



PRIVATE & CONFIDENTIAL



Case Note Review Booklet

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DISCLAIMER: This booklet is produced for Fellows of the Royal Australasian College of Surgeons. Information is obtained under a quality assurance activity.

Case study 1: Preoperative assessment prior to joint replacement surgery I – sudden death day one following elective hip replacement

Case summary

A very elderly patient was referred for assessment with right hip osteoarthritis. The patient was initially seen 1 month prior to surgery. The general practitioner's records revealed an extensive past history of peripheral vascular disease, knee replacement (over 10 years ago), benign positional vertigo, cataracts, thyroid disorder, interstitial nephritis, sensory neural hearing loss and depression.

An uneventful uncemented hip arthroplasty was performed. The preoperative investigations were limited to full blood examination, urea and electrolytes, liver function tests (LFTs), calcium metabolism, C-reactive protein (CRP) test, urine analysis, coagulation studies and blood group status. Thyroid status was not assayed.

The hospital records showed a spike in temperature 12 hours postoperatively that was treated with a fan. The only aberrant investigation noted was that of a mildly elevated CRP. The hospital records indicated a satisfactory postoperative review at 09:00, but the patient suffered a cardiac arrest 90 minutes later. Resuscitation was unsuccessful. The patient's surgeon could not be contacted.

Comment

Any patient undergoing an elective procedure should receive adequate preoperative workup. Although this patient was seen by the surgeon 1 month prior to surgery, preoperative blood investigations were obtained 2 days prior to surgery. A very elderly patient undergoing an elective hip replacement generally requires more than one consultation. Although the patient was taking thyroid supplements, no thyroid function studies were performed.

WAASM comments

The WAASM obtained the coroner's report. It showed extensive multifocal coronary atherosclerosis with a stent that had been in place for some 8 years. There was no evidence of a recent thrombosis, myocardial event and no pulmonary embolus (PE). There was fluid in the lungs in keeping with cardiac failure.

Case study 2: Preoperative assessment prior to joint replacement surgery II – poor selection for elective total knee replacement

Case summary

An elderly patient was admitted under the care of an orthopaedic surgeon for an elective total knee replacement (TKR). The patient had undergone a knee arthroscopy 1 year previously by a different orthopaedic surgeon, with findings of grade 3 chondral wear in the lateral compartment and grade 2 in the medial compartment.

After review, the patient was booked for the TKR by the treating surgeon. At that consultation, it was noted that the patient had poor mobility, with calf pain necessitating rest after a short walking distance. There was a good range of movement in that knee. The patient had significant comorbidities including ischaemic heart disease with angina, previous coronary artery bypass graft, diabetes mellitus type II, peripheral vascular disease, obsessive compulsive personality disorder, transurethral resection of the prostate, and lumbar spine laminectomy. The patient was independent with washing and dressing, was mobile with a walking frame and used a wheelchair outside of home.

The anaesthetic assessment was American Society of Anesthesiologists grade 4 - a patient with an incapacitating systemic disease that is a constant threat to life.

The operation was performed under spinal anaesthetic and the tourniquet time was only 30 minutes. The end time for the surgery was not recorded. The patient spent 1.5 hours in the recovery room with stable observation.

On the first postoperative day, the patient developed fever and desaturated to 77 per cent on 15 L oxygen, and was transferred to the intensive care unit (ICU). On the third postoperative day, the patient developed acute pulmonary oedema with septicaemia and a new atrial fibrillation (AF) with suspected aspirational pneumonia. Antibiotic treatment was commenced and a septic screen was performed. On the fourth postoperative day a bronchoscopy was performed. However, despite full ICU support, the patient died 11 days after surgery.

Comment

This is an example of poor patient selection for elective joint replacement surgery. The patient's assessment particularly that relating to the patient's leg pain and comorbidities were lacking.

With a history of laminectomy, diabetes and calf pain, consideration should have been given to other causes of leg pain, not just osteoarthritis. There was no record of this patient's lower leg neurovascular findings.

A knee arthroscopy in an elderly, fragile patient is an unnecessary surgical procedure. Furthermore, the arthroscopic findings were not indicative of the need for a TKR.

From the social history it appears that this patient had very limited walking ability, requiring a walking frame at home and wheelchair outside the home. It is unlikely that even a successful TKR would have improved this patient's activities of daily living.

Once the early postoperative complications started it would have been very difficult to overcome them, even with the highest level of expertise from the ICU team. It was not clear from the medical notes as to whether fluid overload, aspiration pneumonia or ischaemic stroke was the main cause of the sudden hypoxia and rapid deterioration of the patient.

WAASM comments

The Australian Commission for Safety and Quality in Health Care has published Clinical Care Standards guidelines. One of these relates to Osteoarthritis of the Knee. These guidelines are relevant to the management of this case.

Case study 3: Preoperative assessment prior to joint replacement surgery III – anticoagulation management leads to retroperitoneal haemorrhage following elective hip surgery

Case summary

An elderly patient living at home with mild dementia was initially admitted 6 months prior to death with a massive radiologically proven PE that caused right heart strain. The patient was initially stabilised with therapeutic heparin, later enoxaparin and subsequently with apixaban. An inferior vena cava filter was inserted prior to discharge home. There were subsequent admissions for falls and hip pain.

The final admission was due to a fall at home resulting in a subcapital fracture of the left neck of femur. Surgery was delayed 2 days on the advice of the haematologist, to allow clearance of apixaban. Dementia was documented on admission. Surgery to replace the hip then proceeded without complication.

Postoperative therapeutic Clexane was instituted on haematologist's advice at a dose of 75 mg twice a day. This was continued postoperatively for 6 days. Increasing confusion, hypoxaemia and bowel disturbance ensued. This was associated with steadily dropping haemoglobin (Hb), from an initial postoperative level of 12.5 g/dL to a level of 6.9 g/dL. Although right iliac fossa tenderness was noted, it was ascribed to constipation. Five days postoperatively, a computed tomography (CT) abdomen demonstrated a massive retroperitoneal and psoas muscle haematoma. Clexane was ceased but a coagulopathic state developed despite the transfusion of 6 units of blood. The patient became increasingly confused and agitated and a cardiorespiratory collapse led to death 10 days after surgery.

