

NATIONAL CASE REVIEWS VOLUME 6 NOV 2014

Australian and New Zealand
Audit of Surgical Mortality



ROYAL AUSTRALASIAN
COLLEGE OF SURGEONS

Contents

Chairman's report	1
ANZASM Clinical Editor's report	2
Overall recommendations	3
Case study 1: Lesser spinal surgery may have been better in an obese patient	4
Case study 2: Incisional hernia, obesity and infection	5
Case study 3: Possible infection from urological procedure at the same time as total knee replacement	7
Case study 4: Presentational/ initial management issues	8
Case study 5: Death of a morbidly obese diabetic patient from overwhelming sepsis arising from soft-tissue infection	10
Case study 6: Closer monitoring required in a patient with a past history of cardiopulmonary arrest and sleep apnoea	11
Case study 7: Obese patient did not get adequate DVT prophylaxis	13
Case study 8: Conservative amputation in an obese diabetic – not such a good idea?	14
Case study 9: AAA rupture in an obese patient was a technical challenge	15
Case study 10: The lateral position may improve exposure for laparoscopic splenectomy in an obese patient	17
Case study 11: Surgery for morbid obesity can be lethal – Part 1	19
Case study 12: Cystectomy complications – earlier intervention needed?	21
Case Study 13: Postoperative haemorrhage mistakenly diagnosed as sepsis in a morbidly obese patient	22
Case Study 14: Poor care in wrong hospital in a morbidly obese patient	24
Case Study 15: Surgery for morbidly obese can be lethal – part 2	26
Case study 16 : Neurosurgical cases not exempt	28
Shortened forms	29
Contact details	30

DISCLAIMER: This booklet is produced for Fellows of the Royal Australasian College of Surgeons. Information is obtained under a quality assurance activity. Detail that may identify individuals has been changed although the clinical scenarios are based on real cases.

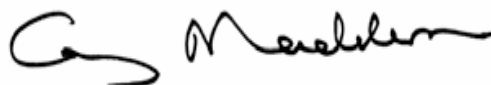


Chairman's report

In this sixth National Case Note Review Booklet of the Australian and New Zealand Audit of Surgical Mortality (ANZASM) there is a particular focus on obesity as a factor in surgical mortality. All surgeons are seeing an increasing number of obese patients requiring complex elective and emergency surgery. This provides unique challenges for surgical access and difficulties in the assessment of patients for both the pre- and post-operative phases of their surgery. It comes as no surprise that as this increase in the size of our patients continues there will be greater difficulties in their management.

ANZASM now covers all States and Territories in Australia. Each state/ region has its own audit office to keep the process local; however, cases from each region are pooled in this National Case Note Review Booklet. The Royal Australasian College of Surgeons (RACS) has made participation in the audit (where it is available) mandatory as a part of the Continuing Professional Development (CPD) requirements for all surgeons. The Medical Board of Australia similarly requires that all registered medical practitioners participate in an appropriate CPD program. The Commonwealth Qualified Privilege legislation ensures that the data can only be used for the purposes of the audit so contributions from treating surgeons and assessors are absolutely confidential and privileged.

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



Guy Maddern

Chair, ANZASM Steering Committee

ANZASM Clinical Editor's report

The sixth booklet includes cases from all 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 assist smaller states who do not have enough cases to produce their own booklet, and particularly to assist in the de-identification process. The smaller states (including South Australia) do not publish their own booklet. Some of the larger states will continue to publish their own case note review booklets as well as contributing to the national booklet.

The cases in this booklet are from a variety of specialties. Some 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.

Most of the cases reported here have a common theme of morbid obesity. This modern disease has a serious impact on all surgical specialities, including difficult access in abdominal and vascular surgery and cardio-respiratory complications in all specialties. It is a very significant co-morbidity which should not be underestimated.

As the ANZASM office is in the same building as the South Australian Audit of Perioperative Mortality (SAAPM) office, it seemed logical that the final clinical editing process would be done by the Clinical Director of SAAPM on behalf of ANZASM. I must emphasise that I did not write this booklet. The real authors are the treating surgeons, the Clinical Directors, and the First- and Second-line assessors of the various States and Territories. To the assessors and the treating surgeons we all owe a debt of gratitude as this publication would not be possible without them. Please learn from these cases.

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



Overall recommendations

- In complex cases, there needs to be clear, demonstrable leadership in patient management. There should be regular team meetings with all disciplines involved to ensure the treatment plan is understood by all.
- Communication is one of the most essential factors in good patient care. This includes communication between surgeons and their junior staff, between disciplines, and between nursing and medical staff. If you do not tell others what you are thinking or what is happening, everyone will be functioning in isolation.
- All clinicians should provide clear and relevant records – many of the cases in this report show deficiencies in record keeping.
- The surgical case form record must contain good, accurate documentation. It should be filled out by a team member who was involved in the care of the patient and has sufficient experience to contribute in a useful fashion to the audit process. If junior staff members complete these reports, they must be checked by a consultant or the junior staff must be informed in advance on the salient points to record.
- Where clinical deterioration occurs in a patient with no clear cause, it is important to remember that the cause may be related to something outside of your specialty knowledge base.
- An acute abdomen in an elderly patient is a very dangerous condition and needs careful management to avoid missing visceral perforations, leaking anastomoses and ischaemic gut.
- Consultants should be actively involved in the care of their patients, including the decision-making process. They should also be willing to obtain other opinions if something is 'not right'.
- Morbidly obese patients are at greater risk of developing cardio-respiratory complications that may be underestimated.

Case study 1: Lesser spinal surgery may have been better in an obese patient

Case summary

A woman in her late-60s presented with a history of low back pain. She had a recent history of increasing pain, numbness and weakness in the legs which limited her walking endurance to 50 metres on a walking frame. There was some relief of her symptoms when lying down. The patient had an extensive past medical history with a number of comorbidities later described as moderately significant. These included obesity (body mass index (BMI) greater than 40kg/m²), non-insulin dependent diabetes, a nephrectomy for carcinoma of the kidney, a mastectomy for carcinoma of the breast, and hysterectomy for carcinoma of the uterus.

A subsequent magnetic resonance imaging (MRI) scan of the lumbar spine showed stenosis of the spinal canal with a degenerative spondylolisthesis. Her operation lasted more than five hours involving a three-level lumbar spine decompression, interbody fusion with segmental fixation to the pelvis. The estimated blood loss was 1,200 ml, but postoperative haemoglobin on the following morning was 8.9g/dL. Calculated according to her weight, the total blood loss over the preceding 24 hours, including the operation, would have been in the order of 2.8–3.0 L.

Postoperative day two, the patient was reported as being unwell. She had poor intravenous access and was

being infused through subcutaneous catheters. Oral fluids were being encouraged. It was noted, however, that over a period of eight hours, her total urine output had only been 66 ml. Blood tests at the time showed a moderate increase in serum creatinine and a moderate decrease in glomerular filtration rate (GFR).

In the early evening, the patient showed signs of some respiratory failure. The urinary output had not improved and two peripheral intravenous (IV) catheters were inserted. A short time later, the patient started vomiting and became unconscious and unrousable. She had a cardiac arrest which was reversed with defibrillation. She was subsequently transferred to the intensive care unit where investigations showed a marked deterioration of renal function with a steep rise in creatinine and fall in GFR. The chest x-rays showed the consolidation of the left lower lobe of the lung with an effusion. Abdominal radiology showed distended loop of small bowel consistent with paralytic ileus.

The patient remained in intensive care until her death eleven days post-operation. She never recovered consciousness. She remained anuric and was treated with dialysis. She continued to have hypoxic respiratory failure and subsequently developed multifocal consolidation of the lungs consistent with acquired respiratory distress syndrome (ARDS) with bilateral pleural effusion. Terminally, she had multiple organ failure with evidence of general sepsis.





Clinical lessons

This patient presented with severe restrictions of her mobility due to back and leg pain with confirmed multilevel spinal stenosis. In addition, she had an extensive past medical history with a number of significant comorbidities. It was reasonable to offer the patient surgery. Various surgery options were available, however the primary aim in the surgical management of spinal stenosis is decompression. The addition of a spinal fusion is a treatment option largely dependent on the patient's general status. It appears that the significance of the comorbidities was underestimated. Sometimes it is necessary to offer a lesser procedure when the patient's general health is suboptimal.

