Contents

Introduction .................................................................................................................. 2

Case 1 Lack of acute care facilities delays definitive care ......................................... 3

Case 2 Beware of ankylosing spondylitis, falls and spinal injury ................................. 4

Case 3 The importance of investigating confusion ...................................................... 5

Case 4 Fractured neck of femur: missed diagnosis and the need
for the orthogeriatric model of care ................................................................. 6

Case 5 Ascending cholangitis requires early intervention...
and consultant’s order not implemented and not checked ................................. 7

Recognition of complications following abdominal surgery .................................... 8

Case 6 Aspiration pneumonitis is preventable .......................................................... 10

Case 7 Higher-risk patients: hernias, appropriate hospitals
for surgery and adequate surgical cover in public hospitals .......................... 11

Case 8 and Case 9 Patients who talk and die: preventable deaths in head injury .......... 12

Case 10 Sepsis following bowel anastomosis ... is it a leak? ........................................ 13

Case 11 Missed diagnosis: look at the x-rays ............................................................ 14

CHASM Committee Membership between July 2012 and June 2013 ...................... 15

Executive and project staff based at the Clinical Excellence Commission .............. 16

Local Health District representatives ................................................................. 16
Introduction

CHASM (Collaborating Hospitals’ Audit of Surgical Mortality) is a peer-reviewed audit of surgical deaths which occur in hospitals where the patient is under the care of a surgeon. The audit provides a critique of the management of de-identified individual cases to each surgeon for educational purposes.

In this fifth CHASM Casebook, the majority of cases deal with complications of abdominal surgery. Many identify the recurring themes of delays in diagnosis, the importance of reviewing investigations, delays in access to operating theatres or critical care facilities and the consultant’s responsibility to ensure that orders given are implemented.

Aspiration remains a prominent co-morbid factor contributing to deaths in surgical patients. Problems in communication and inter-hospital transfer persist.

Professor Peter Zelas, CHASM committee member, has provided a commentary on the recognition and management of post-operative complications in patients who have undergone abdominal surgery, with a focus on the assessment of confusion, deterioration and anastomotic leakage in the surgical patient.

In neurosurgery, the risks of developing intracranial haematoma in patients receiving anticoagulation and who suffer a mild or moderate head injury, continue to cause concern. In these patients, the primary impact is insufficient to cause loss of consciousness. Death from the subsequent development of an intracranial haematoma is entirely preventable by close neurological monitoring and early CT scan, repeated if necessary.

We hope you derive educational value from the cases which follow and, as always, the CHASM committee welcomes your comments.

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CHASM Committee Member
A patient aged in the 70s was admitted to Hospital A with acute abdominal pain, due to a perforated prepyloric ulcer. There was a delay of almost eight hours after the diagnosis was made, because no ICU beds were available and it was agreed that intensive care would be required post-operatively. Attempts to transfer the patient to another facility were unsuccessful. Eventually, there was agreement to evacuate him after surgery. While arrangements were being made for post-operative transfer, his condition deteriorated and he was taken urgently to the operating theatre in Hospital A and repair of the ulcer performed.

A right subclavian venous line was inserted. A chest x-ray confirmed placement of the tip near the right atrium, but in retrospect this was incorrect and the catheter had been placed in the right subclavian artery. It was not known whether ultrasound had been used to assist the catheter placement, and there was no indication in the record that this had occurred.

Inotropic support with noradrenaline was required to support the blood pressure and was infused into the central line, before it was noted by the retrieval team that the line had been inserted into an artery.

After transfer to Hospital B, the subclavian line was removed in the radiology department, where it was noted the patient had sustained a large left hemisphere cerebrovascular accident. Respiratory failure and cardiac arrhythmias followed and supportive measures were eventually withdrawn.

**SURGICAL LEARNINGS:**

- This is another example of the struggle that surgeons and anaesthetists endure with insufficient acute care facilities, in particular, intensive care beds.
- There was a delay in surgery because of the difficulty in obtaining agreement for transfer.
- Rather than delay surgery, with the probability of further peritoneal soiling, it may have been more appropriate to proceed with earlier definitive surgery and arrange transfer to another facility subsequently.
- Systems should be available to facilitate inter-hospital transfer for critically ill patients, with escalation of decision making when there are initial difficulties in expediting the transfer.
- The inadvertent placement of the subclavian line into an artery was not recognised and resulted in a catastrophic cerebrovascular accident. It was not known whether an ultrasound had been used to assist with vascular access.
- A policy directive of NSW Health recommends:
  *Ultrasound should always be used if available and the operator trained in the use of the device for CVAD (central venous access device) insertions, particularly for internal jugular, femoral and PICCs, where the peripheral veins are not visible or palpable.* (see reference below).