Comment

The orthopaedic and surgical management of this patient was entirely appropriate. The decision to delay the surgery to allow the apixaban to be purged from the body to reduce bleeding risks was also appropriate. In view of the previous massive PE, the decision to undertake therapeutic anticoagulation was mandatory.

However, the choice of Clexane warrants discussion. Clexane is notoriously difficult to reverse and a safer choice would have been heparin (easily reversed), which could later have been changed to warfarin or apixaban. The dosage of 75 mg Clexane given twice a day may have been excessive for an elderly patient. This led to the unfortunate development of a massive bleed into the psoas and the retroperitoneum, which was only detected when massive blood loss had occurred and progressive deterioration became inexorable.

Case study 4: Biliary disease I – waiting for a deteriorating patient to get better does not work

Case summary

An elderly patient presented in septic shock. Ultrasound showed gas in the gall bladder wall and a stone impacted at the ampulla of Vater. An endoscopic retrograde cholangiopancreatography (ERCP) was performed 12 hours after the initial presentation to hospital.

The patient was provided with above optimal medical management and ICU resuscitation.

The patient improved somewhat after the ERCP but radiology refused to perform a cholecystostomy and the surgical team chose to wait for the patient to improve and stabilise prior to intervention. As such, the patient was left with no real therapy for a gangrenous gall bladder and subsequently deteriorated catastrophically. The CT scan then showed an ischaemic colon (from sepsis). The patient needed inotropes, required multiple laparotomies and subsequently developed peripheral gangrene. The patient continued to deteriorate and died 22 days after admission.

Comment

Gas in the gall bladder wall is diagnostic of gangrenous cholecystitis and a cholecystostomy is not an adequate treatment for this. Furthermore, if radiology refused to perform the procedure, leaving the surgical team with no definitive treatment, it is always going to end badly. Waiting for a deteriorating patient to get better when the primary cause of the deterioration has not been corrected defies logic.

Case study 5: Biliary disease II – major complication during cholecystectomy

Case summary

A very elderly patient was admitted with a 3-day history of acute cholecystitis and obstructive jaundice. It was poorly documented in the clinical notes as to whether the patient was clinically improving. The initial surgical diagnosis and management plan were also poorly documented.

On admission, the LFTs showed an obstructive pattern. The ultrasound of abdomen, despite the limitations, suggested that there was echogenic biliary sludge within the gallbladder and extending into the common bile duct (CBD), without associated intrahepatic or extrahepatic biliary dilatation.

It was not clear from the documentation if a gastroenterology/hepatobiliary surgeon was involved in discussion of ERCP as an initial management option.

The nursing notes showed that the patient had no pain for 2 days prior to surgery. The patient was haemodynamically stable and had been on intravenous (IV) ceftriaxone and metronidazole since admission. The white cell count (WCC) was normal but the patient had raised CRP.

After waiting for improvement in the LFTs, a decision was made for cholecystectomy. The operative note did not indicate that a trainee started the surgical procedure. However, on the surgical case form the consultant surgeon seemed to indicate that the case was started by a more junior person, and that the consultant surgeon was involved after the complication occurred. From the operative note description, it appears that this was a difficult laparoscopic case from the outset, and that the significant complication occurred before the conversion from a laparoscopic to an open case. A hepatobiliary surgeon was called to repair a major arterial injury and cholecystectomy was completed open. An intraoperative ultrasound scan showed the presence of a CBD stone.

The patient went to the ICU postoperatively but failed to recover from worsening sepsis. Care was withdrawn.

Comment

After waiting for improvement in the LFTs, a decision was made for cholecystectomy. The challenges involved with performing a laparoscopic cholecystectomy after 7 days of acute cholecystitis should have been considered.

Early involvement of an experienced surgeon and consideration of early conversion from laparoscopic to an open case would have reduced the risk of this complication.

With the presence of CBD obstruction and jaundice on admission, consideration should have been given for ERCP prior to cholecystectomy. Such discussion may have occurred, but it was not documented in the notes.

Poor documentation made it difficult to understand some parts of the care provided to this patient.

Case study 6: Biliary disease III – patient presenting with sepsis, signs of biliary obstruction and intra-abdominal fluid collections

Case summary

An elderly patient underwent a right hemicolectomy. The histopathology result was a Dukes' C cancer with extensive lymph node involvement. The patient was discharged but re-presented with jaundice, nausea and vomiting a month later. Ultrasound scans performed that day and CT abdomen performed 2 days later showed multiple fluid collections and dilated bile ducts. Blood tests showed increasing WCC, CRP and bilirubin. The impression was ascending cholangitis and on the third day the patient was transferred to a private hospital with an ERCP service. The ERCP was performed the next day (4 days after admission to the first hospital). At ERCP there was a distal CBD stricture, most likely malignant, and a stent was placed.

The patient was managed, intubated and sedated in the ICU following the ERCP. The Hb dropped to 7.6 g/dL. Three days later a laparotomy was performed for apparent developing sepsis. Haematomas were found in the right upper quadrant and the right iliac fossa, which were drained. The operation report also documented a "cocoon" in the right mid zone that was not explored. The abdomen was closed and no drains inserted. Later, the ICU notes recorded a lot of haemoserous fluid from the wound suggesting a possible wound dehiscence. There was progressive deterioration, a ceiling of care was set and the patient died 3 days after the laparotomy.

Comment

There were no major adverse events in the management of this patient. Given the patient's obstructive LFTs and dilated bile duct, it was assumed that the sepsis was secondary to cholangitis. However, 1 week prior to the ERCP, the CRP was 180 mg/L and at that time bilirubin was only 39 mmol/L. The CT scan 2 days prior to the ERCP showed multiple fluid collections. It is possible that this was the strong driver of the sepsis. Further, there was no pus seen at ERCP after bile flow had been restored through the stent. The expectation would also have been for some improvement following the ERCP had cholangitis been the cause of the patient's sepsis.