The patient underwent surgery including decompression. In addition, she had spinal fusion and stabilization. The operation took more than five hours and in retrospect the addition of the spinal fusion and instrumentation may have been excessive given her age and comorbidities.

The patient did poorly postoperatively, developing a paralytic ileus. In addition, she had problems maintaining intravenous fluids. She had a prolonged period during which the urine output was substantially diminished. Given that the patient only had one kidney, providing adequate IV access for fluids was essential. The morbid obesity was probably a factor in the difficulty of intravenous access. Subcutaneous administration of IV fluid, particularly in the presence of what appears to be an unrecognized paralytic ileus, was inadequate and inappropriate.

The seminal event was vomiting brought on by the paralytic ileus with probable aspiration, which resulted in cardiac arrest. Although she was resuscitated and subsequently nursed in the intensive care thereafter, she never recovered consciousness. She developed respiratory insufficiency due to ARDS and an acute renal failure. Terminally, she had a multiple systems failure. The outcome was inevitable. Paralytic ileus is a not uncommon complication of extensive lumbar spine surgery and appears not to have been considered up to the time of her vomiting and seminal event. Furthermore, the management of her postoperative IV infusion was suboptimal given the past history of nephrectomy.

Case study 2: Incisional hernia, obesity and infection

Case summary

A young patient was operated on in a rural/base hospital setting. The patient underwent an elective, laparoscopic, ventral hernia repair for a recurrent hernia. There was a documented background history of necrotising fasciitis complicating a prior ventral hernia repair. In addition to this, there were the separate comorbidities of hypertension and morbid obesity (BMI 43, weight 140 kg at autopsy).

The patient underwent surgery on an elective list with the operation report documenting adhesions being divided and a mesh repair of the

hernia secured with a combination of sutures and fascial fixation devices. There were no reported intraoperative complications. The patient went back to the general ward postoperatively.

Within a few hours of surgery and over the next two days, the patient complained of refractory pain despite significant analgesia. The patient subsequently developed protracted vomiting one day postoperatively. The patient was reviewed by the surgical consultant and registrar on the Friday morning and by the consultant again on the Saturday morning after the surgery. The surgeon's clinical findings and opinion, according to the notes, were that the pain was presumed to be due to poor analgesic control.

The patient started to demonstrate hypotension and tachycardia on the Saturday evening and had a MET I arrest call in the early hours of Saturday morning. At that time, the patient was assessed to have acute renal failure due to probable abdominal sepsis. A CT scan was performed and free fluid was noted. The patient was taken to theatre for a laparotomy where small bowel was resected and anastomosed. There were changes of necrotising fasciitis involving the abdominal wall and subcutaneous fat. This was all aggressively debrided.

While in ICU after this second operation, the patient remained septic and shocked despite resuscitation and was returned to theatre the next day for a third operation where further necrotic fat was debrided. Due to the patient's critical condition, the patient was transferred to a major metropolitan tertiary centre for

ongoing management and dialysis. At the tertiary centre, a repeat laparotomy (fourth operation) was performed to ensure there was no ongoing reversible abdominal process. This laparotomy did not require any further debridement. On return to ICU at the tertiary hospital, brain death was confirmed due to overwhelming circulatory collapse and sepsis causing cerebral oedema. Treatment was withdrawn and the patient died approximately six days after the original operation.


Clinical lessons

The case was referred to the coroner and the finalised report identified the direct cause of death as 'complications of surgically treated incisional hernia'.

While iatrogenic small bowel injury ultimately led to the severe sequence of events and eventual death of this patient, it was the delay in diagnosis of this complication that led to the established sepsis and multi-organ failure. Recommendations surrounding the delay in diagnosis are the focus here.

On review of the medical record, it seems that there was a period of approximately 48 hours between the onset of severe postoperative pain and the identification of a probable abdominal catastrophe. As far as can be determined, there was no record of any blood work postoperatively until the patient became septic. At that point, the creatinine was already approximately 400. While routine postoperative bloods are not usually necessary, an earlier set of bloods when the patient complained of severe pain may have identified an issue prior to severe sepsis and prompted earlier investigation or transfer to HDU.





Additionally, worsening abdominal pain, not responding to analgesics, and then the onset of vomiting a day prior to the sepsis could have led to enough clinical suspicion to warrant investigation or an earlier return to theatre. It is recommended that these points be considered in the event a comparable clinical situation arises.

Consideration also needs to be given to the implications of surgery on a morbidly obese patient in a rural setting.

Case study 3: Possible infection from urological procedure at the same time as total knee replacement

Case summary

A patient in their mid-80s was admitted to hospital for an elective total knee replacement (TKR). The patient had an extensive medical history and was noted to have had an acute myocardial infarction ten years previously, and an abdominal aortic aneurysm (AAA) repair six years previously. The patient was obese, an ex-smoker, and was suffering from chronic obstructive pulmonary airways disease (COPD) with CO₂ retention. The patient had undergone an uncomplicated right knee replacement two years previously under an epidural anaesthetic.

The patient was at high risk of having postoperative deep venous thrombosis and a lower respiratory tract infection. The patient was reviewed in the anaesthetic clinic

four days later and noted to have symptomatic ischaemic heart disease, and was sent for further cardiology review. The cardiologists' review stated that on the risks of cardiac grounds alone the patient was a low perioperative risk. The operative plan involved the use of an epidural and a planned admission to either the intensive care unit (ICU) or the high dependency unit (HDU) postoperatively.

The patient underwent a left cemented total knee replacement. The operative and intensive care notes state that the patient had a spinal anaesthetic as a result of a failed attempt at an epidural anaesthetic. The estimated blood loss at that stage was noted to be 400 ml and the patient was given intravenous Kefzol and Gentamicin. It is also noted that immediately upon completion of the TKR, the patient underwent a cystoscopy procedure for reasons that are not clear in the notes.

Twenty four hours after being admitted to ICU, it was noted that the drain had produced 900 ml of blood loss and the dressings were noted to be bloodstained. There is no record as to whether the drain was actually clamped overnight to stop the blood loss. The patient started to become agitated within 24 hours postoperatively and was noted to have a non-ST segment elevated myocardial infarction (NSTEMI), confirmed by a rise in the troponin level.

Over the next 24 hours, the patient became increasingly agitated and confused, leading to intubation in ICU. Approximately 48 hours post-surgery, the patient was noted to be oliguric and had a troponin elevation to 2.6.

A family conference was called by the Intensive Care department, the orthopaedic team and the family, and a not-for-resuscitation (NFR) order was signed. The following day, the patient developed cardiogenic shock and sepsis, probably attributable to an aspiration pneumonia of the left lower lobe of the lung. A decision was made five days post-surgery with the family's consent to withdraw all ventilatory and inotropic support. The patient died shortly thereafter with the cause of death attributed to: an acute myocardial infarction; pre-existing coronary artery disease; an aspiration pneumonia; and pre-existing obesity.

Clinical lessons

It is difficult to ascertain from the outpatient notes just how debilitated the patient was as a result of osteoarthritis in the left knee. Despite the high number of pre-existing comorbidities it would appear that there was a successful right total knee replacement two years previously, which may have given the treating team hope that there would be no issues in the postoperative period.

The patient had an adequate preoperative work-up and was reviewed by the general medical team, the cardiology team and the anaesthetic team. A plan was created for the pre-, peri- and postoperative management, all of which were executed as planned. The patient appears to have suffered an acute myocardial event early in the postoperative period which led to the cardiogenic shock. The lower lobe pneumonia was predicted as a possibility by the perioperative medical team assessment.

It should be considered unusual that a patient underwent an invasive procedure of the genitourinary tract immediately following, and in the same anaesthetic period as, a total knee replacement. It is possible that the sepsis may in fact have come from the instrumentation of the genitourinary tract and then seeded into the freshly operated left knee.

If this patient required a cystoscopy, it should have been done either before the knee replacement surgery or at a separate operative time. Possibly, the patient's poor preoperative morbidities were seen as an indication for the two operations to be performed during the same anaesthetic period. There is an incidence of sepsis up to twelve weeks later with instrumentation of the genito-urinary tract.