**Reference**

Beware of ankylosing spondylitis, falls and spinal injury

Case 2

An elderly patient with a history of recent high alcohol intake, was admitted to Hospital A following a fall the day before, when he declined admission. There was low-back tenderness, with limitation of leg movement apparently due to pain but no sensory impairment. On day 2, he had a fall in the ward and developed respiratory distress. A CT scan of the chest showed a collapse of the right lung and a left haemothorax. The thoracic spine showed extensive paravertebral ossification, with rigid fusion and complete traumatic disruption of the vertebral column at the T8/9 level, with a transverse fracture through the disc space. Although the significance of the instability of the thoracic fracture was recognised, the particular pathology of ankylosing spondylitis was not. The patient was transferred to Hospital B for management of the fracture and the spinal cord injury. In Hospital A, bilateral intercostal catheters were inserted to drain the now bilateral haemothoraces.

A repeat CT scan in Hospital B revealed a complete transection of the vertebral column at T8/9. There were two failed attempts to surgically decompress and stabilise his spine, but he was unable to tolerate the prone position during anaesthesia, resulting in a rapid deterioration in his ventilation. Conservative therapy was recommended, but his respiratory function further deteriorated and he was managed with palliation until he died.

Although the condition of his thoracic spine was not specifically mentioned in the clinical records in Hospitals A or B, other than the initial x-ray report, the diagnosis of ankylosing spondylitis seems highly likely.

SURGICAL LEARNINGS:

• Management in the referring and tertiary hospitals was entirely appropriate.
• Although an unusual condition, in the setting of trauma, particular care needs to be taken when managing a patient with a spinal injury and ankylosing spondylitis.
• The diagnosis of ankylosing spondylitis was not made in Hospital A. Spinal trauma in ankylosing spondylitis is notorious, not only because fractures may occur, with, as in this case, transection of the vertebral column and usually spinal cord compression, but also because of heavy bleeding from the bone, which can cause major blood loss.
• An assessment of the risk of falls and their prevention, is of particular importance in patients with ankylosing spondylitis.
The importance of investigating confusion

Case 3

A previously independent elderly patient was admitted to hospital with right upper quadrant pain. He had a past history of mild asthma and treated chronic lymphocytic leukaemia. The diagnosis of pancreatitis secondary to gallstones, was made on the basis of a significantly elevated serum lipase and an abdominal ultrasound.

On day 2 he became confused. He pulled out his IV cannula. Eventually, subcutaneous fluids were administered. There was no report of blood tests, apart from one entry recording hypokalaemia. He became dehydrated and developed a drug-related rash from antibiotics.

There was no attempt to delineate the cause of his confusion. The results of blood tests, other than the electrolytes, were not recorded. He remained confused and had a fall on the ward. An ECG at the time was suggestive of a myocardial infarct, but no further investigations were made. Eventually, he had a cardiac arrest, from which resuscitation was unsuccessful.

Surgical LearningS:

• The second-line assessor commented that the cause of death was unknown, but it seemed likely there was cardiac ischaemia secondary to hypotension and dehydration.

• Careful attention to the multiple causes of confusion in a surgical patient is essential, even when a diagnosis has been made and appropriate treatment for the primary condition given.

• There was no record of any attempt to diagnose the cause of his confusion, noting that on admission, he was not confused and he had been living independently prior to this episode of illness.
Fractured neck of femur: missed diagnosis and the need for the orthogeriatric model of care

Case 4

An elderly patient was admitted to hospital following a fall, in which he sustained a fracture of the neck of his left femur. There was a significant past medical history, including congestive cardiac failure, atrial fibrillation requiring anticoagulation, diabetes mellitus type 2 and macular degeneration. His anticoagulation with warfarin was reversed. The day after admission, he underwent a left hip hemiarthroplasty. He had difficulty mobilising post-operatively, due to pain. An x-ray of the left hip on post-operative day 1 showed a dislocation of the hemiarthroplasty, but this was not noticed nor confirmed until a further x-ray on day 6. His course, following the first operation, was complicated by persisting hypotension and a low haemoglobin, which was managed with transfusion of packed cells. Despite this treatment, hypotension continued. Attempts at mobilisation failed because of pain in the left hip.

He was booked for revision surgery on day 7, but this was cancelled. The revision was performed the day after (day 8).

After he returned to the recovery ward following the revision surgery, he was noted to have a right hemiplegia and a left facial weakness. A cerebrovascular ischaemic event was diagnosed and he was managed with palliation until he died.