Even though, in hindsight, it is difficult to prove that the patient had cholangitis, an ERCP was still the right thing to do given the imaging findings and obstructive LFTs. The patient also failed to improve following the laparotomy, and it could be argued that drains should have been left in situ following the exploration of a septic abdomen with multiple fluid collections. It was completely reasonable to set a ceiling of care in the ICU management once it became clear that there was no improvement.

Another contributing factor to the ultimate outcome was the patient's advanced malignancy.

Case study 7: Biliary disease IV – poor follow-up arrangements in high-risk patient presenting with acute cholecystitis

Case summary

A middle-aged patient with a past history of epilepsy, intellectual impairment, blindness (legally blind) and type I diabetes mellitus re-presented with another episode of acute cholecystitis. The patient had presented a month prior with a seizure secondary to acute cholecystitis. This was managed conservatively and the patient was discharged home with an outpatient clinic follow-up and review in the high-risk anaesthetic clinic.

The patient was significantly compromised physiologically with tachycardia and dehydration. Their temperature was 38.9 degrees on admission and remained elevated during the patient's stay in the emergency department (ED). The abdomen was difficult to examine but apparently tender in the right upper quadrant. The patient was physiologically unstable and numerous boluses of crystalloid and colloids were needed to maintain blood pressure (BP). A bedside ultrasound was documented as showing features of acute cholecystitis with gallbladder sludge and pericholecystic fluid was noted. An urgent CT scan showed acute cholecystitis (as recorded in the high dependency unit notes; the formal report was not available). Deep vein thrombosis prophylaxis and IV antibiotics were administered and an indwelling catheter was inserted.

The patient went to theatre 12 hours after presentation to the ED. There were no notes documenting this decision, so responsibility for the decision making – including the level of involvement of the admitting consultant – cannot be determined. An attempt was made at a laparoscopic cholecystectomy but this was converted to an open procedure as the surgeon was "unable to get views with pneumoperitoneum". No basis for this complexity was offered in the operative notes. The remainder of the operation was documented to be normal, including the intraoperative cholangiogram. A drain was left in situ.

The patient was managed postoperatively in the high dependency unit. The recovery was complicated by respiratory failure with bilateral basal consolidation and pleural effusion. This was complicated further with intermittent mucous plugging and difficulty in suctioning the airways. The patient passed away on the seventh postoperative day.

Comment

There were two principle areas of concern in the management of this patient.

The first was the follow-up management subsequent to the admission that had occurred a month earlier. This patient was admitted with epilepsy secondary to the acute cholecystitis and the risk of a further episode of acute cholecystitis was very high. Instead of being discharged with outpatient clinic review, it would have been more advantageous to undertake the surgery during that admission.

Second, the patient might have been better served by an ultrasound-guided percutaneous cholecystostomy, rather than an operative cholecystectomy. This would have allowed for management of the acute cholecystitis state and stabilisation of the physiological status. It would also have allowed for the resolution of the inflammatory changes around the gallbladder. A percutaneous gallstone extraction may also have been possible.

The above strategy may have avoided the need for an open cholecystectomy. The postoperative management of an open cholecystectomy in this patient was always going to be extremely difficult, with the risk of pulmonary complication and subsequent mortality being extremely high.

Case study 8: Biliary disease V – ERCP complication leads to death in an elderly patient

Case summary

A very elderly patient was referred to a tertiary hospital for investigation and management of an apparent urinary tract infection that was not responding to oral antibiotics. The patient had presented with fever, offensive urine, haematuria and left-sided abdominal pain. The patient was on long-term warfarin for AF.

Screening tests confirmed a significant CRP elevation, markedly elevated international normalised ratio (INR) of greater than 8, and mild liver function abnormalities. No urinary tract organisms had been cultured and an abdominal CT scan was performed to exclude renal calculi. This did not demonstrate any renal tract abnormality, but did demonstrate bile duct dilation due to an obstructing distal CBD calculus following a previous cholecystectomy.

A diagnosis was made of haemorrhagic cystitis, and bladder washouts and antibiotic therapy were commenced. The patient's fever and general condition did not improve with treatment and cholangitis was reconsidered as a cause of the patient's symptoms. The patient was referred to the gastroenterology service and an ERCP arranged following pre-procedure reversal of the elevated INR (vitamin K and Prothrombinex). This was performed 3 days after admission. The documentation of this procedure was poor, but it is evident that an inadvertent retroperitoneal duodenal perforation occurred, perhaps due to misplacement of the guide wire. A CT scan was performed after the procedure because of abdominal pain and tachycardia. This demonstrated the presence of a significant amount of retroperitoneal gas posterior to the duodenum, in keeping with a localised perforation.

Conservative management with total parenteral nutrition (TPN) and antibiotics commenced, and the patient was monitored by serial CT and serum CRP levels. Inexorable deterioration ensued despite CT-guided drainage of a developing retroperitoneal collection 8 days after the ERCP, and a laparotomy 2 days later. The patient continued to decline and died 5 days later.

Comment

This patient presented with probable urinary tract sepsis and an iatrogenic coagulopathy, but ultimately succumbed to an adverse event arising from endoscopic treatment of an incidentally discovered benign biliary obstruction.

On balance, the ERCP was justified in this patient due to the poor response to initial treatment and the difficulty in characterising the initial pathology. Duodenal perforation relating to ERCP is rare (0.3-1.0 per cent) but carries a significant mortality (up to 50 per cent). Documentation pertaining to the procedure was very limited, and it is not possible to ascertain the level of difficulty of the procedure or the degree of experience of the proceduralist.