Case study 4: Presentational/ initial management issues

Case summary

An elderly diabetic & morbidly obese patient underwent planned repair of recurrent umbilical hernia. An underlay meshplasty using composite mesh was performed. The patient continued to experience nausea and vomiting for 48 hours postoperatively and was discharged on the third postoperative day following passage of flatus and bowel movement. However, the patient was brought back to ED 24 hours later having collapsed at home, complaining of abdominal pain and vomiting in a severely compromised physiological state.





The patient was hypothermic, hypotensive and acidotic with high lactate. The WCC was 30,000 and renal function was deranged. The patient continued to deteriorate in spite of ongoing resuscitation and underwent a laparotomy. An early recurrence of the hernia with prolapse of small bowel resulting in its ischemia was found at the laparotomy. Resection of the infarcted bowel with temporary abdominal closure was performed without establishing bowel continuity as a damage control procedure. The patient continued to deteriorate in spite of maximal Intensive Care Unit (ICU) support, culminating in multiple organ failure and death.

Clinical lessons

Area of concern:

The primary surgeon used 8 cm diameter composite mesh with four corner stitches and a further row of continuous stitches close to the defect. The mesh was positioned intraperitoneally. However, the surgeon indicated in the operative notes that the defect was large and surrounding tissues were attenuated. The size of the mesh seems to have been inadequate to achieve tension-free repair with 3–5 cm of mesh beyond the defect in all directions (as indicated in the surgical case form completed by the primary surgeon). The use of only four corner stitches will have left a substantial area of the mesh between the stitches not in proper approximation with the abdominal wall, leading to a potential for the bowel to herniate between them. Sutures are prone to ‘cheese wire’ through attenuated tissues and a continuous stitch is quite likely to lose its efficacy in a situation of this kind, especially if the repair is under tension.

All intraperitoneal meshes are prone to adhesion formation. The literature supports retro rectus, pre-peritoneal placement of the mesh with a series of interrupted sutures placed through the entire abdominal wall (transfascial) at the lateral aspect of rectus muscles. This achieves wider coverage and avoids mesh contact with the bowel. Reported recurrence rates and complication rates for this technique are more favourable.¹

In this case, it seems likely that the small bowel loop prolapsed through the defect in between the corner stitches and became trapped, resulting in ischemia and systemic inflammatory response syndrome (SIRS), ultimately leading to multiple organ failure. This complication could have been prevented if appropriately sized mesh and adequate fixation stitches had been used at the first operation.

Area for consideration:

The postoperative course after the first operation deviated from the expectation. The surgeon anticipated that the patient would be ready for discharge the day after the surgery. The patient vomited a number of times during the 48 hours after surgery and had delayed return of the gut function. In retrospect, these could have been early signs of bowel obstruction.

As documented in the preoperative check list, the patient had been fasting for more than 15 hours prior to the surgery. Postoperative fluid management after the first operation was difficult to assess.

¹ Open intraperitoneal versus retromuscular mesh repair for umbilical hernias less than 3cm diameter. Berrevoet F et al. American Journal of Surgery. 2011(1):85-90, 2011 Jan

The patient seems to have been intermittently supported with intravascular fluid (IVF) during the stay. The renal function showed significant derangement on first postoperative day as compared to preoperative level in spite it remaining within normal laboratory range (urea rising to 8.2 from 4.9, creatinine to 105 from 55, and estimated Glomerular Filtration Rate (eGFR) falling to 44 from more than 90). This may have contributed to the patient's reduction in physiological resilience.

There was a delay in the surgical assessment at the second hospital due to the surgical registrar being scrubbed in theatre. During this delay of at least eight hours between presentation and surgery, attempts were made to resuscitate the patient. An adequately staffed and resourced Acute Surgical Unit model might have contributed to a timely assessment of this patient, leading to early surgical intervention.²

Continued deterioration appropriately guided the second laparotomy. Damage control procedure was appropriate, considering the physiological state of the patient. It is unclear from the presented documents whether the hospital is able to satisfactorily treat morbidly obese patients and whether there are sufficient safe guards in place to do so. The size of the defect, the size of the mesh used, as well as the mode of fixation of the mesh, could not be established from the documentation provided.

² Key performance indicators in an acute surgical unit: have we made an impact?. Hsee L et al World Journal of Surgery. 36(10):2335-40, 2012 Oct.

Case study 5: Death of a morbidly obese diabetic patient from overwhelming sepsis arising from soft-tissue infection


Case summary

This morbidly obese patient in their mid-40s was treated for an infected laceration on the left leg at a regional hospital. The patient was then re-presented, via casualty, in septic shock and multiple organ failure at the same hospital two weeks later.

There are 340 pages in the medical record. Approximately three of these pages relate to surgical notes. There were no formal notes written in the chart by the consultant surgeon, although there were some transcriptions.

On admission, there was clearly concern about the nature of the primary source of the sepsis. An exploration of the leg in the ICU was recorded in the notes by a Medical Officer. There is no mention of a consultant surgeon being present. A clinical diagnosis of a compartment syndrome is suggested, but there does not seem to have been an attempt to measure compartmental pressures. The operator describes: 'no pus, no fasciitis. Viable tissue'. A medial fasciotomy seems to have been performed. However, the surgeon filling out the surgical case form stated that necrotic muscle was present. This suggests that myonecrosis was present, and is at odds with the hospital record.





The terms myo-necrosis or necrotising fasciitis are not mentioned in the postmortem, and may not have been the source of the sepsis. Both a staphylococcus and a streptococcus were isolated from the wound, and a cellulitis itself may have produced this syndrome of overwhelming sepsis (as has been suggested by the pathologist). The changes of necrosis may have been secondary to the consequences of a compartment syndrome, and an inadequate fasciotomy in a rapidly deteriorating patient.

Clinical lessons

When decisions are made about a patient 'in extremis', consultant input is mandatory. The consultant surgeon has to take responsibility for diagnosis and treatment of acute surgical problems. This responsibility should be clear in the medical record.

On reflection, this patient was probably not salvageable, whatever the nature of sepsis in the leg. The surgical diagnosis should have been pursued, however, as there may at least have been an indication for life-saving amputation in the presence of necrosis from any cause. Due to the poor surgical records relating to this admission, the precise diagnosis remains elusive.

Case study 6: Closer monitoring required in a patient with a past history of cardiopulmonary arrest and sleep apnoea

Case summary

A patient in their late-70s was admitted for a left TKR. Comorbidities included obesity with a BMI of 47, atrial fibrillation (AF), a history of smoking, congestive cardiac failure, renal impairment, insulin use for Type 2 diabetes, sleep apnoea (presumed), gastroesophageal reflux disease, hypertension and hypercholesterolemia. The patient also had a previous right TKR, after which the patient sustained a respiratory arrest.

There was no suggestion of intraoperative complications, with an appropriate surgical time of approximately two hours. Preoperatively, the cardiac function was assessed with the transthoracic echocardiogram, which showed left ventricular hypertrophy, but normal systolic function and no haemodynamically significant valve dysfunction. Also, the preoperative blood work was essentially normal. The patient was known to have sensitivity to opioids and a femoral nerve catheter was inserted prior to surgery.

Postoperatively, the patient was stable. Later that day the patient was reviewed by the pain service who noted that the patient was drowsy and felt it appropriate to leave the femoral nerve catheter in situ for longer, given the patient's sensitivities to opioids. At 1.30 pm, a Medical Emergency Team

(MET) call was made for hypoxia with the patient saturating at 80 per cent on six litres of oxygen. The patient was given naloxone and frusemide and the oxygen increased to 15 L via a Hudson mask. The patient had evidence of type-two respiratory failure but improved with the naloxone. The medical notes suggest some cardiac failure although the chest x-ray report at this time does not confirm fluid overload.

Day two post-surgery, the patient was considered stable although there was some evidence that renal function was deteriorating. The femoral nerve catheter remained in situ, and at this stage the patient was saturating at 93 per cent on four litres via nasal prongs. Physiotherapy commenced during the day, following a review by the pain team, and the patient appeared stable.

