic Surgery

#### CASE SUMMARY

A woman in her late nineties suffered a heavy fall onto concrete. She sustained a bruise/abrasion above the left eye and lower forehead and complained of discomfort in her right shoulder. She was assessed in an emergency department and x-rays, which included the right shoulder, face and skull showed no underlying fractures. Prior to her injury, she had been active and alert and enjoyed socialising. Her medical history consisted of successful coronary artery bypass surgery, total knee and hip replacements and type 2 diabetes with good medical control. In the days following her fall, she became progressively unwell, hypotensive, drowsy and complained of general discomfort. A blood culture grew a *Staphylococcus aureus* organism and a full blood examination was consistent with a fulminating infection. She was transferred to a medical unit for ongoing management, which included appropriate intravenous (IV) flucloxacillin and vancomycin antibiotic

medication. Despite this, her condition slowly deteriorated. Both upper limbs became oedematous and it appeared that most of her discomfort was related to her right shoulder and left wrist, though she also appeared to be generally in pain when moved in her bed. A bone scan carried out 11 days later showed increased uptake of radioactive traces in the right shoulder and left wrist regions. An ultrasound of the right shoulder demonstrated fluid collection about the joint, from which pus was aspirated.

Two days following the bone scan, she was referred for an orthopaedic opinion. Following review, a member of the orthopaedic team recommended exploration and drainage of the shoulder. An open operation was carried out the next morning and a large abscess was found extending about the shoulder and under the pectoralis major muscle and into the region of the acromioclavicular joint. An excision of the infected articular surfaces of the shoulder joint and the acromioclavicular joint was performed, and a closed irrigation drainage system was set up. Despite ongoing antibiotic treatment, the activity of the infection persisted, and the condition of the patient continued to deteriorate. She subsequently died 18 days after admission.



## CLINICAL LESSONS

There was a significant delay in establishing definitive surgical management mainly because the patient's shoulder was not identified as the infective focus. A quicker orthopaedic referral would probably have facilitated earlier detection and treatment of the shoulder. Gross sepsis/septicaemia in a patient with known total joint replacements and/or musculoskeletal injuries should ideally initiate more rapid orthopaedic referral. It is also possible that there may have been multiple infective foci, including the left wrist joint, and an aspiration or arthrotomy of the wrist at the time of shoulder surgery would have clarified/excluded this. Closed irrigation/drainage is not as effective as open drainage and it is strongly recommended that one or more large corrugated drains in the most dependent aspect of the shoulder abscess cavity would be more appropriate.

## Case study 2: Elderly patient at risk of airway compromise – the importance of appropriate planning and expertise

### Otolaryngology Head and Neck Surgery

#### CASE SUMMARY

A male in his late seventies presented with a locally advanced recurrence of a skin squamous cell carcinoma (SCC) on his right cheek. The patient's history included reflux, heavy alcohol use and depression. Staging showed localised disease on positron emission tomography (PET) and magnetic resonance imaging (MRI) involving the masseter muscle. Surgery was recommended with postoperative radiotherapy.

Preoperative anaesthetic review anticipated difficult intubation with trismus due to tumour invasion of the masseter/ zygoma, poor neck movement due to previous cervical spine fusion surgery and moderate obesity (96 kg). A plan was made for awake fiberoptic intubation. An eight-hour, combined ear, nose and throat (ENT) and plastic surgical procedure was performed. The procedure comprised excision of oral tumour, partial maxillectomy, excision of oral mucosa, radical parotidectomy/neck dissection, and locoregional flap and

facial nerve static reconstruction. On admission to theatre, the patient could not be ventilated adequately through a laryngeal mask airway (LMA) as the larynx could not be adequately visualised with a fibreoptic bronchoscope. Intubation was achieved by the ENT team using anterior commissure laryngoscopy to pass a bougie prior to intubation. A traumatic intubation was described. A Code Blue was called in theatre due to the patient trying to extubate himself at the end of the procedure and restraints were required. He was sent to intensive care unit (ICU), intubated, restrained and ventilated.

A planned extubation was undertaken on postoperative day two with the ENT team and ICU consultant present. Following extubation, the patient was talking and oxygen saturation (SaO<sub>2</sub>) was 100% on 4L but haemoglobin (Hb) had dropped to 8.1 g/dl. One unit of packed red cells was transfused. The patient was later reviewed by the ENT team who described a haematoma at the upper edge of the flap, and suspected alcohol withdrawal delirium. Diazepam, fentanyl and haloperidol were recommended. Nasogastric (NG) feeds were commenced as no oral intake was allowed with the flap. The patient desaturated after vomiting feed early on day three but SaO<sub>2</sub> returned to 95% on 4L following this.

On day four, the patient had another suspected aspiration episode with an acute upper-airway obstruction followed by asystole. The first to attend was the ICU registrar who started cardiopulmonary resuscitation (CPR) and IV adrenaline then attempted intubation. The registrar was unable to intubate and tried an LMA. The ICU consultant, ENT registrar and anaesthetic registrar attended, noting SaO<sub>2</sub> at 70% with LMA and poor seal. No view of the larynx could be obtained by the ICU consultant using fibreoptic laryngoscopy via the LMA, during which time SaO<sub>2</sub> dropped to 30% with ongoing asystole/CPR/adrenaline. The anterior commissure scope could not be located. Needle cricothyroidotomy was performed which returned cardiac output and SaO<sub>2</sub> to 80%. Blind intubation was achieved by the ICU consultant which maintained SaO<sub>2</sub> at 80%. Asystole lasted approximately 83 minutes before return of sinus tachycardia after which SaO<sub>2</sub> rose to 97%. The NG tube was blocked and removed after the arrest. A chest x-ray (CXR) noted normal position of the NG tube pre-arrest.

The patient remained ventilated and sedated until day five when he was assessed by the ICU consultant as having severe hypoxic brain injury. The family agreed for palliation. The patient was extubated, given

analgesia and declared deceased on day six.

## CLINICAL LESSONS

The patient most likely had aspiration pneumonia that led to the arrest. The decision to operate seems reasonable and required placement of an NG tube due to the oral defect. Postoperatively, the patient had reduced airway protection consequent to being restrained and sedated, and having impaired conscious state with alcohol withdrawal/delirium. He was also at an increased risk of aspiration due to reflux and being overweight. The diagnosis of aspiration pneumonia is noted in the ICU registrar's notes and tircarcillin/clavulanate (Timentin) was started following the initial arrest.

After extubation, the airway was not secured and was not able to be secured rapidly when compromised. Airway compromise was considered likely given the extent of resection and duration of surgery, and was anticipated by the treating team given that the patient was left intubated for 36 hours postoperatively. Following the difficulties encountered by the anaesthetist at induction, it was known that the airway could not be secured emergently by traditional methods. Expertise in re-establishing this airway in a crisis was not immediately available following extubation.

When a patient has impaired airway protection, consideration should be given to delaying NG feeds. This situation can arise when conscious state is impaired, and the patient is at risk of aspiration. Consideration should also be given to securing the airway with a tracheostomy in the postoperative period, for instance following long surgery, and head and neck surgery involving the upper aerodigestive tract. The threshold for tracheostomy placement should be lower when a patient is not able to be intubated, as in this case. If a tracheostomy is not used, the method of intubation in a crisis should be clearly documented. In this case, immediate cricothyroid puncture or intubation with a bougie through an anterior commissure scope, might be appropriate. Expertise in these techniques should be immediately available for the 48 hours following extubation.