This patient's clinical course, from a complicated ERCP to death over a period of 2 weeks, was entirely typical of this complication. The standard of care provided to the patient was otherwise excellent, with no evidence of any significant deficiencies.

Case study 9: Delay I – recognising and investigating a deteriorating patient

Case summary

A middle-aged patient presented with slightly atypical symptoms of perforated viscus. There was a background history of a dermatological condition that required topical steroids for some months prior to presentation. There was a suggestion of deconditioning during the preceding 3 months.

The diagnosis of a perforated viscus was correct and the decision for surgery appropriate. Intraoperative findings revealed a perforated ulcer in the anterior aspect of the first part of the duodenum and the appropriate procedure was performed (washout and omental patch).

The initial postoperative management was appropriate but the patient deteriorated and required reintubation on the second postoperative day. The presumed diagnosis of acute respiratory distress syndrome was made without any obvious cause identified. There was no documentation in the medical notes by the surgical team to indicate that the possibility of a leak had been considered. Further, the patient continued to fail to progress and this should have raised the possibility of a leak. By the seventh postoperative day, no CT scan had been performed despite purulent discharge from the drain and a WCC of approximately $30 \times 10^9/L$.

Instead, a CT with oral contrast was proposed for the following morning. This is not the standard practice and the logic behind the decision was not clear. The CT report stated that there was extravasation of oral contrast to the periduodenal region, as well as a larger collection in the mesentery of the small bowel.

A second exploration was performed following the CT scan in order to re-patch the duodenal perforation. The intraoperative findings documented by the treating surgeon indicated that there was only a small area of contamination.

Comment

This patient ultimately died from a cardiac event, but this was the result of ongoing sepsis caused by inadequate surgery and a delay in timely reintervention. Even without any enteric or bile-stained fluid in the drain, there was still the possibility of a leak given that the CT scan showed the tip of the drain located superior to the collection. In addition, documentation as to the exact drain content was poor.

It is apparent that obvious signs were not appreciated or acted upon. The initial omental patch was appropriate, but the developing ARDS on the second postoperative day was a significant warning. The reason for a delay in requesting the CT scan needs to be investigated further. If the CT with oral contrast had been performed earlier, in all probability this patient would have survived.

The choice of second operation may not have been appropriate. The surgeon may have minimised the degree of contamination, realising that the leak had been going on for quite a few days and that there had been a delay. Redoing a leaking omental patch is prone to failure due to poorer tissues secondary to inflammation. Consideration should have been given to a form of resectional surgery, such as antrectomy or gastrojejunostomy with a drain placed next to the duodenal stump.

It is recommended that a Root Cause Analysis be undertaken to prevent similar events happening in the future.

Case study 10: Delay II – recognising and investigating a deteriorating patient

Case summary

An elderly nursing home patient was transferred via ambulance in the early evening with 2 days of diarrhoea and vomiting and associated abdominal pain. It was thought the fever prior to hospital admission was related to a gastroenteritis outbreak. The patient had a background history of type II diabetes mellitus, multiple myeloma and memory impairment.

Assessment in the ED 2 hours later at 21:00 noted abdominal distension with notable tenderness and disorientation. The daughter advised the ED junior doctor that the patient was a poor historian but prior to admission had suffered increasing confusion, lethargy and stomach pains.

The blood gas suggested a metabolic alkalosis. Investigations revealed a lactate of 4 mg/dL, sodium of 126 mEq/L, chloride of 90 mEq/L (most likely due to prolonged vomiting), creatinine of 112 $\mu\text{mol/L}$ and glucose of 17.1 mmol/L. An abdominal CT scan showed small bowel obstruction (SBO) with a transition point at the mid small bowel.

The general surgical registrar reviewed the patient at 23:00. By this time, the patient was tachycardic (110 beats per minute), with a systolic BP of 118 mm Hg. The WCC was $14 \times 10^9/\text{L}$. The patient was admitted under general surgery noting diagnoses of partial SBO, dehydration, hyponatraemia and acute renal impairment. The plan was for IV fluids, electrolytes, "expectant management", medical referral and review in the morning.

Shortly after midnight the patient's systolic BP dropped to 82 mm Hg and soon the pulse rate rose to 149 beats per minute. Faeculent fluid was noted following nasogastric tube insertion. Three hours later, by the time the patient was moved from the critical care area of the ED to a single room on the ward, the pulse was 117 beats per minute with systolic BP of 83 mm Hg. Between 1.5 and 2.6 litres of fluid had been prescribed.

Shortly after transfer to the ward the patient was found unresponsive by nursing staff. The patient was asystolic and resuscitation attempts were futile.

Comment

It is significant and highly concerning that a patient who had decompensated and who was in a state of hypovolaemic/septic shock was not managed with a greater sense of urgency and did not have their care escalated.

Most importantly, perhaps, the patient was under-resuscitated. The level of experience of the clinicians assessing the patient, compounded by night staffing, likely contributed to the delayed diagnosis, lack of escalation and subsequent death of this patient. While the outcome may not have been ameliorated, this serves as due warning to junior medical staff that a plan is not "set and forget". Instead, ongoing and judicious review of a patient's response to their initial management should be a core component of their care.

Case study 11: Delay III – poor supervision results in missed ischaemic bowel

Case summary

An elderly patient was sent to the ED via ambulance by the general practitioner after presenting from home with acute abdominal pain. Morphine was given prior to transfer, but in the ambulance the pain was still recorded as 7/10. The patient was triaged as a category 3 in the mid-afternoon (15:20), and according to the nursing notes was seen by a doctor 70 minutes later (16:30) who ordered bloods, x-ray, and who noted but declined to treat a BP of 230/120 mm Hg. The patient required multiple boluses of IV Fentanyl without relief of the pain. The ED doctor noted the abdominal pain, did not record a diagnosis and documented “discussed with senior, plain abdominal films requested and full blood count, urea, electrolytes, creatinine, LFTs, lipase, CRP and lactate sent”. An arterial gas at that time was normal. There was no further medical documentation, although there was ongoing nursing documentation indicating that the doctor was aware of the elevated BP and ongoing pain scores of 7/10.