The patient was reported to be alert and chatting early the next morning and at 1.15 pm was administered 2.5 mg of Endone, to which it was noted that the patient responded well. No other respiratory sedative agents were administered. According to the notes, the patient was next checked at 7.00 am the following morning, at which time they were found to be unresponsive, cyanotic and pulseless. A Code Blue was called and cardiopulmonary resuscitation (CPR) commenced, but the patient was pronounced dead shortly thereafter.

Clinical lessons


This patient may have been a more risky proposition for surgery than originally recognised. The patient had significant comorbidities and had a previous respiratory arrest after having the right knee replaced only the year before. Significant cardiac and

respiratory comorbidities probably warranted the patient being considered for a High Dependency Unit (HDU) bed. Previous sensitivities to opioids, morbid obesity, and a possible history of sleep apnoea may all have potentially contributed to the cardiorespiratory arrest. The exact nature of the cause of death, however, is not clearly identifiable and a coroner's report for the accurate cause of death would be valuable to review.

In terms of the medical management, the initial diagnosis of congestive cardiac failure has not really been substantiated well and it also appears that the medical teams were concerned about the low urine output, which in fact may have been normal in the first 24 hours after surgery. There is little clinical evidence to support a diagnosis of fluid overload; it is more likely that the respiratory failure was related to the patient's sensitivity to opioids, obesity, possible lung disease from having been a smoker, and potentially underlying sleep apnoea. The use of high flow oxygen may also have been an issue if the patient was relying on oxygen drive for triggering ventilation.

The major area of concern in this case relates to the environment in which the patient was managed. It appears that the patient remained on the ward despite having multiple MET calls and the involvement of the ICU liaison. In hindsight, it may have been more advisable for the patient to have been admitted to a high dependency unit, especially given the patient's previous cardiorespiratory arrest following knee replacement and their known sensitivity to opioids. On balance, the medical management may be considered to have been reasonable, however closer observation of the patient was probably required.





Case study 7: Obese patient did not get adequate DVT prophylaxis

Case summary

This patient in their 30s was a morbidly obese diabetic who was crushed between two cars, but was not trapped and did not require extraction. The patient was taken to hospital where a diagnosis of a fractured acetabulum was made. Initial management was with traction through a femoral pin. The fracture was fixed with screws and a plate.

The following day, a diagnosis of a large left pulmonary artery embolism was made. At that stage, treatment was undertaken with therapeutic doses of Clexane. Three days later, the patient complained of abdominal pain and vomiting, following which cardiac arrest and then death occurred.

Clinical lessons

Based on the notes provided, there appears to be no record of consultation with anyone other than a haematologist following the first pulmonary embolus. All of the notes appear to have been written by the junior orthopaedic team. There appears to be a discrepancy reoperative Clexane. While this is referred to in the nursing notes with a suggestion that 20 mg was an insufficient dose, there is no record of Clexane being put on the drug order chart.

This first appears after the pulmonary embolus and is a therapeutic dose of 100 mg. The summary provided by

the registrar comments on the use of Clexane therapeutically and also on the failure to provide an Inferior Vena Cava (IVC) filter, stating this was considered inappropriate. There is, however, no mention of this discussion in the notes. It is reasonable to expect a pivotal decision such as this to be noted.

It would have been prudent for the management of Deep Vein Thrombosis (DVT) prophylaxis in this high-risk patient to have been directed by a medical team. Especially following the complication of pulmonary embolus, the involvement of specialists in such instances is considered paramount. The involvement should include examination of the patient and closer monitoring of the management regimen. The opinion of appropriate specialists on therapeutic measures such as IVC filters should be sought, particularly in a case such as this one in which a young patient already has one pulmonary artery severely compromised by a large embolus.

This aspect of the management of this case should be considered suboptimal. The issue of pre- and early postoperative anticoagulation could have been addressed with an appropriate postoperative checklist that could have been consulted on a daily basis during the postoperative period (N.B. While being largely a nursing reminder, the Care Plan in the notes does not include DVT prophylaxis). Appropriate specialists should have been more heavily involved in the management of complications outside the first area of expertise of the managing unit.

Case study 8: Conservative amputation in an obese diabetic – not such a good idea?

Case summary

An obese diabetic patient in their late-50s with gangrene affecting the right second, third and fourth toes was admitted to hospital as an emergency public patient under the care of a general surgery consultant. The patient was described as morbidly obese with 'end-stage' diabetes and complications of retinopathy and chronic renal failure. A left below-knee amputation had been performed 12 months earlier.

The patient was treated with intravenous antibiotics for cellulitis to the foot, and the blood supply to the leg was assessed by Doppler ultrasound. It was reported that there was occlusion of the only patent artery in the leg, the anterior tibial artery around 10 cm above the ankle joint. Three days after admission, the patient proceeded, after a 24-hour delay due to theatre access issues, to have the second, third, fourth and fifth toes amputated under a spinal anaesthetic.

Wound healing was suboptimal and the patient was returned to the operating theatre and, again under a spinal anaesthetic, had a forefoot amputation. The patient was seen that day by one of the medical teams and required treatment for worsening cardiac failure and pneumonia. Two days later, a MET call was made after the patient collapsed on the ward. The patient's condition remained poor over the next three weeks.


A note was made that there was die-back of the wound edges on the foot and that, following a second Doppler arterial ultrasound, there were signs of 'inoperable distal disease'. The patient's condition remained poor, and shortly afterwards a below-knee amputation was performed under a general anaesthetic given by a locum anaesthetist. After returning to the ward, however, the patient became nauseated and unwell and was transferred to the intensive care ward that night where the patient was treated with three units of blood transfusion and appropriate analgesia. Blood pressure remained low and the patient was oliguric and tachycardic. The patient died from what was stated to be acute myocardial infarction approximately 36 hours after the final operation.

Clinical lessons

The quality of the record keeping in this case was good, providing a clear account of a steady decline in the patient's condition during the hospital stay. However, a more detailed vascular surgery assessment prior to the first operation may have contributed to a more favourable outcome. The surgeon commented on the initial assessment that he or she did not want to give the patient a 'double amputation to start with and so tried leg conserving surgery'.

If that was the case, then a longer preoperative course of antibiotics, better assessment of the arterial supply by CT angiogram, and the input of a vascular surgeon would have been worthwhile. The end result may not have been any different, but it might at least have been arrived at with fewer operations.





Case study 9: AAA rupture in an obese patient was a technical challenge

Case summary

A 70-year-old man was referred by their general practitioner (GP) to the emergency department (ED) with an eight-hour history of loin and testicular pain. Initial suspicions highlighted by the GP included a urological or vascular cause (presumably ureteric colic), testicular torsion, and ruptured abdominal aortic aneurysm (AAA). At the time of review by the GP, the patient was normotensive and stable. Morphine was given for pain and ambulance transfer arranged. Past history included COPD, obesity, diet-controlled Type 2 diabetes, hypercholesterolaemia and a previous history of smoking.

No ED or ambulance notes were supplied. An ED ultrasound provided evidence of a large AAA. A non-contrast CT was performed, confirming a 10 cm aortoiliac aneurysm and a contained retroperitoneal rupture. At surgery, a large aortoiliac aneurysm was encountered. Control of the proximal aorta was technically challenging and time consuming owing to the patient's obesity. During the eight-hour operation, bypass to the right common femoral artery and left iliac bifurcation was performed, as well as a right femoral thrombectomy. Postoperatively, the patient became oliguric with dark stained urine, and CK rose to 117,000. Haemofiltration was commenced in ICU.

A stormy postoperative course followed with intermittent rapid AF, oozing from the laparotomy wound, and prolonged intubation with subsequent tracheostomy. Broad-spectrum antibiotics were commenced for sepsis but inotrope requirements increased progressively. CT after one week revealed no new pathology. The patient continued to deteriorate with rising WCC, and required maximal-dose noradrenaline and vasopressin. Despite a family meeting where 80 per cent mortality was discussed, a further exploratory laparotomy was performed which found no specific pathology and did not improve the patient's condition.