SURGICAL LEARNINGS:

- This case again emphasises the value of an orthogeriatric model of care for fractured neck of femur. No geriatrician was involved in the management at any stage.
- Where possible, after optimisation of the co-morbidities, it is desirable that elderly patients with fractured neck of femur be operated on within the first 48 hours.
- There was a delay in the diagnosis of the dislocated hemiarthroplasty.
- More aggressive management of the hypotension, probably due to hypovolaemia, might have avoided the intra-operative cerebrovascular accident.
An elderly patient was admitted to rural Hospital A with a diagnosis of acute cholecystitis. He was being treated with warfarin for cardiac arrhythmia and his INR was raised and was appropriately corrected. Three days later he was transferred to regional Hospital B.

On admission to the acute surgical unit, ascending cholangitis with an obstructed biliary tree, due to a calculus at the lower end of the common bile duct, was diagnosed on an abdominal CT scan. Further vitamin K was given. ERCP (endoscopic retrograde cholangiopancreatogram) was planned for day 2, but was deferred because of untreated hypokalaemia. Potassium replacement had been requested by the consultant but not given. ERCP services were unavailable the two days following (weekend) and the ERCP was planned for day 6. On day 5 he became unwell, with septic symptoms of malaise, lethargy, tachypnoea and oxygen desaturation, but remained afebrile. Blood cultures grew enterococcus faecalis and proteus mirabilis. Continued deterioration occurred with sepsis. Despite resuscitation and support, he died on day 5.

**Case 5**

SURGICAL LEARNINGS:

- Sepsis and its cause were immediately diagnosed and treated.
- The ERCP was delayed due to hypokalaemia and the consultant requested potassium replacement, but this was not done. Had the hypokalaemia been treated promptly, the ERCP would have been performed as planned and the outcome may have been different.
- Later in the course, there was an initial failure to recognise the severity of the deterioration. In an elderly patient, the systemic signs of sepsis may not be readily apparent.
Recognition of complications following abdominal surgery

The importance of early recognition and appropriate management of complications following abdominal surgery, have been highlighted on a number of occasions by first- and second-line assessors, when reviewing CHASM cases. SurgWiki, on the RACS website, provides a very good overview of the principles of post-operative care. CHASM data provides several issues in abdominal surgery which occur repeatedly and are worthy of highlighting and re-emphasis. These may be either of a general nature or specific to the abdominal procedure.

Confusion is frequently referred to in the clinical records, often noted as “cause uncertain” and can be inferred as a contributing cause of surgical mortality. On-site staff are the ones who are called to see the patient, often late at night. It would be useful for hospitals to consider establishing protocols for the management of confusion in the surgical patient, such as the ‘DETECT Manual’\(^1\). Confusion, especially in the elderly, has many causes, of which hypoxia and sepsis should be high on the index of suspicion.
The Deteriorating Patient and Escalation. While the introduction of SAGO (Standard Adult General Observation) charts has resulted in heightened awareness of the significance of changes in a patient’s vital signs, there continue to be case reports where guidelines are not followed when abnormalities occur. These charts are colour-coded, where observations in the yellow zone require clinical review and in the red zone, require a rapid response call. When considering deterioration in a post-operative patient, sepsis, electrolyte disorders, bleeding, pulmonary embolism, cardiac arrhythmia or infarct, or the effects of medications, should each be considered and excluded, as well as causes specific to the particular procedure. Junior hospital staff should be confident to escalate their concerns, feel they are being clinically supported and able to receive appropriate advice on the status of a patient who is causing concern.

Anastomotic dehiscence. As referred to in this Casebook, and occurring regularly in previous years, there have been delays in the prompt recognition of an anastomotic dehiscence. The typical picture of this complication is well recognised, with abdominal pain and a fever occurring on about the fifth post-operative day. These two features should alert surgeons to exclude anastomotic dehiscence as the very first possibility. Abdominal signs may be masked by obesity, co-existing pulmonary complications and, as in the case referred to in this Casebook, apparent conflicting clinical views when the patient was in the intensive care unit. A CT scan or gastrografin enema (for large bowel anastomosis) can support the clinical diagnosis.