### **Case study 3: Perineal debridement post penectomy – delayed diagnosis of sepsis, inadequate initial treatment and inappropriate surgical review**

## Urology

### CASE SUMMARY

A man in his late seventies

underwent a partial penectomy for biopsy-proven carcinoma of the penis. Nine days later, he underwent total penectomy and perineal urethrostomy. He initially seemed to be making satisfactory progress following the second procedure, but his white cell count (WCC) slowly increased, from 11.2 to 21  $\times 10^9/L$  between day three and day ten when he died. C-reactive protein (CRP) showed a similar increase. The renal function slowly deteriorated over this time, with creatinine increasing from approximately 120 to 170  $\mu\text{mol/L}$ . Blood cultures on day seven grew both *Enterococcus faecalis* and *Bacteroides fragilis*. This finding should have raised alarm bells.

The progress notes during the period of clinical deterioration were completed by either a surgical cover or a night surgical resident. There were no comments made by medical staff from the attending unit. Little comment was made regarding the appearance of the surgical wound. The patient had a catheter removed and replaced, and there was comment of cloudy urine and infection within the urine. A computed tomography (CT) scan that showed gas in the perineal wound was obtained at approximately 3:00 pm on the day the patient died. The progress notes make no comment with regard to the appearance of the wound prior to this.

It was only at 5:00 pm that a diagnosis of septic shock was made following a Medical Emergency Team (MET) call. A Code Blue was called and, as best I can tell, it was after this that the patient was taken to the operating room for wound debridement. The situation was probably already beyond salvage at this stage, however the patient survived the procedure and then went to intensive care. There he was acidotic, had dilated pupils, and only had a blood pressure (BP) because of the adrenergic support that he was given. He had a cardiac arrest and was declared dead at approximately 8:40 pm.

## CLINICAL LESSONS

There appeared to be evidence of significant sepsis which was under-diagnosed and under-treated, and this directly led to the death of the patient. In retrospect, drainage should have been more aggressive and applied earlier. Antibiotic therapy should have been more appropriate and administered earlier. The prescribed antibiotics, namely ceftriaxone and ampicillin, were probably inappropriate for the blood cultures that had been obtained. It seems from the notes that the attending surgical unit were not as 'hands on' as should have been expected. The possibility of a symbiotic infection does not seem

to have been entertained. There were investigations done regarding the chest and urine, but the actual wound seems to have been underestimated as the source of sepsis until the final CT scan.

## **Case study 4: Severe haemorrhage due to aorto-ventricular injury**

### **Cardiothoracic Surgery**

#### **CASE SUMMARY**

A woman in her seventies was admitted for elective aortic valve replacement for severe aortic stenosis. Comorbidities included chronic obstructive pulmonary disease (COPD) requiring steroids, diabetes mellitus, hypertension, non-ST-elevation myocardial infarction, and chronic kidney disease.

The patient underwent aortic valve replacement utilising a 19 mm tissue valve prosthesis. Non-pledgeted everting mattress sutures were placed for valve implantation. After releasing the cross-clamp and coming off bypass, severe bleeding was noted from the aortic root. A transoesophageal echocardiogram showed an enlarging haematoma in the aorto-ventricular (AV) groove. Initial attempts were made to control bleeding with sutures and packing, failing which cardiopulmonary bypass was reinstated. A

pericardial patch was sutured from the aorta to the roof of the left atrium and the base of the right atrial appendage. Subsequently, the aorta was reopened and the valve was explanted. A tear in the right coronary sinus of Valsalva was repaired with a pericardial patch. It was not possible to suture the prosthesis after root repair; hence the aortic root was replaced with a Freestyle valve conduit. After releasing the cross-clamp, uncontrollable haemorrhage and an enlarging haematoma in the aortic root were noted. The situation was considered irretrievable and the patient died in the operating room.

The Coroner was consulted. The patient was not referred for post-mortem as the cause was quite evident from operative findings. The cause of death was given as a death due to AV injury during aortic valve replacement.

#### **CLINICAL LESSONS**

This case was essentially an isolated aortic valve replacement. The patient presented with some technical challenges given gender, age and the long-term use of steroids. Tissues in patients with this profile tend to be frail and little margin of error exists while operating. There was a small aorta and aortic root. Surgery was planned appropriately, and the correct size of valve was implanted.

It is not uncommon to have AV disruption while excising a heavily calcified aortic valve. Generally, it is quite obvious on inspection of the annulus or while placing sutures for the aortic valve. In this case, AV disruption was probably missed or occurred after implantation of the aortic prosthesis. The treating surgeon chose non-pledgeted sutures for valve implantation. In this patient, however, sutures with pledgets might have helped to hold the disrupted (unrecognised) AV junction. Severe haemorrhage from the aortic root after aortic valve replacement is diagnostic of AV disruption or a tear in the root. Packing with gauze while off bypass most likely made the situation worse, due to pulsatile blood flow and high intraventricular pressure. Suturing a patch to stop bleeding is a futile exercise in this situation. Delay in explanting the valve (time spent initially with packing and suturing while off bypass) allowed blood to dissect into the left ventricle outflow muscle which manifested in the form of a haematoma. The decision to replace the aortic root could have been taken earlier, which may have made a difference to the outcome.

Death on the table is a very difficult situation for surgeons. Without being critical of the operator, it is noted from the operation report that the surgery was carried out by a qualified

Fellow who did not seem to have been assisted by a senior colleague (assisted by registrar/Fellow). It is unclear whether the Fellow asked for assistance or whether such a request came too late.

In conclusion, the timely help of an experienced operator could have assisted in early recognition of the problem. Early institution of bypass when the severe haemorrhage was first noted could have avoided or limited the development of the aortic root dissection and the haematoma. An earlier decision to replace the aortic root may have made a difference to the outcome.

## **Case study 5: Delayed diagnosis of Hirschsprung's disease leading to bowel necrosis in a five-month-old girl**

### **Paediatric Surgery**

#### **CASE SUMMARY**

A five-month-old girl presented to her local emergency department with abdominal distension, in extremis. She required CPR, intubation and ventilation before transfer to a tertiary centre. She had previously been investigated as a neonate for abdominal distension and constipation with a rectal suction biopsy which was interpreted as being unlikely to represent

Hirschsprung's disease. On arrival at the tertiary hospital, she continued to be resuscitated and a laparotomy was performed.

The findings of the laparotomy were consistent with Hirschsprung's disease with a sigmoid colon transition zone. Biopsies were taken, and an ileostomy formed. The following day, a second laparotomy and silo formation were performed for abdominal compartment syndrome. The bowel perfusion improved on delivery from the abdomen. The baby remained critically ill over the following days, with the visible bowel in the silo showing signs of necrosis. On day five, a further laparotomy was performed with resection of the majority of small bowel. This left 50 cm of small intestine of which only 25 cm looked healthy. Despite continued intensive management, the decision to withdraw care was made the following day because of continuing deterioration and multiorgan failure.