Over the course of the next few days, the patient demonstrated no improvement in any parameter. Two weeks after admission, concerns were raised about increasing acidosis, serum lactate and unresponsiveness to inotropic agents. Repeat CT was performed, demonstrating postoperative gas around the aortic graft, and some jejunal thickening indicative of ischaemic small bowel. General surgical opinion was sought and a decision made not to escalate treatment. Inotropes and ventilation were withdrawn and death ensued almost immediately.

Clinical lessons

1. Role of CT imaging in suspected ruptured AAA:

While the ED notes are absent and it is not possible to determine the details of events in ED, it would appear that there was enough information to make a presumptive diagnosis of ruptured AAA based on history and ultrasound evidence. As rapid CT facilities have

developed, there has been a trend towards more preoperative imaging in patients with suspected or known ruptured AAA. The role of such imaging must be considered carefully and the target information clearly specified (i.e. non-contrast for aneurysm extent or confirmation of rupture only, or with contrast for emergency EV AR planning, irrespective of renal function). There should not be undue delay to theatre as there is very limited benefit in survival from preoperative CT imaging, unless the intention is to perform emergency EV AR.

2. Surgical fatigue and the value of senior assistance:

Ruptured aortoiliac aneurysm requires more complex and longer surgery, and carries significantly higher mortality in comparison to a straightforward ruptured AAA requiring tube graft repair. In the setting of a long, complex and technically challenging procedure, physical and mental fatigue can also become an important issue. The operation notes were scant and did not reflect the technical challenge of the procedure as evidenced by the anaesthetic chart. An extra pair of experienced hands can sometimes make light work of a difficult task, and in many cases surgical colleagues are willing to assist even when they are not on call. There is no shame whatsoever in approaching one's colleagues for help.

3. Recognition and management of prolonged ischaemia:

Two main complications arose from the length of the procedure: lower limb ischaemia and reperfusion injury with associated myoglobinaemia and

metabolic stress, and acute renal failure due to a combination of acute tubular necrosis and myoglobinuria. If suprarenal clamping had been applied, the risk of renal failure would have been further increased. In this case, prophylactic leg fasciotomies were not performed, but may have been of value in reducing the potential myo-necrotic stress from compartment syndrome.

4. Advance care planning and limitation of support:

Over the following two weeks, despite the fact that the patient was deteriorating on multiple fronts, treatment continued to escalate. It is not clear whether the ICU or surgical team was responsible for setting the overall tone of treatment but it required a third team to indicate the futility of further treatment. The philosophy of care in different ICUs can vary widely, but when clear goals or targets are not kept in mind patients can be allowed to languish and/or receive futile care with the result of prolonging patient discomfort, family anxiety and grief, and the overconsumption of limited health care resources.





(5) Role and timing of re-laparotomy, consideration of abdominal compartment syndrome:

Re-laparotomy was performed after some delay and despite recognition of clinical futility. There may have been a case to perform this earlier for suspected abdominal dehiscence when a stoma bag was required to collect fluid discharge from the laparotomy wound, or at the earliest suspicion of ischaemic gut. In patients with large haematoma from ruptured AAA, prolonged intra-abdominal surgery and aggressive fluid resuscitation, especially in the setting of obesity, abdominal compartment syndrome may contribute to postoperative renal failure and ventilatory compromise. There may have been a role for primary laparoscopy at the time of initial surgery.

Case study 10: The lateral position may improve exposure for laparoscopic splenectomy in an obese patient

Case summary

This patient in their mid-60s had steroid-dependent idiopathic thrombocytopenia and was morbidly obese with a weight of 113 kg and a height of 1.3 m (BMI 67). A splenectomy was scheduled. The patient was appropriately managed to optimise the platelet count. A laparoscopic splenectomy was

attempted by a consultant surgeon and registrar. The patient was supine on the operating table and the spleen was mobilised. Bleeding occurred from the splenic vessels near the tail of the pancreas, said to be due to traction. The operation notes indicate that it was difficult to retract due to the patient's obesity. In addition, the laparoscopic camera had significant interference with snow on the screen of the monitor. This was not considered to be correctable. The patient was then converted to an open operation via a left subcostal incision. The splenic vessels were then amputated with the stapler, a process which included a portion of the pancreas, which was oversewn. A drain was placed, and the procedure completed.

The patient's recovery was slow but satisfactory. By the fifth day, there was considerable ooze from the abdominal wound. On the ninth postoperative day, a left intercostal catheter was placed and this drained 1.3 L in the first hour. Later that day, the patient became very unwell, hypotensive and required admission to ICU for inotropic support. The patient returned to theatre for a laparotomy where a wound dehiscence was identified together with a wound infection. The consultant surgeon and registrar identified a necrotic greater curve of the stomach, which was excised. The necrotic tail of pancreas was also excised. The patient remained in ICU and again was returned to the operating theatre for a further laparotomy. At this operation, a perforation of the transverse colon was identified and a stoma fashioned. A diaphragmatic defect was repaired and further debridement of the necrotic tail of pancreas was carried out. The

wound was not closed fully but left to granulate by secondary intention.

The patient made slow progress over the next few weeks, but again deteriorated. The patient declined further active intervention and died almost three months after the first operation.

Clinical lessons

A decision to operate in this patient was very reasonable as the patient was steroid dependent. The laparoscopic approach in this case is considered to have been the correct one; there was much to gain in view of the patient's obesity. The patient was reportedly supine on the operating table. The standard approach to laparoscopic splenectomy has changed over the past few years so that most surgeons now carry out this operation with the patient in a lateral position (right side down) with the table broken, as would happen for a nephrectomy-type procedure. This position allows improved exposure of the spleen by automatically retracting away the stomach and other organs.


Surgeons should give consideration to using a lateral approach for future operations. It is notable that there were technical problems with the camera and monitor during this operation. Clearly, visualisation is one of the most important aspects of laparoscopic surgery and these problems would have been very frustrating for the surgeon. In this situation, one would normally give consideration to the availability of another laparoscopic stack or even support from the Medical Physics Department.

It is unclear from the operation notes as to whether a harmonic scalpel was used in the laparoscopic

splenectomy. There is published evidence that the use of a harmonic scalpel for laparoscopic Nissen fundoplication is a safe and rapid approach to mobilising the short gastric vessels. While publications may not specifically describe its use in laparoscopic splenectomy, it would seem reasonable to extrapolate the use of this instrument in such cases. It is uncertain if the use of a harmonic scalpel would have prevented the complication of greater curve gastric necrosis, but it was following this event that the patient's condition gradually worsened until the end result of death.

It is unclear from the operation notes as to whether a harmonic scalpel was used in the laparoscopic splenectomy. There is published evidence that the use of a harmonic scalpel for laparoscopic Nissen fundoplication is a safe and rapid approach to mobilising the short gastric vessels. While publications may not specifically describe its use in laparoscopic splenectomy, it would seem reasonable to extrapolate the use of this instrument in such cases. It is uncertain if the use of a harmonic scalpel would have prevented the complication of greater curve gastric necrosis, but it was following this event that the patient's condition gradually worsened until the end result of death.





Case study 11: Surgery for morbid obesity can be lethal – Part 1

Case summary

A patient in their mid-50s had a vertical banded gastroplasty for morbid obesity. There was satisfactory weight loss for the first few years, but this did not last. Weight gain rose to more than 160 per cent of the patient's ideal weight. This led to a bilio-pancreatic bypass procedure. A cholecystectomy was also performed at the same time. An operative cholangiogram was reported as being normal and the pathology report indicated the presence of 'chronic cholecystitis'.

The patient rapidly lost weight. Within four months of the bilio-pancreatic bypass, the patient was less than 130 per cent of their ideal body weight. This was associated with a number of relatively minor clinical problems and a CT scan of the abdomen recorded 'intense fatty infiltration of the liver'.

After cutting their leg on holiday, the patient developed cellulitis, accompanied by liver failure without the stigmata of chronic liver disease. At that time, the serum albumin was 22 g/L and the serum bilirubin was more than six times the upper limit of normal.