Some 9 hours later, the confused patient was wandering around the ED and collapsed on the floor. Following review, an electrocardiogram (ECG) was performed and the lactate sent earlier was noted to be 2.4 mg/dL. The abdominal CT was performed 11 hours after admission. It is not clear if the images were reviewed before the patient collapsed just over an hour later. A repeat lactate was 13 mg/dL and pH 7.22. An urgent surgical review was arranged and the surgery commenced shortly after the CT scan. At surgery, an ischaemic small bowel volvulus was resected but not anastomosed. The patient went to the ICU intubated.

The patient was extubated later in the morning. In the evening there was a sudden deterioration following a large vomit and the patient required cardiopulmonary resuscitation (CPR) and was reintubated. The patient was returned to theatre 2 hours after this for a relook. Global minimal change was revealed but with worsening renal and liver failure, and a coagulopathy in the setting of profound acidosis, the patient was returned to the ICU for palliation and died 8 hours later.

Comment

Gut ischaemia leading to death is not necessarily unexpected in an elderly patient. Expedient diagnosis and treatment is the best, even only, chance of survival. Survival was very unlikely in this case given an initial pH of 7.10 and lactate of 18 mg/dL prior to the first surgery.

There was poor assessment and senior oversight, and this patient was left to decline in the ED without a diagnosis. Ischaemic gut should be considered in any elderly patient with severe, especially poorly controlled, abdominal pain. This patient was in the ED for 9 hours before a rapid decline merited further investigation, and with a further deterioration again before a surgical review was sought. It would seem the progress from deterioration to surgical review and then to surgery was quite timely, as was the subsequent surgical management.

As there was no anastomosis or stoma made at the original operation, it was always the intention that there would be a relook laparotomy. As such, the rationale behind the extubation is not clear. With an effective SBO at the staple line the airway was now no longer protected, and there was a high risk of the aspiration that occurred.

Case study 12: Delay IV – indecisions delayed colonoscopy for ischaemic bowel

Case summary

An elderly patient was admitted with abdominal pain and vomiting. Comorbidities included arteriosclerosis with coronary and carotid disease, polycystic kidney disease, hypertension, pacemaker, and multiple liver and bone metastases from a neuroendocrine tumour. Surgical history included sigmoid colectomy for diverticular disease, left hemicolectomy for bleeding and laparotomies for a caecal volvulus, adhesions and ischaemic bowel (different hospital).

The first ED note was just before midnight and recorded that the patient was visibly distressed and groaning. The abdomen was distended with rebound tenderness and guarding. The WCC was $19 \times 10^9/L$, lipase 619 U/L and lactate 2.1 mg/dL. It was initially decided not to organise a CT scan, as creatinine was 32 $\mu\text{mol/L}$ with a glomerular filtration rate of 16 mL/min. The differential diagnosis included ischaemic bowel and a referral to general surgery was made 2 hours later.

The on-call general surgery registrar reviewed the patient 50 minutes later. The WCC and lactate were noted and a CT was requested but antibiotics were not commenced. The CT performed 4 hours after admission revealed a colonic volvulus and the general surgery trainee referred the patient to the on-call gastroenterology trainee.

A gastroenterology trainee reviewed the patient (no time recorded) and noted a dilated large bowel up to 27 cm with twisting of the mesentery on CT. Following discussion between the gastroenterology trainee and the on-call gastroenterology consultant, a scope was planned for the morning.

At the morning post-take round, the consultant surgeon appreciated the urgency of the situation, but the patient was already in the endoscopy suite. Necrotic bowel was found. The patient was in theatre within 90 minutes and the necrotic colon resected. The patient was admitted to the ICU postoperatively.

On the second postoperative day, the patient developed AF, the WCC was $13 \times 10^9/L$ and Hb was 81 g/dL. Over the next 48 hours the patient became more confused, WCC increased to $31 \times 10^9/L$ and Hb dropped to 66 g/dL. Four days later it was decided that there would be no further surgical intervention and the patient was transferred to the ward. The patient deteriorated over the next 3 days and died. A CT performed the day before death showed no evidence of an anastomotic leak.

Comment

The delay in the treatment of this patient is a major area of concern. The general surgery trainee clearly did not understand the gravity of the situation. It took more than 12 hours for this patient to undergo surgery after admission for what seems an obvious ischaemic bowel. It is expected that a general surgery trainee would recognise the need for an emergency laparotomy, and that they would discuss it with the consultant. Similarly, the gastroenterology trainee documented a CT diagnosis of a colonic volvulus and discussed it with the gastroenterology consultant. It is expected that a gastroenterology consultant would recognise that volvulus requires emergency decompression.

Case study 13: Delay V – diagnosis of perforated gastric ulcer

Case summary

An elderly patient was admitted with a diagnosis of influenza A pneumonia (later confirmed on sputum micro culture and sensitivity test). The complicated past medical history included end stage renal failure on peritoneal dialysis, ischaemic heart disease, peripheral vascular disease with a degree of peripheral neuropathy and hypertension. Treatment commenced with antibiotics and supplemental oxygen.

Two days after admission, the patient started complaining of intermittent abdominal pain. The patient had previously been treated for peritonitis and remarked that this felt similar. After 5 days of this intermittent pain (diagnosed at one stage as faecal loading), the patient became unresponsive and had a medical emergency team (MET) call. A chest x-ray revealed free gas under the diaphragm. The inflammatory markers were now markedly raised.

A surgical review, requested some hours later, concluded the patient had peritonitis. At urgent surgery there was a 2 cm perforation in the posterior gastric antrum with four quadrant contamination. After copious lavage, a primary repair in two layers (with a Connell stitch and then an inverting Lembert stitch) was performed as the omentum was too thin to securely perform a Graham patch. It was decided not to perform a distal gastrectomy as the patient was too unwell.