### **CLINICAL LESSONS**

There is no question that the medical care during the final admission was of a high standard. The main concern is related to the interpretation of the rectal biopsy undertaken in the neonatal period. There are considered to be two criteria required to exclude Hirschsprung's disease

from rectal biopsy and the initial biopsy fulfilled only one of these. As a result of the biopsy being small, it was not able to address whether the lack of ganglion cells on microscopy was significant. The pathologist's report was ambiguous, stating that the biopsy was normal but did not exclude Hirschsprung's disease. Because the baby passed faeces spontaneously over the subsequent few days while still an inpatient, the biopsy was not repeated, and the baby was discharged. No surgical follow-up was arranged. A further concern is the discharge from the referring emergency department the evening prior to admission. The notes are not available, so no comment can be made regarding whether the clinical decision at that time warrants criticism. The clinical deterioration with Hirschsprung's enterocolitis can be rapid, but if Hirschsprung's disease had been 'excluded' it would not feature in the differential diagnosis. The degree of constipation between admissions is not clear although the baby was on laxatives and on/off constipation is mentioned in the clinical notes.

A diagnosis of Hirschsprung's disease should only be excluded if ganglion cells are evident on rectal suction biopsy. In the absence of ganglion cells, but where a normal acetylcholine esterase stain is seen, the pathologist's report should

clearly state that Hirschsprung's disease cannot be excluded. Accurate communication regarding these pathology results is of critical importance. It is not clear from the neonatal admission records how, and to whom, the results were conveyed. Most importantly, it is not known whether the biopsy was described verbally as 'normal' within the surgical team and whether the details of the report were discussed. This relates to the facts of the biopsy (no ganglion cells seen) and the interpretation (normal).

When the baby was readmitted at five months of age, the assumption was made that the biopsy result and the baby's clinical progress did not warrant a repeat biopsy. It is not uncommon for babies with Hirschsprung's disease to pass faeces normally for some time following rectal instrumentation (rectal washouts & biopsy). In a baby with a textbook presentation of Hirschsprung's disease and a non-diagnostic biopsy, the investigations should have been repeated. Had this baby been followed up in a paediatric surgical clinic for ongoing problems with constipation, there is a good chance that the biopsy result would have been reviewed and the biopsy repeated.

Communication is a particular problem in neonatal units. Because the primary carers in most neonatal units are neonatologists,

the discharge counselling is not performed by surgeons. Paradoxically, a baby with a similar presentation on a paediatric surgical ward would probably not be discharged without clear instructions about what to do in the event of ongoing problems and would thus be more likely to receive paediatric surgical follow-up.

## **Case study 6: For high-risk patients, thorough surgical and anaesthetic pre- assessments are essential**

### **General Surgery**

#### **CASE SUMMARY**

An elderly woman had multiple comorbidities and a two-and-a-half-year history of slowly progressive SCC of her mid oesophagus, for which she had previously declined treatment. She was referred by her gastroenterologist for insertion of a percutaneous endoscopic gastrostomy (PEG) feeding tube by the endoscopic method at the local public hospital. A chest CT scan showed significant tumour enlargement. The patient was admitted and placed on the operating list of another unit.

It appears that the surgeon had no prior knowledge of her case until the patient was in theatre. The



considerable risks had been discussed with the patient and her family, and documented prior to this surgeon's involvement. The severity of her oesophageal symptoms were not documented but it is presumed that her dysphagia was considered a sufficient reason to justify attempted amelioration. The patient's 'not for resuscitation' (NFR) wishes were recorded. At endoscopy, the tumour was obvious and guidewire pneumatic dilation was attempted to facilitate passage of the endoscope into the stomach. Re-appraisal revealed that the oesophageal tumour had split, allowing visualisation of the mediastinum. Pneumo-mediastinum and pneumothorax ensued, followed by cardiac arrest from which the patient was resuscitated. In consultation with the patient and family, supportive treatment was continued but the patient deteriorated and died on the fourth postoperative day.

## **CLINICAL LESSONS**

The assessor had the impression that the reporting surgeon/endoscopist was ambushed by the case. There can be little criticism of the patient's in-hospital care and sympathetic attention shown to her family by all levels of staff. Oesophageal perforation was a considerable, even probable, risk and the surgical team provided the best possible care

once the complication developed. This case exemplifies a not uncommon situation encountered in the public hospital system – that of shared responsibilities. We have an admission arranged by the gastroenterologist placed on the waiting list and allocated to a surgical list. Given the opportunity to personally review this patient in advance, I suspect that the reporting surgeon might have advised against the procedure. With the patient in theatre, it is difficult to review a complex medical situation and difficult to refuse to operate and send the confused patient back to the ward. Unfortunately, the surgeon was ultimately responsible for the procedure and was understandably distressed by the outcome. A small technical issue with the endoscope was complained of, and although it did not appear to have adversely affected the patient, it may be a reflection of the care of the endoscope. The reporting surgeon made mention of oesophageal stenting which might have been an option if the distal lumen could have been visualised. This would have required the appropriate equipment and endoscopic skills.

In conclusion: gastrointestinal (GI) endoscopic surgical lists often evolve in an ad hoc manner with initial consultation in the waiting bay, exposing the surgeon to the

unexpected. Surgeons should not receive high-risk patients at the theatre door without prior familiarity with the case and appropriate anaesthetic pre-assessment having been undertaken. Ideally, difficult cases should be flagged, and management considered in a joint clinic situation demonstrating that a management plan exists for the possible adverse event.

## **Case study 7: Poor knowledge of *Pseudomonas* infections, consideration of early expert referral**

### **Plastic and Reconstructive Surgery**

#### **CASE SUMMARY**

The patient was a man in his eighties who was readmitted to a medical unit with a three-day history of pain and swelling of the left middle finger, associated with shakes and chills. He had recently been an inpatient for six weeks for treatment of lower leg cellulitis and *Pseudomonas* sepsis sensitive to meropenem. The possibility of an infected pacemaker lead had been raised.

The patient's comorbidities included rheumatoid arthritis for which he was being treated with an immunosuppressant and prednisolone. He had previously

undergone coronary artery bypass grafting and had a permanent pacemaker for complete heart block. A plastic surgery opinion was sought, and a diagnosis of an infected tendon-sheath was made, but the medical unit decided to treat the patient for a flare-up of arthritis or gout with an increased dose of prednisolone. Antibiotics were withheld as the medical unit felt they might 'cloud the diagnosis'.

Around 24 hours after admission, the blood cultures revealed *Pseudomonas* sensitive to ceftazidime, gentamycin, piperacillin/tazobactam (Tazocin), and ciprofloxacin, but not meropenem. The Plastic Surgery Unit was again consulted, and the patient consented for a tendon sheath washout, where pus was found in the tendon sheath.

The patient remained under the primary care of the medics who considered the likely source of infection to be infected pacemaker leads. The possibility of removing the pacemaker was rejected because of patient frailty and it was decided to treat him with a six-week course of intravenous gentamycin and piperacillin/tazobactam, followed by oral ciprofloxacin. The patient was returned to theatre for a further washout of his flexor tendon sheath where no pus was found. The infected tendon sheath provided no further surgical problem for the patient.