The patient consulted a hepatologist. During the next couple of months, the abnormal liver function tests improved and a liver biopsy revealed that there was complex hepatocellular injury with steato-hepatitis, portal fibrosis, bile duct proliferation, and haemosiderosis. It was felt that severe

protein undernutrition contributed to the liver failure and the hepatologist also commented that 'there are reports of liver failure occurring after this procedure as a result of severe steato-hepatitis requiring liver transplantation and there have been reported deaths'. The patient was subsequently labelled as having non-alcoholic hepatic steatosis.

Both the surgeon and the hepatologist thought it advisable for the patient to undergo a reversal of the biliopancreatic bypass. However, the hepatologist commented: 'I feel the reversal should not be done until the bilirubin and albumin are almost in the normal range'. It was also felt that the patient should be considered for a liver transplant if the liver function tests continued to deteriorate.

There was a recurrence of the cellulitis associated with a deterioration in the liver function, both clinically and biochemically. The patient underwent further abdominal surgery at a private hospital. The notes are not clear about the exact details, but it seems that the ileal segment was lengthened by 150 cm. At the time of surgery, the serum albumin was 22 g/L and the serum bilirubin was twice the upper limit of normal.

One week post-surgery, the patient's liver function tests deteriorated and the patient developed a wound infection that required debridement. The serum bilirubin was five times the upper limit of normal and this was associated with enzyme changes indicative of deteriorating hepatocellular function. The patient's condition deteriorated markedly during the second week after surgery, when the wound dehiscid and

copious amounts of ascitic fluid began to leak into the dressing. The patient became increasingly encephalopathic and there were concerns about an underlying anastomotic leak. A CT was performed and the report commented that there was 'no evidence of efferent or biliary loop obstruction has been demonstrated', but that there were 'ascites, wound dehiscence and bi-basal lung changes'.

Twelve days after surgery, the patient was directly transferred to an ICU in a teaching hospital. At that time, the patient had 'wound dehiscence, sepsis, liver failure, intravascular coagulation with renal failure and adult respiratory distress syndrome'. A laparotomy was performed to exclude a remediable surgical cause. The liver was noted to be 'hard' and, despite the dehiscence, a four litre ascites was present in the peritoneal cavity. There was no evidence of an anastomotic leak, but adherent loops of bowel could not be safely removed to display the anastomosis. Necrotic fascia at the end of the wound was debrided and the abdomen was left partially open for drainage. The patient died the next day.

Clinical lessons

In the bilio-pancreatic bypass procedure, a long Roux-en-Y segment of small bowel is excluded from the food stream and drains into the terminal ileum. Although it is an accepted form of bariatric surgery, it has been associated with non-alcoholic hepatic steatosis and it is recognised that this may lead to liver failure and death.

Patients undergoing surgery for morbid obesity are relatively young. This, combined with the reality that these procedures have a failure rate

that increases over time, means that an increasing number of patients will become candidates for re-do bariatric surgery. The performance of increasingly invasive procedures to manage weight loss needs to be balanced very carefully against the biological costs.


The decision to perform bariatric surgery requires careful deliberation and consultation. It is expected that both the surgeon and the patient will be aware of the main risks. In this instance, a CT scan performed soon after the bilio-pancreatic bypass indicated 'intense fatty infiltration of the liver', but there is no evidence that this was acted upon by referral to a hepatologist with consideration of the need for a liver biopsy. Surgeons who perform unusual procedures should understand the full implications of their actions.

The performance of major abdominal surgery on hypo-albuminaemic patients with known liver impairment is associated with very poor outcomes. In this case, if surgery was thought necessary to reverse the liver impairment, then:

1. It should have been performed in a major hospital, either public or private, with an adequate ICU
2. Consideration should have been given to the performance of a lesser, temporary procedure (e.g. a proximal side-to-side enteric anastomosis). Concerns about long-term weight loss should be considered negligible when a patient's life is at risk.

Surgery for morbid obesity requires a team approach during the pre-,





peri-, and postoperative periods. There need to be defined pathways of care that allow for the timely and expert management of clinical problems. This calls into question the appropriateness of isolated surgeons making decisions about and performing bariatric surgery within a loose and opportunistic network of clinical services.

Case study 12: Cystectomy complications – earlier intervention needed?

Case summary

A 70-year-old obese, diabetic patient with a previous history of coronary stent had a radical cystectomy and formation of ileal conduit for muscle invasive transitional cell carcinoma. The procedure took three and a half hours with a stapled ileo-ileal anastomosis with sutured uretero-ileal anastomoses over stents.

Postoperatively in HDU, the majority of the urine was produced via the pelvic drain and a urine leak was diagnosed. This was managed by a catheter in the conduit initially. The next morning, 1,400 ml was found to be draining via the pelvic drains and negligible urine output via the stoma. A decision was made to divert the urinary stream using bilateral nephrostomies. Over the next two days, the pelvic drainage reduced and the patient was discharged from high dependency.

On the ward, the patient's mobility appeared to be limited to sitting out of bed, with poor ability to actually walk about. Slow oral fluids were started.

The ureteric stents had been dislodged and new antegrade stents placed radiologically with corresponding increased output via the conduit. The nephrostomies were removed. By the seventh postoperative day, Total Parenteral Nutrition (TPN) was commenced for continuing ileus.

The patient developed vomiting, and diagnosis of ileus was made. The patient had become anuric with the diagnosis made of recurrent urine leakage, treated by re-insertion of nephrostomies. The patient had difficulty with pain management and was put on a ketamine infusion, causing sedation and decreased mobility. There was apparent slow improvement in bowel function, which then deteriorated to a new ileus and vomiting on day 12. Imaging had shown a large urine leak. On day 14, the patient had a laparotomy, division of adhesions, drainage of collection, revision of anastomosis, and inadvertent small bowel injury (and repair).

There was little improvement over the next week, when an enterocutaneous fistula was diagnosed, erupting via the laparotomy wound. This was high output and initially managed conservatively. Faecal peritonitis developed the subsequent week, and another laparotomy with washout was performed. Both large and small bowel fistulas were found. The patient had a prolonged admission with numerous interventions over the next two months, eventually dying due to infective endocarditis, sepsis, and destruction of the aortic valve.

Clinical lessons

Many patients like this one are less well than the sum of their comorbidities would suggest and have less capacity

for recovery from their complications than the average patient. This patient, suffering from an advanced malignancy and likely preadmission undernutrition in spite of the obesity, was compromised in their ability to recover from what resulted in a series of physiological assaults (operation, urine collection, ileus and malnutrition, and ultimately sepsis).

Although this patient's admission was spread out over three months with numerous interventions and complications, hindsight tells us a great deal about how early decisions can impact on outcomes. One early intervention that may have changed the course of events would have been the decision to manage the urine leak (identified in recovery) with nephrostomy diversion rather than immediate revision. This led to the abdominal collections and re-exploration which also caused bowel injury, resulting in the fistulae. Urologists use nephrostomies as a temporising measure if laprotomy and repair are predicted to be complicated. However, immediately postoperatively there is likely little impact in a short re-look. Ironically, this decision indirectly led to the patient requiring a laparotomy at 10 days post-operation.

Although nephrostomies were an easy decision, this led to numerous complications including: the lack of postoperative mobility contributing to ileus; difficulty in interpretation of urine output, leading to late recognition of hypovolaemia; and, ultimately, hypo-perfusion of the bowel and anastomoses. Unfortunately, the management of this patient was temporising rather than definitive. If there is another

lesson to be drawn from this case, it is that we ignore or gloss over the warning signs at our peril. This patient could have been treated more aggressively with nutrition, fluid resuscitation, and operatively, perhaps changing the ultimate sequence of events.

Case Study 13: Postoperative haemorrhage mistakenly diagnosed as sepsis in a morbidly obese patient

Case summary

A patient in their late-40s with Type 2 diabetes, COPD and morbid obesity presented to a regional emergency department with abdominal pain. The pain had been present for several hours prior to the presentation and was associated with vomiting and diarrhoea. Examination findings in ED were of generalized tenderness, but the patient was afebrile and observations unremarkable. A plain abdominal film showed some dilated small bowel. There was, most noticeably, a WCC of 17, but the C-reactive protein was only 12.