The patient slowly progressed in the ICU to the point of extubation, but subsequently developed a further myocardial event. Care was capped following discussions with the patient's family and death ensued.

Comment

The main error was that the symptoms were not recognised earlier by the medical team.

There was a delay contacting the surgical team and earlier intervention may have made a difference. The decision to perform a primary repair was appropriate in this circumstance. Another option would have been to perform a jejunal patch. However, a subsequent contrast study did not show any leak, implying that the repair remained intact. By the time the surgeons were involved, this high-risk patient was critically unwell and the ultimate outcome was not unexpected.

Case study 14: Non-surgical intervention I – PEG tube placed in colon

Case summary

A very elderly, demented patient with refractory Parkinson's disease underwent insertion of a percutaneous endoscopic gastrostomy (PEG) tube. There were no notes available for the first operation performed during this admission, so it is difficult to make specific conclusions about the management.

Some 7 days later, faecal drainage and bleeding was noted around the PEG. A gastroscopy showed that the PEG was in good position and a CT scan revealed no free air or fluid. The patient was relatively well.

The next day, a gastroscopy and colonoscopy for ongoing bleeding noted a large hole in the transverse colon. An omental closure was attempted but failed to close the hole and the PEG was removed. At mini-laparotomy the colon hole was oversewn.

The patient progressively deteriorated and the decision was made for palliative care. The patient died 3 days later.

Comment

The decision to place the PEG in the first place is questionable. The decision-making process and discussions were not documented, but at best it was only going to prolong the life of an elderly, demented patient. The question arises as to whether the goals of care were documented or even discussed.

Given the patient's status, the decision to operate on the colon was questionable. In the face of ongoing bleeding it may have been a reasonable decision, but palliation could still have been considered.

Although colonic injury is a recognised complication of PEG insertion, this was clearly a procedural injury that caused the death of the patient.

Case study 15: Non-surgical intervention II – failure to recognise bleeding complication following pleural tap

Case summary

An elderly patient was admitted under the care of a general surgeon with a diagnosis of choledocholithiasis. Investigations in the ED demonstrated jaundice with a bilirubin of 91 mmol/L, alanine transaminase of 183 U/L, alkaline phosphatase of 2621U/L and gamma glutamyltransferase of 483 U/L. Cholecystitis was suspected, IV antibiotics commenced and a dose of vitamin K was given.

An ultrasound scan organised for the following morning demonstrated a non-occlusive portal vein thrombus. There was mild gall bladder wall thickening and associated echogenic sludge and calculi, but no definite evidence of choledocholithiasis or biliary duct dilatation.

Moderate volume of ascites and a right pleural effusion were noted. A 6 cm abdominal aortic aneurysm was noted to be stable (this was due to be repaired at another hospital in the very near future). A CT scan performed later the same day confirmed non-occlusive thrombus in the portal vein. Large volume ascites was noted.

The right pleural effusion was further investigated with a CT scan of the chest. This demonstrated a 4.5 x 4 cm mass at the level of the right hilum affecting the right upper lobe bronchus and invading the mediastinum. Also noted was an apparently malignant mediastinal lymph node that appeared to be invading the superior vena cava and left brachiocephalic vein. The superior vena cava obstruction was causing gross subcutaneous oedema of the chest wall. There was also evidence of lymphangitis involving the partially collapsed right upper lobe.

The following day the patient was assessed by the respiratory registrar who recommended an ultrasound-guided pleural tap and requested the heparin be withheld. The respiratory team declined to take over the patient's care. A gastroenterology review concluded that it was likely that the pulmonary malignancy was causing the deranged LFTs.

For reasons not clear in the notes, the pleural tap was done on the ward by the respiratory registrar without ultrasound guidance. The patient was known to have an INR of 1.5. Note was made that there was constant oozing of blood following the scalpel incision. The note also stated that the first pass was successful and that 840 mL of dark-straw-coloured clear fluid was obtained. No immediate complications were noted. Unfortunately the note does not state where the tap was done anatomically or the size of the needle or drain used.

Less than 3 hours later the patient was reviewed for chest pain and was found to be visibly distressed with severe shortness of breath. The patient was still under the care of the general surgical team. The patient was given oxygen, analgesia and a repeat chest x-ray was arranged. Approximately 90 minutes later, the patient was reviewed again by a different respiratory registrar. There was now blunting of the costophrenic angle not present in the chest x-ray performed immediately after the pleural tap. After discussion with the consultant it was concluded that as the Hb appeared to be stable, the patient was not tachycardic or hypotensive. The clinical situation and chest x-ray appearances meant it was unlikely there was a significant haemothorax. They did not see any need for chest tube insertion.

The patient was reviewed by the same registrar 90 minutes later because of low BP. The BP had been unrecordable and was then measured to be systolic 64 mm Hg on manual recording. The patient was noted to be cool peripherally. The differential diagnosis was bleeding due to haemothorax, ruptured abdominal aortic aneurysm or sepsis. Another chest x-ray was organised and this demonstrated complete opacification of the right lung field. The consultant respiratory physician reviewed the patient. A bedside ultrasound scan of the right chest performed by the original respiratory registrar and an ultrasonographer concluded that there was minimal fluid in the right chest. They concluded that the source of the bleeding "does not appear to be related to today's pleural aspiration".

A CT scan of chest, abdomen and pelvis was organised to exclude a ruptured abdominal aortic aneurysm. Unfortunately the patient arrested while in the CT scanner. The CT scan demonstrated a massive right-sided haemothorax with active extravasation at the seventh intercostal space. The patient was resuscitated with fluids and taken to the ICU. A chest drain was inserted and a cardiothoracic consult was arranged.

It was decided that the patient was unlikely to survive a thoracotomy, and in any case had locally advanced lung cancer for which treatment options were likely to be limited. Interventional radiology felt that the patient was too unstable for embolisation. There was a decision to cease active treatment. The patient died approximately 10 hours after the pleural tap.