Over the next three weeks, gentamycin levels were noted to be supra-therapeutic on several occasions. The patient's renal function steadily declined. A pre-terminal diagnosis of subacute bacterial endocarditis was made, and, following a decision by the patient and his family, active treatment was ceased, two days prior to death.

### CLINICAL LESSONS

A review of the 'bigger picture' would indicate that this admission was part of an ongoing uncontrolled infection that was treated ineffectively during the patient's previous admission. The infected tendon sheath represented a metastatic infection from an uncontrolled primary source which was most likely the patient's pacemaker lead.

The possibility of removal and/or replacement of the patient's pacemaker was considered but was rejected on the basis that it would be a high-risk procedure. There was no indication in the medical record regarding the status of the person making this decision. Exchanging the permanent pacemaker may have resulted in a different outcome, affecting both the course of his infection, and the renal failure. Despite apparently being too frail for pacemaker changeover, the patient was treated

with toxic drugs. This reflects a tendency for non-procedural specialists to overestimate the risks and underestimate the value of interventional treatments and to view drug treatments as 'conservative'

The choice of antibiotic treatment also requires inspection. A decision was made to treat the patient in the medium term with a combination of IV gentamycin and piperacillin/tazobactam. Both of these antibiotics are nephrotoxic and intended only for short-term use. The patient's antibiotic treatment placed him at high risk of developing renal injury. The choice of a different combination of antibiotics might have avoided the development of renal failure. There is no indication in the medical record that the opinion of an infectious diseases specialist was sought.

*Pseudomonas* is an opportunistic organism. In the presence of a compromised immune system, it can be very difficult to treat. It is characterised by behaviours which include its ability to rapidly develop resistance to antibiotics and to secrete a biofilm. The implication of these behaviours is that once a biological implant becomes contaminated with *Pseudomonas*, the probability of eradicating the organism is extremely low. Once an infection is established, an aggressive approach is required which takes into account its

behaviour. The decision to dismiss the option of exchanging the patient's pacemaker does not seem to have taken these factors into account. There should have been greater consideration of the history that a six-week course with meropenem during his previous admission had failed to control the patient's infection. In a clinical setting in which a particular strategy has failed, it is likely that a repetition of that strategy in the ongoing clinical setting will fail again. If knowledge or a skill set is lacking, early referral should always be considered. Referral to a clinical microbiologist or infectious diseases specialist should have been considered as part of the decision-making process. There appears to have been no curiosity as to whether the pacemaker lead was indeed contaminated. Consideration should also have been given to requesting permission to remove the lead after death to examine and culture it for contamination.

## **Case study 8: Suspected allergic reaction in a patient with no known previous drug allergies**

### **Orthopaedic Surgery**

## **CASE SUMMARY**

A male patient in his mid-fifties was admitted for management of right hip pain that had been present for two weeks. It was of spontaneous onset. The pain was over the lateral aspect of the hip, buttock and anterior thigh. It was burning in nature and increased on weight bearing. There was no associated fever. The hip was irritable and had decreased range of motion. There was a possible right axillary abscess as well. The patient was started on cephalexin by his general practitioner (GP) prior to admission.

Initial CRP was 54 and a CT scan of the pelvis and right thigh was unremarkable. There was no mention of any effusion in the hip joint. The patient's hip symptoms improved, and he started mobilising. The patient was reviewed by the surgical team for the axillary lump the day following his admission. Their assessment concluded likely induration or lymph node mass, with a plan to continue with either cephalexin or flucloxacillin and to do an ultrasound if there was no improvement. Two days after admission, the patient was started on flucloxacillin as per the surgical team recommendation with an ultrasound to follow. The patient was deemed fit to be discharged from the Orthopaedic team the next morning.

Ten minutes after starting two grams

of IV flucloxacillin, the patient started having nausea and vomiting and turned red all over the body. He became sweaty, started shaking and lost consciousness but he was breathing. Code Blue was called, and the patient was transferred to ICU. Flucloxacillin was stopped and a working diagnosis of cardiac arrest secondary to penicillin anaphylaxis was made. The patient was intubated and had CPR with supportive medications. He was also noted to have multiorgan failure. He did not respond to treatment and died approximately 24 hours later in ICU.

### **CLINICAL LESSONS**

This patient died with presumed penicillin anaphylaxis. He was admitted with hip pain and a possible, but unconfirmed, axillary abscess. He had raised inflammatory markers and an effort should have been made to rule out a septic hip (although this may not have changed the outcome). Another possibility is septic shock. If penicillin anaphylaxis was the ultimate cause, then the outcome may not have been changed. It should, however, remind us that anaphylaxis can happen in patients with nil known drug allergies or who may have received the drug previously. This raises the question as to whether there should be a policy to test a small dose initially.

## **Case study 9: Management of adhesive small bowel obstruction complicated by postoperative anastomotic leak**

### **General Surgery**

#### **CASE SUMMARY**

A female patient in her early sixties was admitted with adhesive small bowel obstruction (SBO) two years following an open right hemicolectomy for cancer. The patient presented to a small district hospital with symptoms typical of an adhesive SBO. The diagnosis was confirmed on a CT scan. The patient was planned for a transfer to the nearest regional hospital with a surgical service, however, the transfer did not take place until 36 hours after her initial presentation to hospital. When the patient arrived at the regional hospital the following morning, she was not assessed by the surgical registrar until midday. The patient was then placed on the ward prior to being reviewed by the consultant the next morning, despite complaining of 10/10 pain for the past 48 hours.

Following a gastrografen small bowel study, the patient was taken to the operating room for an exploratory laparotomy and two small bowel

resections. At the time, it was noted that the more distal anastomosis was leaking and it was re-resected (including the original ileocolic anastomosis) and re-anastomosed. The patient was reviewed by ICU postoperatively and deemed fit for the ward.

Over the next few days, it was noted the patient had a low urine output and poor oxygen saturations. On day three, post-operation, the patient had three MET calls and was admitted to the ICU with septic shock. A computed tomography pulmonary angiography (CTPA) did not demonstrate a pulmonary embolism (PE) and the surgical team decided that a relook laparotomy was necessary to exclude an anastomotic leak. On return to the operating room, it was noted that the proximal anastomosis was leaking. This was resected and re-anastomosed. The patient returned to the ICU and made slow progress over the following days. On day four post the second operation, faeces were noted discharging from the wound. After discussions with the family, it was deemed that further surgery would be futile and the patient was palliated and allowed to succumb to her sepsis.

## **CLINICAL LESSONS**

The main area for consideration was the delay of approximately 52 hours

between the time that the patient presented to the district hospital and the first operation, mostly due to the delay in transfer from the district hospital. It was unclear from the notes whether this delay was due to a late request for transfer, a failure of the first hospital to impress upon the retrieval services the urgency of transfer, or if there were other factors beyond anyone's control (e.g. weather, lack of available aircraft). The delay was compounded by the receiving surgical team not progressing to surgery soon after the patient arrived at their hospital. An earlier visit to the operating theatre may have reduced the chances of finding ischaemic gut at the time of the first operation. Patients with a clear diagnosis of SBO complaining of significant pain and needing high dose narcotics should proceed to surgery as soon as possible. Given that the surgical team received the patient at midday, the patient should have proceeded to surgery that afternoon, not the following afternoon (an additional delay of 24 hours).