In the morning, the patient was febrile 38.5, tachycardiac 108 and tachypnoeic 26. Medical review occurred again and noted increased pain in the patient's right iliac fossa but, due to wide spread wheeze, pneumonia was felt to be the most likely diagnosis. A surgical review was requested and a CT ordered, where a diagnosis of appendicitis was made





and the patient prepared for surgery. Antibiotics and salbutamol were commenced. All bloods were repeated, the only change being an increase in the C-reactive protein to 54 and Arterial Blood Gases performed showing a pH of 7.34, pCO₂ 54, pO₂ 94 and a bicarbonate of 29.

Due to scheduling, the patient was taken to theatre by a second consultant surgeon at midday. A gangrenous appendix without perforation and minimal suppuration was found. The operation note simply states 'appendectomy'. Intraoperatively, an arterial line was inserted and all observations were within normal limits. The operation finished an hour later, and the patient was transferred to recovery, where observations were stable until approximately 2.30 pm when their blood pressure dropped from 145/68 to 92/49. No medical documentation of fluid resuscitation is apparent but by 3.20 pm a metaraminol infusion had been commenced with some effect.

After being transferred to the HDU, the patient became hypotensive. Fluid resuscitation was initiated by emergency staff but appears to have consisted of 500 ml gelofusin stat and 1,000 ml of Hartman's over one hour. The metaraminol infusion was increased with little effect and the patient died that evening. At no stage was the anaesthetist, admitting surgeon or operating surgeon contacted in regards to the postoperative hypotension, and the reviewing doctor listed septic shock as the diagnosis. In addition, the surgeon was not informed of the death until the following day.

A postmortem revealed a large tear in the mesentery between the appendix and terminal ileum, associated with approximately 1,600 ml of blood. There was one stitch in this area. The patient also had significant coronary artery disease but there was no evidence of acute infarction and no evidence of septic shock.

Clinical lessons

The diagnosis of appendicitis can be highly problematic in any group of patients, but particularly the obese, where even obvious peritoneal signs can be difficult to detect. Admitting this patient overnight with continual reassessment can hardly be criticized. Even if a surgical review was arranged earlier, it would have been inadvisable to take such a patient to theatre in the middle of the night. The approach of fluid resuscitation, antibiotics and appropriate investigations with an operation by a consultant surgeon and anaesthetist in daylight hours was entirely appropriate.

The operative note simply states 'appendectomy' with no indication of difficulty or bleeding, the presumption being it was uneventful. However, in view of the postmortem finding and the stitch in the area, there may have been some intraoperative difficulties. This is impossible to determine from the inadequate documentation provided.

There is little positive to say about the subsequent management of this patient. The commencement of a metaraminol infusion in recovery has been documented by nursing staff but there is no indication as to who ordered it. It was a mistake to attribute the postoperative hypotension to septic shock without considering other

possible causes. Septic shock from a gangrenous non-perforated appendix is a difficult pathophysiological argument to make. No thought as to the possibility of haemorrhage seems to have been entertained and the fluid resuscitation of 1,500 ml was woefully inadequate for the management of either condition.

Why the surgeon involved was not contacted when the patient deteriorated, let alone died, can only be described as a complete system and communication failure. Whether a different outcome would have occurred had this happened is not certain. The treating surgeon also attributed the death to septic shock but did note that the operative findings did not support this. It stands as a warning to all such units that the management of all patients should always involve consultation and communication with the admitting doctor.

In short, this patient's death was preventable; steps could and should have been taken to prevent it. In no situation is it acceptable for a care regimen under which a patient is obviously deteriorating be allowed to proceed without direct communication with the admitting team.

Case Study 14: Poor care in wrong hospital in a morbidly obese patient

Case summary

This patient in their late-50s had a significant medical history including hypertension, Type 2 diabetes, cerebrovascular disease

(cerebrovascular accident at age 47), hypercholesterolaemia, gastro-oesophageal reflux disease, obstructive sleep apnoea with COPD, depression, and was morbidly obese (137 kg, BMI 38).

The patient presented with acute cholecystitis and was treated conservatively with arrangements made for a staged laparoscopic cholecystectomy two months later. The surgery was embarked upon laparoscopically but could not be successfully completed because of abdominal obesity and adhesions which precluded a safe view of the gall bladder and Calot's triangle. A conversion to an open procedure was made. Despite this, adequate visualisation of the cystic duct was not possible and a subtotal cholecystectomy was performed, leaving the neck of the gall bladder.

The management in the recovery room was problematic as the patient became agitated and uncooperative. This led to the dislodgement of both the intravenous line and the nasogastric tube. There was decreased oxygen saturation throughout the recovery room stay.

The anaesthetist was contacted regarding inadequate pain relief. The patient was reviewed by a Resident Medical Officer (RMO) twice in the late evening because of persisting tachycardia and reduced oxygen saturation. A decision was made overnight to transfer the patient to the HDU.

The patient was re-examined by a medical staff member the following morning and was identified as having worsening urine output and increasing





tachycardia and hypoxia. Blood gas analysis showed severe and worsening acidosis, and hypoxia.

There was a progressive deterioration; arrangements were made to transfer the patient to a tertiary center. On arrival, several hours later, the patient was 'in extremis' from advanced multiple organ failure and was requiring high doses of inotropic support. Resuscitative measures were attempted but these were unsuccessful, and the patient died the following morning.

The cause of death was multiple organ failure with intra-abdominal haemorrhage following abdominal surgery in a patient with ischaemic heart disease.

Clinical lessons

There are a number of substantial concerns about various issues with respect to this patient's care, mainly in the postoperative setting but also preoperatively.

High Risk for Elective Surgery - There is little doubt that this patient was a high-risk candidate for this surgery and their potential needs outstripped what was available in the local hospital. Medical problems included morbid obesity, hypertension, Type 2 diabetes, cerebrovascular disease, hypercholesterolaemia, gastro-oesophageal reflux disease, and obstructive sleep apnoea with COPD in the setting of recent acute cholecystitis.

Perioperative Care Arrangements

- Given the risks involved and the potential for deterioration in a patient with obstructive sleep apnoea, plans to manage the patient in the HDU postoperatively should have been

made prior to surgery taking place. It is surprising that it was considered appropriate to manage the initial postoperative care in the Day Surgical ward. The postoperative observation charts demonstrate a significant and ongoing deterioration. Oxygen saturation on presentation was 98 per cent (presumably on room air). The saturation was never above 94 per cent on day of the surgery. The patient's pulse rate became elevated at 6.30 pm (97 bpm) and again two hours later (120 bpm).

Administration of Anticoagulant

Medications - Clexane was administered to this patient twice in the initial postoperative period and this appears to contradict a direct order given by an RMO. The dose administered of 40 mg was a reasonable dose; this should be considered a minor contributing factor in this patient's outcome. Nonetheless, intra-abdominal haemorrhage was a finding at postmortem.

Unrecognised Sepsis - It is of concern that little was done despite clear evidence of the patient developing severe sepsis through the following indices: increasing abnormal blood gases; dwindling urine output; increasing potassium level; worsening tachycardia; and worsening hypoxia.

Frusemide was administered in the hope it would address the reduced urine output; this suggests that the treating doctor considered the patient to be in fluid overload. In hindsight, this was inappropriate and doubtless exacerbated the patient's ongoing deterioration.

It is clear that the patient continued to deteriorate overnight and that the nurses sought input from the

Emergency Department (ED) staff. It appears that the ED doctor did not attend to the patient but instead offered instructions by telephone. It should have been apparent that the patient required increasing physiological support, however an antibiotic Ceftriaxone was prescribed over the telephone and further Frusemide also recommended.

Need for Escalation of Care – It is not certain whether the rural hospital involved had a system in place governing the clinical management of the deteriorating patient. Tertiary hospitals employ a medical emergency team (MET) which is actioned in response to the recognition of deterioration in patient care. The triggers for activating a Code Blue, or MET call, are fairly standardised across sectors. They pertain to physiological deterioration including pulse rate, blood pressure, urine output, oxygen saturation and ‘general concern’ about patient condition. If such a system existed, it clearly was not activated appropriately.

There was a significant under-recognition of the severity of the deteriorating condition. It is of concern that this patient was managed by telephone in some instances rather than a personal medical review.