Professor Peter Zelas, OAM
November 2013

Aspiration pneumonitis is preventable

Case 6

A patient aged in the late 70s underwent an uncomplicated segmental liver resection for liver metastases from a colonic adenocarcinoma. Post-operatively, he was admitted to the intensive care unit for 24 hours. The nasogastric tube was removed within the first 24 hours. Between post-operative days 1 and 6, progress was satisfactory and he tolerated a light diet. Nausea and vomiting with abdominal distension were recorded on the morning of day 7. No nasogastric tube was inserted, despite continuous nausea and vomiting. No investigations (including a plain abdominal x-ray or CT scan) were performed, to establish a possible intra-abdominal cause. He developed faeculent vomiting, followed by acute aspiration. Resuscitation was unsuccessful.

SURGICAL LEARNINGS:

- Aspiration pneumonitis remains a serious and frequent complication in patients recovering from abdominal surgery. Death from aspiration should be preventable by continuing vigilance of the clinical team, by the recognition of the potential serious significance of nausea and vomiting, especially in an elderly patient having undergone major abdominal surgery and by the consideration of the early passage of a nasogastric tube.
Higher-risk patients: hernias, appropriate hospitals for surgery and adequate surgical cover in public hospitals

Case 7

A morbidly obese, diabetic patient, aged in his late 60s, presented to Hospital B following discharge from private Hospital A, where he had undergone a planned composite mesh repair of a recurrent umbilical hernia. An intraperitoneal repair with four corner sutures, supported by a continuous stitch, was used to close the defect. Following the procedure, he had experienced nausea and vomiting for 24 hours and was discharged on the third post-operative day, following the passage of flatus and a bowel motion.

When he was admitted to Hospital B later on the day following discharge from Hospital A and a collapse at home, he was hypothermic, hypotensive, acidotic and with a raised white cell count and impaired renal function.

An urgent CT scan revealed a recurrent ventral hernia. Some hours later, he underwent an emergency laparotomy, with resection of infarcted small bowel which had herniated between the lateral edges of the mesh and the abdominal wall. Temporary abdominal closure was performed, without establishing bowel continuity as a damage control procedure. He continued to deteriorate and developed multiple organ failure. Death followed.

SURGICAL LEARNINGS:

- The initial procedure should probably have been performed in a facility with resources to support high-risk patients.
- The second-line assessor commented that the literature supports retro-rectus pre-peritoneal placement of the mesh, with a series of interrupted sutures placed transfascial through the entire abdominal wall, at the lateral borders of the recti muscles. This achieves wider coverage and avoids mesh contact with the bowel. Reported recurrence and complication rates were reported as more favourable than with other techniques.
- There was a delay before he was assessed by a member of the surgical team in acute hospital B, because the registrar was scrubbed in theatre. Acute surgical unit models require adequate staffing and resources. Timely assessment may have led to earlier surgical intervention.
- The damage control procedure as a part of the laparotomy was appropriate, having regard to his poor physiological status.

Reference

1. Berrevoet F et al.
   Open intraperitoneal versus retromuscular mesh repair for umbilical hernias less than 3 cm diameter.

2. Hsee L et al.
   Key performance indicators in an acute surgical unit: have we made an impact?

3. Truskett P et al.
   Acute surgery units: the future face of emergency surgery.
Patients who talk and die: preventable deaths in head injury

Case 8

A patient aged in the late 60s was admitted under a medical team, with a transient ischaemic attack and electrolyte disturbance. He underwent anticoagulation with clopidogrel. Following a quite reasonable neurological recovery and immediately prior to discharge to a subacute facility, he had a fall in the bathroom on the ward and hit his head. Over the succeeding days, he complained of headache which did not resolve. Acute neurological deterioration occurred eight days after the fall. A CT scan of the brain showed a large acute subdural haematoma. He underwent a craniotomy under cover of a platelet transfusion, but was slow to recover. A further craniotomy for a recurrent subdural haematoma was necessary, but there was no significant neurological recovery and palliative care was instituted.

Case 9

A patient aged in the early 60s was seen in the emergency department about six hours after an unwitnessed fall at home. He was being treated with warfarin, following an aortic valve replacement some years earlier. There was a possible brief loss of consciousness, but he was able to converse lucidly with his family. Later in the evening he developed headaches and vomiting and was taken to the emergency department. When he was admitted at midnight, he had a Glasgow Coma Score (GCS) of 14. Neurological observations were recorded at midnight, 0130 and 0220 hours. Between 0130 and 0220, his GCS decreased to 3 and his pupils became fixed and dilated. At 0220 the neurosurgical team was notified. A CT scan of the brain revealed an acute subdural haematoma. Vitamin K was given and a craniotomy performed to drain the haematoma. His neurological status did not improve and he died two days later.