Another area of concern relates to the second operation at which an anastomotic leak was diagnosed. The decision to resect the leaking anastomosis and re-anastomose it was incorrect. Patients who are in septic shock, on inotropic support and hypo-albumenic should not

undergo an anastomosis. The safer option would have been to convert the leak to either a loop or end ileostomy. The second subsequent leak and septic insult would have certainly contributed to the patient's demise.

## **Case study 10: Death following left anterior cerebral artery infarction associated with coiling of a ruptured anterior communicating artery aneurysm**

### **Neurosurgery**

#### **CASE SUMMARY**

A man in his mid-fifties was found with altered consciousness by his colleagues in the workplace. He was noted to be confused, agitated and incontinent. Given a history of anaphylaxis, he was administered 300 µg with an EpiPen. His Glasgow Coma Scale (GCS) was reported to be 13 at the time; he was incontinent of faeces and urine and complaining of headache. Four people assisted him onto the paramedic stretcher as he could not stand. He was sent to a local hospital where his GCS, following a seizure, dropped to 9. He was intubated and ventilated. A CT scan performed showed Fisher grade 4 subarachnoid haemorrhage and clinically World Federation

of Neurological Societies (WFNS) grade 4. He was retrieved to a tertiary neurosurgical unit. A CT scan of the brain was performed which demonstrated hydrocephalus in addition to his Fisher grade 4 subarachnoid haemorrhage.

He was immediately taken to the angiography suite and a digital subtraction angiography (DSA) was performed which demonstrated a ruptured small necked anterior communicating aneurysm measuring 6 mm at its maximal diameter. A second unruptured 2.5 mm left-sided saccular posterior communicating artery aneurysm was also seen but not treated. He underwent balloon-assisted coiling of his anterior communicating artery aneurysm which, according to the report provided, appears to have been entirely uncomplicated. There was no evidence of parent or distal vessel occlusion at the end of the procedure, nor thrombus in the vicinity of the coils. The coils were in a good position and were not compromising the flow to the distal vessels. No antiplatelet therapy was advised given the circumstances at completion. An external ventricular drain (EVD) was inserted shortly thereafter and the patient was returned to ICU.

Neurological assessment the following day suggested impairment

of movement on the right side, raising suspicion of a neurological deficit. CT scan and CT angiogram showed evidence of left anterior cerebral artery infarction with likely occlusion of the A2 segment. Over the next three days, an infarct evolved, producing increasing mass effect and raised intracranial pressure. The patient initially obeyed commands with the left side but progressively deteriorated. After his family conveyed the wishes of the patient not to be left with any neurological deficit, the patient was palliated and died on day four postoperatively.

### CLINICAL LESSONS

This patient appears to have been treated in a very acceptable and standard fashion. His subarachnoid haemorrhage was diagnosed early and he was given appropriate emergency care. He was transferred to a tertiary centre with the facilities and expertise to deal with his pathology. His aneurysm was coiled and then an EVD was inserted to manage the hydrocephalus. He suffered a known complication of the intervention and unfortunately died from this.

The only considerations of note are:

- The use of balloon-assisted occlusion for the coiling of this aneurysm. There is some discussion in the neurovascular

forums as to the need for balloons to assist coiling of the aneurysm. I suspect that this relates to the particular anatomy of the aneurysm and the neuroradiologist is the best person to comment on this, but I am advised by our own neuro interventionists that this is a common practice. Literature suggests that balloon assistance does not necessarily increase the risk of thrombo-embolic events and the fact that no clot was in the vicinity at the end of the procedure suggests that this event was not related to the use of a balloon.

- Sometimes, a distal clot may form if the coils slightly protrude from the neck and disturb flow. Again, the neuroradiologist is the best person to comment on this but it is a well recognised complication of the procedure.
- The indications for use of antiplatelet agents. They will increase the risk of re-bleeding and therefore their use in the acute setting is not always possible. Furthermore, the indications are fairly well defined and they do not necessarily need to be used if no thrombo-embolic complication is evident at the completion of coiling.

I feel that this case was managed



appropriately and the patient died from a well-recognised but unfortunately unpredictable event of thrombo-embolism in a distal outflow vessel complicated by malignant infarction which led to severe swelling and raised intracranial pressure.

## **Case study 11: Iatrogenic rupture of a right ventricle during redo sternotomy – missed opportunities to operate earlier and with more advanced expertise**

### **Cardiothoracic Surgery**

#### **CASE SUMMARY**

This patient in her seventies had undergone cardiac surgery for critical aortic stenosis and coronary artery disease approximately three years earlier, with two bypass grafts and a 19 mm aortic bioprosthetic valve implanted. The implanted valve functioned but with very little change in the calculated aortic valve area. The patient was subsequently referred to the same treating surgeon a few years later with progressive shortness of breath, but the treating surgeon did not believe the reported gradients.

A few months later, the patient was re-referred for a second time

after becoming even more short of breath despite increasing diuretics. It was reported that there was also severe aortic regurgitation. An electrocardiogram (ECG) revealed a calculated aortic valve area of 0.6 cm<sup>2</sup>, which had been 0.75 cm<sup>2</sup> prior to the first operation.

The pulmonary artery pressure was 63 mmHg. The patient was admitted for redo aortic valve replacement, but the surgery was further delayed because of an asymptomatic urinary tract infection with normal inflammatory markers, acute kidney injury due to hypovolaemia from diuretics, endoscopy for investigation of nausea, mild anaemia found to be due to an incarcerated hiatus hernia and haemorrhoids, and investigation of benign cervical lymphadenopathy.

She also underwent coronary angiography and aortography confirming severe aortic regurgitation. This was done via the right common femoral artery. The cardiologist mentioned that there had previously been a large groin haematoma. Use of a percutaneous closure device was not mentioned. Surgery was finally booked for three days later, with the patient having been in hospital for more than a fortnight. Anaesthesia was commenced without incident but, after dividing the sternum partially with an oscillating saw, a large venous haemorrhage occurred that

was scavenged and returned via peripheral IV line. The surgeon then unsuccessfully attempted repeated cannulation of the right common femoral artery. The patient became progressively hypotensive and died.

## CLINICAL LESSONS

The patient would have benefited from a much earlier operation to provide relief from the critical patient-prosthesis mismatch and subsequent structural valve deterioration from shear stress. Waiting until the valve leaflets had torn was not ideal. Any tissue valve would have quickly deteriorated but the chosen brand was particularly sensitive. Most important, however, was the lack of situational awareness as to how profoundly unwell the patient was. The endoscopy was performed with only sedation, there was a finding of deranged creatinine which was due to hypovolaemia, there was felt to be only stable aortic stenosis and regurgitation, and there was a complete lack of intensive care input.

Regarding the haemorrhage, the adherent right ventricle was either torn by traction injury due to separation of the sternal halves, or the actual edge of the oscillating saw blade cut the ventricle. This complication, although rare, is particularly fatal. Literature reports an incidence of 2% in redos, with a mortality of more than 30% once

it occurs. These results, however, are not contemporaneous, as the general trend is for aggressive use of peripheral cardiopulmonary bypass to allow such hearts to decompress. This is generally achieved by cannulation of the common femoral vessels, which proved impossible when done emergently in this case.