Comment

The patient had active bleeding shortly after an intervention procedure. Unless positively proven otherwise, the assumption should have been that the two were related.

It is very difficult to understand the reluctance of the respiratory team to recognise that there had been a complication. Even when the patient was hypotensive and had developed a completely opacified right lung field, just 3 hours on from having a completely clear lung field, the team were reluctant to accept the situation.

There is little doubt that if the haemothorax had been diagnosed when the patient first developed shortness of breath and evolving pleural fluid on chest x-ray, a chest drain could have been inserted, the patient transferred to angiography for embolisation and the situation rescued.

The general surgeon expressed frustration over the not-infrequent situation in which patients who do not have a general surgical problem are left under the care of general surgery. While this frustration is understandable, that was not the cause of the patient's demise in this instance.

Case study 16: Non-surgical intervention III – limits of care not documented for bleeding ulcer

Case summary

A very elderly arteriopath with chronic obstructive pulmonary disease was transferred from a country hospital to a peripheral hospital with bleeding secondary to gastric ulcer. A clot was found in the ulcer at endoscopy and it was not disturbed.

The patient re-bled the day after the scope. After discussion with the patient's family regarding ongoing treatment, the surgeon felt that a repeat scope was not appropriate. In keeping with that, the ICU would not take the patient unless a scope had been undertaken. The patient succumbed shortly thereafter.

Comment

The initial management of the patient was appropriate and surgery was not indicated. It is unclear why the idea of a second scope was not entertained. It is possible that this decision was discussed with family, but it was not documented.

Case study 17: Complex medical issues that might have been better managed in a tertiary hospital

Case summary

This was a young patient with a past history of obesity. The patient was a smoker (7 cigarettes per day) and had been admitted 4 weeks earlier with a diagnosis of acalculous cholecystitis and managed with antibiotics. A diagnosis of thrombocytopenia (platelet level less than $40 \times 10^9/L$) was also made on this admission and steroids commenced. The patient was discharged for outpatient review.

The patient re-presented 2 weeks after the initial admission (2 weeks before the final admission). A magnetic resonance cholangiopancreatography performed at this time was said to be normal. An elective cholecystectomy was planned.

However, only 2 weeks later the patient was re-admitted again with right upper quadrant pain (persistent since discharge), fevers, nausea and vomiting. Vital signs were normal but there was some tenderness in the right upper quadrant / epigastric area. Platelet level was $89 \times 10^9/L$. The abnormal LFTs were improving. An ultrasound was performed as a normal study. A gastroscopy performed the day after admission was normal. A review by a medical registrar was undertaken. The platelet level continued to drop to $34 \times 10^9/L$.

Three days after the final admission, a MET call was activated as the patient had a cardiac arrest. An ECG showed an ST-elevated myocardial infarction (STEMI). The patient passed away shortly after.

Comment

There are a number of unsatisfactory aspects to this patient's management, as outlined below.

The diagnosis of acalculous cholecystitis

Acalculous cholecystitis typically occurs in patients who are critically ill. In this patient, a diagnosis of acalculous cholecystitis was made on at least two previous occasions. In the absence of relevant notes, the basis on which this diagnosis was made is unclear. However, a magnetic resonance cholangiopancreatography was said to be normal, as was the ultrasound performed during the admission under discussion. The patient was scheduled for an elective cholecystectomy.

Acalculous cholecystitis has been associated with a mortality rate of up to 50 per cent. Therefore, a definitive management should have been instituted as a matter of urgency. It was rather inappropriate for the patient to be discharged home and reviewed on an outpatient basis.

The diagnosis and management of the thrombocytopenia

The patient was documented on multiple occasions as having clinically significant thrombocytopenia. However, there was no documentation that any investigation or review had been undertaken by a haematologist.

The management of the patient's final admission

There appears to have been a rather slow process of management of this patient during the final admission. The patient was admitted with an unclear diagnosis and continued to deteriorate clinically and haematologically. A more proactive approach to this patient's management would have been better. Consideration should have been given to transferring this patient to a medical institution with more readily available medical support.

Case study 18: Inadvertent CPR despite advance health directive and not for resuscitation order in neck of femur fracture patient

Case summary

A very elderly patient with suspected bilateral subcapital neck of femur fracture secondary to a mechanical fall was admitted to a tertiary teaching hospital. Routine pathway care was followed for management of a neck of femur fracture and an appropriate left hip hemiarthroplasty was performed by a competent surgeon.

Following surgery, a MET call was made for tachycardia at 150 beats per minute, and the hospital-out-of-hours-team registrar, resident medical officer, nursing staff and the ICU senior registrar responded with treatment for AF with a fluid bolus and amiodarone. Suggestion was made for a monitored bed and routine bloods were taken. The patient was transferred to the cardiology ward for cardiac monitoring. The event time was noted to be 23:31 on postoperative day one.

Approximately 3 hours later, a further MET call was made for unresponsiveness. As the patient had been transferred to the cardiology ward for monitoring, a cardiology resident medical officer commenced CPR. This continued for approximately 5 minutes until the 'not for resuscitation order' and 'advance health directive' were found, and active treatment was ceased.

The details of the two overnight MET calls were documented in ward round notes and appropriately communicated to the family the following morning.

Palliative treatment continued appropriately until the patient passed away.

Comment

This clear end of life scenario revealed that an unfortunate breakdown in communication had occurred when this very elderly patient was transferred between wards. This resulted in inadvertent CPR and external cardiac pacing in the cardiac ward. The importance of clearly documenting end of life goals could not be more plainly demonstrated.

Case study 19: Clear documentation of goals of care appropriately limits treatment

Case summary

This patient was an arteriopath and previous interventions included a laparotomy and small bowel resection for mesenteric ischaemia more than 10 years earlier. That was followed by a superior mesenteric artery stent. The patient had a STEMI 3 years prior to the final admission and a non-STEMI 2 years prior to the final admission.