Finally, and perhaps most importantly, this patient’s perioperative needs would have always been a challenge to meet. Even if the surgery had progressed entirely satisfactorily, the patient’s multiple co-morbidities created a level of complexity whose perioperative care might perhaps have been better managed in a tertiary centre.

Case Study 15: Surgery for morbidly obese can be lethal – part 2

Case summary

This clinically obese patient in their 30s underwent elective laparoscopic sleeve gastrectomy for morbid obesity. There was a past medical history of obstructive sleep apnoea and endoscopy in 2012 with intraoperative de-saturation. The patient developed rapid desaturation from an obstructive airway following the administration of propofol as a sedating agent. The anaesthetist was unable to improve the airway with the usual manipulation and intubation was necessary for maintenance of the airway. As a consequence, the scheduled bariatric surgery was postponed with the advice to the patient to decrease their current weight of 123 kg to 110 kg on a prescribed very low calorie diet (VLCD) or a fat-free diet.

The patient then sought the services of another surgeon. The patient was 127 kg at the time of the scheduled sleeve gastrectomy, clearly having ignored the advice of the first surgeon consulted. The planned surgery went ahead with the second surgeon. Once intubated, the patient was easy to ventilate. The laparoscopic sleeve gastrectomy was difficult due to steato-hepatomegaly and took two and a half hours. This lengthy operation reflected the difficulty encountered by the surgeon who noted limited view at laparoscopy. The liver was massive and fatty, and the liver split on retraction from its sheer weight. The





bleeding from the split liver required application of Surgiseal. Problematic bleeding was then encountered from the splenic hilum and required Floseal. Both the bleeding from the liver and spleen indicated that the laparoscopic view was poor, access difficult and limited. With credit to the surgeon, he managed to perform the planned surgery under challenging circumstances.

In recovery, the patient required IV morphine 24 mg in eight divided doses. The patient had difficulty maintaining oxygen saturations on a Hudson mask 8 L O₂/min and was tried on the continuous positive airway pressure (CPAP) machine, then transferred to the ward at 8.00 pm. At 8.40 pm the patient was found to be in cardiorespiratory arrest. During resuscitation, there was difficulty in intubation. At 9.10 pm, when there was a return of pulse and spontaneous breathing, the patient was transferred to ICU, sedated, and cooled to 33°C. In ICU, the pupils remained non-reactive. Death occurred due to hypoxic encephalopathy.

Clinical Lessons

This patient had known significant risk factors at the time of the elective surgery: morbid obesity, severe obstructive sleep apnoea and steato-hepatomegaly.

The patient was previously assessed to be of significant risk after the endoscopy and was advised to lose weight prior to having a gastric analysis to reduce the risks. Preoperative VLCD diet has been shown to significantly decrease visceral fat (including liver volume by 20–30%) and to improve not only laparoscopic access but to

induce weight loss, which in itself helps improve a patient's comorbidities including sleep apnoea.

Unfortunately, the patient did not comply with the initial advice and presented for bariatric surgery having gained more weight at 127 kg. Hence it was not surprising that the surgery was difficult as the laparoscopic access was limited by a massive and fatty liver. For laparoscopic access to the stomach, the liver has to be retracted anteriorly. Fatty livers tend to be soft and fragile and on retraction have been known to fracture easily. I suspect that the massive visceral and omental fat encountered intra-abdominally resulted in the splenic hilar injury and further bleeding.

The known severity of the patient's sleep apnoea should not have been ignored. In hindsight, the patient might have been considered for transfer to ICU and intubated following surgery. This may have prevented the hypoxic episodes in recovery which probably resulted from a combination of factors including: patient lying in a supine position; obstructive airways; and sedative drugs (including morphine). This drop in blood oxygen may have precipitated the cardiac arrest.

In summary, this patient's death was the unfortunate result of an elective surgical procedure. The risks from bariatric surgery are considered higher than the standard elective procedures as a result of both the obesity and the associated comorbidities of obesity. However, for this patient, the identifiable known risk factors could have been addressed and minimized to optimise the patient's recovery from surgery. These include:

preoperative VLCD to reduce the size of his visceral organs; the weight loss induced by the VLCD would have resulted in an improvement in the patient's obstructive sleep apnoea and hence reduced his risk of hypoxia from sedation, pain and positioning in the postoperative period; and, in view of the previous hypoxia, precautionary measures to maintain this patient's airway should have been adopted in the postoperative period. In hindsight, consideration should have been given to transferring the patient to ICU from the operating theatre, intubation, and monitoring in the immediate postoperative period.

Case study 16 : Neurosurgical cases not exempt

Case study

An early middle aged man with a history of sleep apnoea, Type 2 diabetes mellitus and morbid obesity was admitted for an elective operation of a trans-sphenoidal removal of a pituitary tumour which was associated with hyper-cortisolism. He was admitted several days prior to the planned procedure and assessed by thoracic medicine, endocrinology and anaesthetics and his condition optimised preoperatively.

The operation was uncomplicated. There was mild diabetes insipidus immediately postoperatively but no major fluid or electrolyte dysfunction. On day one postoperatively he was transferred from ICU to the ward. That night he

suffered difficulty in breathing and a rapid decline in oxygen saturations necessitating a transfer back to ICU. A chest x-ray was poor in quality but suggested lower lobe pneumonia. There was a strong clinical suspicion of a pulmonary embolism but it was not possible to obtain a CT pulmonary angiogram because of his body size. Nevertheless he was treated for PE .

There was a further reduction in oxygen saturation leading onto a cardiac arrest. He was resuscitated but had poor neurological recovery, remaining unconscious. A further cardiac arrest followed shortly after resulting in death.

Clinical lessons

In this case it was reasonable to assume that the cause of the respiratory impairment was PE. However the coronial postmortem showed no evidence of pulmonary embolism but a lower lobe pneumonia. One could reasonably assume that his morbid obesity contributed to poor respiratory function and that the signs of infection or PE (clinical and radiological) were hampered by his obesity. In retrospect it is difficult to see what else could have been done, in view of the rapid deterioration and demise.



Shortened forms

AF	atrial fibrillation
ANZASM	Australian and New Zealand Audit of Surgical Mortality
APTT	Activated Partial Thromboplastin Time
ASA	American Society of Anesthesiology
AXR	abdominal x-ray
BSL	Blood Sugar Level
CPD	Continuing Professional Development
CPR	cardiopulmonary resuscitation
CT	computed tomography
CXR	chest x-ray
DEM	Department of Emergency Medicine
DVT	deep vein thrombosis
ED	emergency department
ERCP	endoscopic retrograde cholangiopancreatography
HDU	high dependency unit
ICU	intensive care unit
INR	International Normalised Ratio
IV	intravenous
LIF	left iliac fossa
MET	medical emergency team
RACS	Royal Australasian College of Surgeons
SAAPM	South Australian Audit of Perioperative Mortality
WBC	white blood cell

Contact details

Royal Australasian College of Surgeons

Australian and New Zealand Audit of Surgical Mortality

199 Ward Street
North Adelaide SA 5006
Australia

Telephone:
+61 8 8219 0900

Facsimile:
+61 8 8219 0999

Email:
gordon.guy@surgeons.org

Website:
www.surgeons.org/for-health-professionals/audits-and-surgical-research/anzasm.aspx

The information contained in this annual report has been prepared on behalf of the Royal Australasian College of Surgeons, Australian Audit of Surgical Mortality Steering Committee. The Australian and New Zealand Audit of Surgical Mortality, including the Western Australian, Tasmanian, South Australian, Australian Capital Territory, Northern Territory, New South Wales, Victorian and Queensland Audits of Surgical Mortality, has protection under the Commonwealth Qualified Privilege Scheme under Part VC of the *Health Insurance Act 1973* (gazetted 23 August 2011).





NOTES

A series of horizontal dotted lines for taking notes, spanning the width of the page below the 'NOTES' header.



ROYAL AUSTRALASIAN
COLLEGE OF SURGEONS

Australian and New Zealand
Audit of Surgical Mortality

199 Ward Street
North Adelaide SA 5006
Australia

Telephone: +61 8 8219 0900

Facsimile: +61 8 8219 0999

Email: audit@surgeons.org

Website: www.surgeons.org/