The angiography report was a missed warning. Although a thoracic CT scan was performed and used as evidence for a standard redo sternotomy, this was an educated guess. The patient had several factors that mandated full peripheral cardiopulmonary bypass before sternotomy, including severe pulmonary artery hypertension and the intrinsic lack of reserve to cope with any degree of haemodynamic derangement - due to critical aortic stenosis and severe aortic regurgitation.

In summary, the case suffered from a lack of situational awareness and heuristics, and other cognitive errors amongst the physicians involved. When calculating the operative risk from EuroSCORE II, a figure of nearly 50% was estimated and one could thus argue for the case to have been done at a major teaching hospital utilising a team with extensive advanced cardiothoracic expertise.

## **Case study 12: Decision to operate on an elderly patient with infected hip hemiarthroplasty and significant comorbidities**

### **Orthopaedic Surgery**

#### **CASE SUMMARY**

This man in his late eighties was reviewed in the Orthopaedic Outpatient Department (OPD) of a major metropolitan teaching hospital following a two-week history of increasing pain and stiffness in his left hip associated with purulent sinus discharge from a surgical scar three years after hemiarthroplasty surgery. He had remained systemically well and was able to walk using one stick.

He was offered early staged revision surgery to remove the infected hip implant, debride the wound and insert an antibiotic impregnated cement spacer in the hip joint (first stage revision). The patient was classified, in the pre-admission clinic, as an 'intermediate risk'. His history included a cerebrovascular accident (CVA) two years earlier and documented mild dementia. He underwent a pre-anaesthetic assessment and was deemed suitable for surgery which was carried out by an orthopaedic consultant, in the presence of a

consultant anaesthetist, a week after the OPD assessment.

The operation took more than five hours and, even if not detailed in the operating note, a separate entry in his case notes suggested that it was associated with a fracture of the femoral shaft which required multiple cerclage wiring. The patient was documented as stable after surgery and began mobilisation in the ward under the supervision of a physiotherapist on the first postoperative day. He developed hypotension almost immediately afterwards and, due to a further drop in his BP, a MET call was initiated within 30 minutes. After undergoing an ECG, he was diagnosed as having suffered from a myocardial infarction (MI). Over the ensuing hour or so, he was assessed by the ICU consultant on duty but deemed unsuitable for ICU admission due to his age and comorbidities. He died a few hours later with his wife and family aware and supportive of the ICU consultant's assessment. The Coroner's report confirmed that his death had been due to an MI.

The consultant orthopaedic surgeon involved suggested that the decision to operate may have been an 'Area of Consideration' as "the patient was not significantly unwell systemically and given his age and comorbidities". He concluded, however, that the event may not have

been preventable.

## CLINICAL LESSONS

The decision to operate is an 'Area of Consideration' for a man in his late eighties with a history of stroke two years earlier and with documented evidence of dementia. The patient was three years post his original hip operation and, even with a discharging sinus from the scar, he was not yet systemically unwell and was still able to walk independently with one stick. During his pre-admission consultation, his planned surgery was deemed to be of 'intermediate difficulty' but, according to the available records, the operation took at least five hours to complete. A second 'Area of Consideration', therefore, may be the advice given to the patient and his family on the nature of the planned operation and the level of expertise of the surgeon involved. This may have underestimated the complexity of revising a cemented femoral stem three years post-surgery, despite the likelihood of a deep infection. The operation was associated with a femoral shaft fracture requiring multiple cerclage wiring and this would have contributed to the substantial duration of the operation.

## Case study 13: Decision to reverse a Hartmann's procedure in an elderly patient with parastomal hernia

### General Surgery

#### CASE SUMMARY

This patient in his early eighties had undergone a Hartmann's procedure for sigmoid colonic perforation two years previously. A large, incarcerated parastomal hernia containing small bowel, with small bowel thickening causing intermittent SBO, subsequently developed. The patient was treated with NG tube decompression and had colonoscopic evaluation of the proximal colon and the rectosigmoid stump prior to surgery.

The patient underwent laparoscopic reversal of the Hartmann's procedure, low anterior resection, lysis of adhesion and formation of loop transverse colostomy. The procedure took approximately five hours. Postoperatively, the patient had appropriate ICU admission and required ongoing inotropic support. The inotropic support was felt to be necessary due to systemic inflammatory response syndrome secondary to the prolonged surgery. The patient continued to deteriorate and became peritonitic

and was brought back to theatre on postoperative day two. On laparotomy, an enterotomy and contamination from leaked enteric content was found. A washout and repair of the enterotomy was then performed. The patient continued to deteriorate and died the following day (postoperative day three).

## CLINICAL LESSONS

The decision to operate on this patient was appropriate, based on a large incarcerated parastomal hernia containing compromised small bowel causing SBO. This patient did not seem to have significant comorbidities that would suggest he was a poor surgical candidate.

The procedure which was performed, however - a laparoscopic reversal of the Hartmann's procedure, low anterior resection, lysis of adhesion and formation of loop transverse colostomy - contributed to the poor outcome of the patient and was an inappropriate surgical decision. This was an elderly patient with preoperative hypoalbuminaemia at 29 g/l and a recent history of SBO, who then underwent prolonged surgery due to significant adhesions within the abdomen and pelvis.

The treating surgeon explained that the purpose of performing the procedure laparoscopically was to avoid midline laparotomy due to

the patient's history of respiratory problems. On the chart, it was documented that the patient had a history of asthma but that this was not associated with hospital admission or steroid requirement over the past 40 years. Despite the treating surgeon's concern for the 'history of respiratory problems', there was no preoperative respiratory consult to further assess and optimise this patient prior to surgery.

The laparoscopic surgery took five hours, and prolonged surgery is associated with an increase in the likelihood of complications. Studies have demonstrated a 14% increase in the likelihood of complications for every 30 minutes of additional operating time <sup>(1, 2)</sup>. This likely reflects intraoperative difficulties and, in this case, it was due to significant adhesions.

The patient had a delayed diagnosis of inadvertent enterotomy causing severe sepsis and death. The diagnosis of inadvertent enterotomy in this patient is difficult, but it caused death and would probably have been prevented had the patient not undergone significant adhesiolysis.

Laparoscopic reversal of the Hartmann's procedure and anterior resection with anastomosis was a borderline decision, especially in the setting of preoperative

hypoalbuminaemia at 29 g/l. Preoperative hypoalbuminaemia is a well-known risk for anastomotic leak. Intraoperative findings of significant adhesions and performing anastomosis at low rectum should have led to the consideration of changing the surgical approach to a re-siting of the colostomy. Hence, the procedure that was performed caused an adverse event that caused the death of this patient who would otherwise be expected to survive. It would probably have been prevented if the patient had a re-siting of the stoma instead of the complicated surgery that was performed.

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## Case study 14: Unexpected death following elective coronary artery bypass graft: theatre or catheterisation laboratory for early arrest?