SURGICAL LEARNINGS:

- In a patient who has a fall while receiving anticoagulation and who complains of continuing headache following a minor, or moderate head injury, consideration should be given to ordering a CT scan of the brain, to exclude an intracranial haematoma, even if there are no objective neurological signs and the GCS is 15 (a normal level of consciousness).

- In patients receiving anticoagulation who sustain a minor, or moderate head injury, the possibility of sudden neurological deterioration from raised intracranial pressure caused by a mass lesion is a well-recognised complication. It is best monitored by regular and frequent neurological observation in hospital and an early CT brain scan, repeated if necessary.
Sepsis following bowel anastomosis ... is it a leak?

Case 10

A patient in the 70s was seen in the emergency department of a rural base hospital, complaining of vomiting and loose bowel motions. He was treated with intravenous fluids, antibiotics and discharged with a working diagnosis of pneumonia and viral gastroenteritis.

He re-presented on day 3, in septic shock and with an acute abdomen. A laparotomy showed an incarcerated ventral hernia with small bowel perforation. A small bowel resection was performed. Post-operatively, he recovered well and was discharged from ICU to the ward on day 8.

He was re-admitted to ICU on day 9, when there was evidence of sepsis. Further surgery was not performed until day 13, by which time his clinical condition had deteriorated further. He was afebrile. His obesity may have confounded a clinical abdominal assessment, as no abdominal distension, nor peritonism, was recorded.

A CT scan of the abdomen revealed a free fluid, gas within the superior mesenteric vein and intramural gas in the wall of the small bowel. Distension of the small bowel also suggested mechanical obstruction. On day 11, E.coli organisms were cultured from his blood.

Laparotomy performed on day 13 revealed four quadrant peritonitis and a leaking anastomosis. A small bowel resection and anastomosis was performed. On day 15, the abdominal drains contained bowel contents. A further laparotomy was performed and the leaking anastomosis oversewn. He deteriorated further, there was evidence of small bowel contents in the drains and a decision was made for palliative care.

SURGICAL LEARNINGS:

- Although initial recovery from surgery was satisfactory, deterioration due to sepsis occurred shortly after discharge from ICU. Given the history of a recent bowel resection, consideration should have been given to a leaking anastomosis as a cause of the sepsis, a diagnosis supported by the CT scan.

- At the second laparotomy, consideration could have been given to “salvage surgery”, rather than undertaking an anastomosis in an ill, septic patient with peritonitis. Indeed, this could have been an option at the initial post-operative laparotomy.
Missed diagnosis: look at the x-rays

Case 11

A patient aged in the 80s presented to Hospital A with a six-day history of abdominal pain and constipation, which was initially diagnosed clinically as a sigmoid volvulus. There were significant co-morbidities, including chronic airway obstruction (receiving home oxygen), chronic renal failure and atrial fibrillation (on warfarin). He was managed conservatively with nil-by-mouth, intravenous fluids, a flatus tube and an enema.

The abdominal x-ray performed on day 1 was reported as showing a distal small bowel obstruction, although this was recorded in the clinical record as “? sigmoid volvulus”. A small bowel obstruction was not recognised until day 5. Conservative management continued, including a flatus tube and fleet enema, through days 2-4. His bowels opened, flatus was passed, but his abdomen remained distended.

On day 5 he vomited. A CT scan was performed, which confirmed the high-grade small bowel obstruction in the mid-ileum.

A nasogastric tube was inserted. On day 6, there was non-tender abdominal distension, but he was transferred to Hospital B, because of worsening respiratory failure.

On arrival, laparotomy was planned for day 7. In the seven hours prior to surgery, 415ml of nasogastric aspirate was recorded. On induction, gastric fluid was seen in the pharynx and subsequently in the endotracheal tube. One thousand ml was then aspirated from the stomach. The surgical pathology at laparotomy was ileal obstruction, due to adhesions. Although the procedure of division of adhesions and small bowel resection with an anastomosis (bowel ischaemia was present), was straightforward and uneventful, during the procedure there were difficulties with ventilation and he had poor oxygen saturation. His condition did not improve following the surgery and he died from respiratory failure.

SURGICAL LEARNINGS:

- Aspiration pneumonitis remains a frequent and serious complication in surgical patients. It was likely that aspiration occurred at, or before, induction of anaesthesia.
- There was a delay in diagnosis, because the significance of the initial abdominal x-ray performed on day 1 was not noted until day 5, after the CT scan. There were no features of sigmoid volvulus present on the initial plain abdominal x-ray.
- Earlier diagnosis of the small bowel obstruction would have altered management, probably resulted in consideration of the passage of a nasogastric tube and brought forward the time of surgery. Had this been so, aspiration may not have occurred.
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