Five months prior to the final admission, the patient had an emergency laparotomy and small bowel resection under surgeon A. This was complicated by an enterocutaneous fistula and the patient was managed on TPN. One month prior to the final admission (on the eve of a public holiday period), a local repair of the fistula was attempted but failed. The patient had a further myocardial infarct.

During the final admission, the patient was managed in a tertiary hospital under surgeon B. The patient had very poor quality of life, with two stoma bags and requiring TPN. It was clear that only further surgery was going to close the fistula, but that this would be very high risk. There were clear discussions as to the limits of care: if there were complications after surgery there was to be no intervention. There were appropriate discussions with cardiologists around any further intervention prior to surgery. The patient was protected with heparin until 4 hours prior to the surgical start time.

The patient underwent what seems to have been a fairly straightforward laparotomy (approximately 3 hours) and small bowel resection. All went well for 48 hours but then the patient complained of severe abdominal pain, became unstable and the lactate started to rise. The assumption was that this was mesenteric ischaemia, whether related to a thrombosis in the superior mesenteric artery or more global.

In view of the preoperative discussions, the patient was treated symptomatically and died 72 hours later.

Comment

The details of the initial operation were not available, but a leak following an emergency small bowel resection, while regrettable, is a recognised complication, especially in an arteriopath. The attempt at a local closure of the fistula was doomed to fail, and while this did not exacerbate the fistula it did prompt a further myocardial infarction. The specialty of surgeon A is not known, but given that the patient was subsequently referred to surgeon B, a specialist colorectal surgeon, it is possible that the patient should have been referred earlier.

Surgeon B treated the patient entirely appropriately. Surgeon B was in an unenviable position, as the only way to solve this patient's problem was further surgery, but it was clearly very high risk. Surgeon B very appropriately waited until the abdomen was likely to be more surgeon friendly, using this time to minimise the patient's medical comorbidities and, very importantly, determine the limits of treatment in the event of a postoperative complication.

In the absence of a postmortem, the cause of the postoperative deterioration cannot be stated with certainty, but mesenteric ischaemia was far more likely than a small bowel leak, and this was recognised by surgeon B. The decision to manage this symptomatically was entirely appropriate and in keeping with the patient's wishes.

Surgeon B was apprehensive regarding the potential complexity of the last operation, but it seems that this was not a major issue. It reaffirms the value in waiting many months for the abdominal cavity to mature before a reoperation. This is the most important learning message.

Case study 20: Bleeding following head and neck surgery

Case summary

A young patient underwent a partial glossectomy, total thyroidectomy, bilateral neck dissections and a free flap reconstruction for a tongue cancer and a coincident papillary thyroid cancer. Postoperative chemoradiotherapy and iodine-131 therapy commenced immediately and finished 6 months later.

One month later, the patient had a perioperative tracheostomy and the wound subsequently healed. It reopened a few weeks later. Two weeks after the wound reopened, the patient was admitted. Swabs and bloods were taken and oral antibiotics commenced. A CT scan of the neck showed an abnormality in the neck, "?abscess ?tumour, awaiting radiology consult review" (according to handwritten notes as the formal report was not provided). The patient was discharged and wound management followed up outside the hospital.

An external ultrasound performed 3 days after the patient's discharge showed an abnormal avascular soft tissue mass inferior and deep to the tracheocutaneous fistula.

One month later, the consultant requested that the patient be placed on the waitlist for exploration of neck wound, and closure of tracheocutaneous fistula with local flap. There was no evidence of tumour recurrence.

Twenty days after this consultation, the patient was readmitted after bleeding from the wound. An Hb of 89 g/dL suggested significant blood loss. Good IV access was secured, group and hold performed, and the wound was cleaned and packed. The patient was mildly coagulopathic (activated partial thromboplastin time of 41.9 seconds). The patient was scheduled for surgery to close the fistula the following week. There was no record of either oral or IV antibiotics during the admission, though the patient was discharged from the previous admission on Augmentin Duo Forte. Several nursing note entries mentioned blood stained sputum.

Five days later the patient had a small bleed followed within minutes by catastrophic bleeding from the neck wound. The patient succumbed despite the best efforts of medical staff, including consultant head and neck surgeons.

Comment

Whilst tracheocutaneous fistulae occasionally persist following removal of the tracheostomy tube, it is much less common for them to spontaneously reopen once healed. Wound infection and tumour recurrence would be possible causes. The possibility of a pseudoaneurysm was considered during the last admission as the summary records that a CT angiogram was performed. This showed no contrast extravasation or pseudoaneurysm formation, and would have been comforting to the surgical team. The degree of pain was surprising for an uncomplicated tracheocutaneous fistula, and may have suggested infection or perhaps osteoradionecrosis.

There was no record of antibiotics being given during the last admission, and this may represent a potential oversight. However, the patient was afebrile, there was no record of pus in the wound and the WCC was normal.

It is impossible to say if earlier exploration of the wound with local flap closure and IV antibiotics, with or without hyperbaric oxygen therapy, would have prevented the fatal erosion into a great vessel in the root of the neck. Any catastrophic bleeds into the airway in patients who have undergone chemoradiotherapy for pharyngeal cancers should be considered a herald bleed, taken seriously and managed promptly.

SHORTENED FORMS

AF	atrial fibrillation
BP	blood pressure
CBD	common bile duct
CPR	cardiopulmonary resuscitation
CRP	C-reactive protein
CT	computed tomography
EKG	electrocardiogram
ED	emergency department
ERCP	endoscopic retrograde cholangiopancreatography
Hb	haemoglobin
ICU	intensive care unit
INR	international normalised ratio
IV	intravenous
LFTs	liver function tests
MET	medical emergency team
PE	pulmonary embolus
PEG	percutaneous endoscopic gastrostomy
SBO	small bowel obstruction
STEMI	ST-elevated myocardial infarction
TKR	total knee replacement
TPN	total parenteral nutrition
WAASM	Western Australian Audit of Surgical Mortality
WCC	white cell count