### Cardiothoracic Surgery

#### CASE SUMMARY

A patient in her seventies, with grade 22 arteriopathy symptoms and a positive exercise stress test, was referred for elective coronary artery bypass grafts and reviewed as an outpatient by the treating surgeon. A comprehensive assessment was recorded. From the angiogram, the left anterior descending artery (LAD) was identified as the best vessel. The circumflex was not judged large enough to graft and the right-sided vessels were thought to be questionable targets. Left main stenosis was noted. Surgery was recommended and an operative mortality risk of 3-4% quoted. The patient elected to proceed. There was no record of discussion of any non-surgical treatment options.

Surgery was performed five weeks after the assessment. The cardiothoracic surgical trainee was listed as the operator, with the treating surgeon assisting. The left internal mammary artery (LIMA) was prepared as a skeletonised pedicle

graft, divided distally and wrapped in papaverine soaked gauze. It was noted to have good flow on division and was 2 mm in diameter.

Cardiopulmonary bypass was used with systemic cooling to 34°C. The right and circumflex vessels were judged non-graftable, and the LIMA placed end-to-side on the LAD. The size and quality of the target vessels was not stated. Separation from bypass was uneventful and the post bypass transoesophageal ECG showed preserved left ventricular function. Cardiopulmonary bypass time was 52 minutes, with a 27 minute cross-clamp time. Noradrenaline (NA) infusion of initially 5 ml/hr rose to 8 ml/hr before transfer to the ICU at 12:30 pm.

The patient's initial course in ICU was uneventful, with subcostal drainage of 100 ml in the first hour, rising to 250 ml then 350 ml in the subsequent hours. At 2:30 pm, the patient had deteriorated, with NA increasing to 14 ml/hr, and lactate on blood gas to 2.9 mmol/L. The patient was administered 500 ml of 4% albumin in two boluses, as a large arterial swing was noted. Central venous pressure was recorded as falling from 17 to 12 mmHg. Cardiac arrest ensued, and CPR was administered for two minutes, with 1 mg adrenalin and another 500 ml albumin given. The decision was taken to transfer the patient to the

catheterisation laboratory where LAD spasm was seen. An anaesthetic record is present, but no procedure described, either in the file or on Cardiobase. An intraaortic balloon pump was inserted. On return to ICU at 6:15 pm, the patient was reasonably stable with NA at 8 ml/hr, but cardiac index was recorded at 1.27 L/min/m<sup>2</sup>. Hb was 90 g/dl despite two units of blood. A vascath was inserted for deteriorating acidosis. At 9:45 pm, an emergency sternotomy was performed in ICU for intractable ventricular fibrillation. Intracardiac adrenalin x3 and direct-current shocks were administered. A brief handwritten note described this event. A decision against extracorporeal membrane oxygenation was recorded. The chest was left open. Lactate rose to 16 mmol/L and cardiac index was 1.7 L/min/m<sup>2</sup>, despite high dose inotropes (40 NA, 30 adrenalin and 6 vasopressin).

The patient made minimal progress over the next four days and the sternum remained open. Gut ischaemia was thought to be possible. The patient died on the fourth postoperative day.

## CLINICAL LESSONS

Having reviewed both the preoperative and postoperative angiograms, the decision to operate was appropriate in the presence of

a significant and symptomatic left main stenosis. My calculation of the patient's EuroSCORE II is 1.8%. It is a little surprising that the right vessels were judged ungraftable, but certainly there was no target in the circumflex territory. In view of this, the allocation of the case to the trainee was inappropriate. The patient exhibited high and increasing drainage in the first three hours, associated with deteriorating haemodynamics. The observed spasm seen on catheterisation may be a secondary, rather than primary, event. As such, if the patient had returned to theatre, there was the potential to identify a surgical source for the ongoing haemorrhage and place a supporting venous graft off pump to the distal LAD.

## **Case study 15: Endovascular failure highlighting the importance of postoperative monitoring**

### **Vascular Surgery**

#### **CASE SUMMARY**

A female patient in her early eighties was admitted for management of critical limb ischaemia affecting the left leg/foot following minor trauma. Approximately two weeks before admission, she had fallen and sustained some superficial skin lacerations that had failed to

heal and become very painful. The patient had mild cognitive defect and had recently been admitted to a low-care geriatric facility. She had a background of hypertension, obstructive airways disease, and continued to smoke five cigarettes per day. There was no history of diabetes, renal impairment or ischaemic heart disease. She was a small, underweight woman.

Angiography revealed occlusion of the left common iliac/external iliac and superficial femoral arteries. There was non-occlusive disease in the right common iliac, external iliac and superficial femoral arteries. An initial plan to perform aortoiliac bypass was modified to an endovascular approach.

On day one, an attempt was made to reopen the occluded left common and external iliac arteries by endovascular means, which failed. On day two, the patient was taken to theatre in the mid-afternoon and underwent a five-hour procedure consisting of right common iliac angioplasty/stent, right to left femoral crossover and left femoral to infrageniculate bypass with reversed vein. There is a comment that there was 700 ml blood loss. The patient was returned to ICU with hypothermia and hypotension despite metaraminol infusion.



There appears to have been some delay in getting a fluid balance chart on return to ICU, with Hb on oximetry being 62 g/dl at 1:00 am, and formal Hb at 2:25 am being 81 g/dl after two units of blood (preoperative Hb 122 g/dl). The patient was returned to theatre on day three to address ischaemia in the right leg. She was hypotensive and had an Hb of 80 g/dl at the time. During the procedure, it became evident that the patient was bleeding from the left leg due to a tie coming adrift from the vein bypass. Postoperatively, the patient suffered multiorgan failure, required haemodialysis, and never recovered consciousness. Life support was withdrawn ten days post operation.

## CLINICAL LESSONS

It is reasonable to comment that there was a delay in obtaining a postoperative Hb, and there appears to have been inadequate response to the Hb measure of 62 g/dl during the immediate postoperative period. In the context of hypotension and low Hb immediately after a vascular procedure, prompt and thorough exclusion of bleeding is essential. It is unlikely that acute ischaemia of the right leg would be the cause of the patient's poor condition this close to surgery, and more attention to other causes, particularly bleeding, might have altered the outcome.

The absence of information in

the case notes concerning the appearance of the left leg, the recorded drainage, detailed records of the BP and drugs administered hindered understanding of this case. Clinical notes made by both ICU and the vascular surgical teams would have been helpful in understanding why bleeding was not considered in the first instance, and why initial surgical efforts were aimed at revascularising the right leg.

## Case study 16: The importance of optimal preoperative care in managing the well- recognised complications of small bowel obstruction

### General Surgery

#### CASE SUMMARY

This female in her late eighties from a low-level care nursing home was brought to hospital by ambulance with a two day history of abdominal pain, bilious/feculent vomiting, obstipation and a hard, tender periumbilical hernia. She was morbidly obese with a history of gout, hypertension, hypercholesterolemia and asthma, for which she was taking an angiotensin II receptor antagonist, a loop diuretic, cholesterol reducing agent and multiple inhaled asthma preventatives. She had no Advance

Care Directive. Premorbidly, she mobilised with a walker and required some assistance with showering.

The emergency department doctor correctly diagnosed an obstructed/incarcerated umbilical hernia and instituted an NG tube and urinary catheter, and charted 1 L of crystalloid over two hours, which was given. Her lactate level was 2.9 mmol/L, creatinine 148 mg/dl, with estimated glomerular filtration rate (eGFR) reduced at 20 ml/min, WCC 17.7 10<sup>9</sup>/L and Hb 148 g/dl consistent with ischaemia and dehydration, with other bloods normal. Her vital signs were normal, but a BP of 120/60 mmHg may have been hypotensive for her.

She was seen and admitted by the surgical team who arranged urgent theatre. The management plan documents 'no bowel movement (NBM), IV fluid, and analgesia' and requests a fluid balance chart. However, IV fluids were not ordered, and there was no specific documentation of requested output intervals. Nursing staff in the emergency department did not commence a fluid balance chart. A consent form was charted, but an acute resuscitation plan (ARP) was not. Nor was there any documentation or plan to take this patient to ICU postoperatively.

Time to theatre and choice of

surgery were appropriate and anaesthesia and surgery were uneventful with a laparotomy, reduction of hernia, small bowel resection with stapled side to side anastomosis and primary closure. In recovery, she was documented to have hypotension and oliguria for which she was admitted to ICU postoperatively for fluid management. There was an initial temporary response to moderately aggressive fluid resuscitation with BP improvement, but oliguria continued. An acute kidney injury of pre-renal cause was presumed, with metabolic acidosis, creatinine 193 mg/dl, eGFR 20 ml/min, and a normal renal ultrasound.

Despite escalating supportive management, insertion of radial/central lines, and inotrope infusion, she remained hypotensive with evidence of fluid overload and atrial fibrillation. She was considered a poor candidate for dialysis. A family meeting was held which ratified the ICU plan for active supportive management without escalating invasive therapy. On day three post operation, she developed global peritonism consistent with either anastomotic leak or further ischaemic bowel. Further surgery was considered and discussed. However, both the patient and family appropriately declined. With no physiological reserve, she

was unlikely to survive a second procedure. Comfort measures were instituted, and she died later that day.

## CLINICAL LESSONS

This case highlights the importance of preoperative care in managing the well-recognised complications of dehydration and acute renal failure in small bowel obstruction. A period of five hours between surgical admission and theatre elapsed, where the patient was still in the emergency department and did not receive any fluid resuscitation, nor was there any documentation of NG losses or urine output. The surgical team should have charted replacement fluid therapy for the anticipated preoperative period. Nursing staff should have commenced a fluid balance chart on insertion of NG catheter and urinary catheter and flagged increased fluid loss or reduced urinary output to medical staff. Adequate fluid resuscitation did not genuinely commence until the patient arrived in theatre. This almost certainly contributed to her postoperative renal failure and subsequent death.

Furthermore, there was limited documentation of the consent process or whether risk of death was discussed with the patient, who would have died without surgery, but had significant risk of complications

and death with surgery. This would have been the ideal time to discuss an ARP documenting the patient's preferences for return to theatre, CPR, defibrillation and other invasive interventions (including dialysis), particularly in the event of anticipated postoperative complications.

Given the patient's comorbidities and obvious dehydration on presentation, it would have been appropriate to flag this patient as high risk for postoperative complications and plan for postoperative high dependency unit (HDU) / ICU care. Overall, there appears to be a significant lack of communication between the emergency department, surgical and nursing staff in the preoperative period, which has contributed to the inadequate preoperative management of this patient.

The decision to operate was appropriate given her pre-morbid levels of function, and the decision not to return to theatre was also appropriate given her significantly deteriorated physiological reserve.

## Case study 17: Postoperative bleeding in the cardiac patient

### Cardiothoracic Surgery

#### CASE SUMMARY

This female patient in her late seventies was admitted with acute coronary syndrome. The patient was in acute pulmonary oedema and was taken for coronary angiogram. She was found to have triple vessel disease and an ECG showed an ejection fraction of 20% with preserved right ventricular function. The decision of the cardiologist and cardiothoracic surgeon was for medical stabilisation in this high-risk setting.

On the evening of day two, she became hypotensive which was attributed to cardiogenic shock which was stabilised with IV fluids. The plan the next day was for consideration of balloon pump and levosimendan. The surgical impression was that the patient would not survive emergency bypass and that stenting would be preferable. This also depended on whether there was viable muscle to revascularise.

On the afternoon of day three, a decision was finally made to proceed with emergency bypass surgery. The patient was taken to

the catheterisation laboratory in the afternoon, had a balloon pump inserted and then underwent multi-vessel coronary artery bypass surgery. The patient required six units of blood intraoperatively and it is noted that she was on Plavix. She arrived in the ICU very late in the evening of day three. Over the next five hours, her Hb dropped to 77 g/dl from 127 g/dl. The patient deteriorated rapidly over the next couple of hours and was severely acidotic and her Hb dropped to 35 g/dl. The surgeons were contacted at some time near the peri-arrest stage and re-open was performed in the ICU. Bleeding was found from the left atrial appendage but by this stage the patient was deceased.

#### CLINICAL LESSONS

The first-line assessor stated that the bleeding was not detected and acted on appropriately by the ICU team, there was no communication or late communication with the surgical team, and the preoperative management needed to be reviewed. The assessor also questioned why the patient was not in an intensive care setting preoperatively or on inotropic support.

With respect to the postoperative course, the patient arrived late at night in an emergency situation. This is always a difficult time for management, and bleeding then

occurred in this critically ill patient, which was not picked up until late. It is likely that the chances of survival, even if everything went perfectly, were not great. However, the fact that the bleeding was not detected until the arrest stage certainly led to an early death. Complex patients are best dealt with during daytime hours when the hospital is fully staffed, however this is not always possible in the emergency setting late at night.

In terms of preoperative management, this patient was clearly extremely high-risk for surgery and coronary stenting would have been preferable (if technically possible). A trial of waiting during the first week and medical optimisation is always better in this setting. One could argue that the cardiologist should have listened to the surgical advice to wait. I am not sure whether being on inotropes early would have really helped the situation.

# Shortened forms

ARP	acute resuscitation plan	IV	intravenous
AV	aorto-ventricular	LAD	left anterior descending artery
BP	blood pressure	LIMA	left internal mammary artery
COPD	chronic obstructive pulmonary disease	LMA	laryngeal mask airway
CRP	C-reactive Protein	MET	Medical Emergency Team
CPR	cardiopulmonary resuscitation	MI	myocardial infarction
CT	computed tomography	MRI	magnetic resonance imaging
CTPA	computed tomography pulmonary angiography	NA	noradrenaline
CVA	cerebrovascular accident	NBM	no bowel movement
CXR	chest x-ray	NFR	not for resuscitation
DSA	digital subtraction angiography	NG	nasogastric
ECG	electrocardiogram	OPD	Outpatient Department
eGFR	estimated glomerular filtration rate	PE	pulmonary embolism
ENT	ear, nose and throat	PEG	percutaneous endoscopic gastrostomy
EVD	external ventricular drain	PET	positron emission tomography
GI	gastrointestinal	SaO <sub>2</sub>	oxygen saturation
GCS	Glasgow Coma Scale	SCC	squamous cell carcinoma
GP	general practitioner	SBO	small bowel obstruction
Hb	haemoglobin	WCC	white cell count
HDU	high dependency unit	WFNS	World Federation of Neurosurgical Societies
ICU	intensive care unit		

# Contact details

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# Notes

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