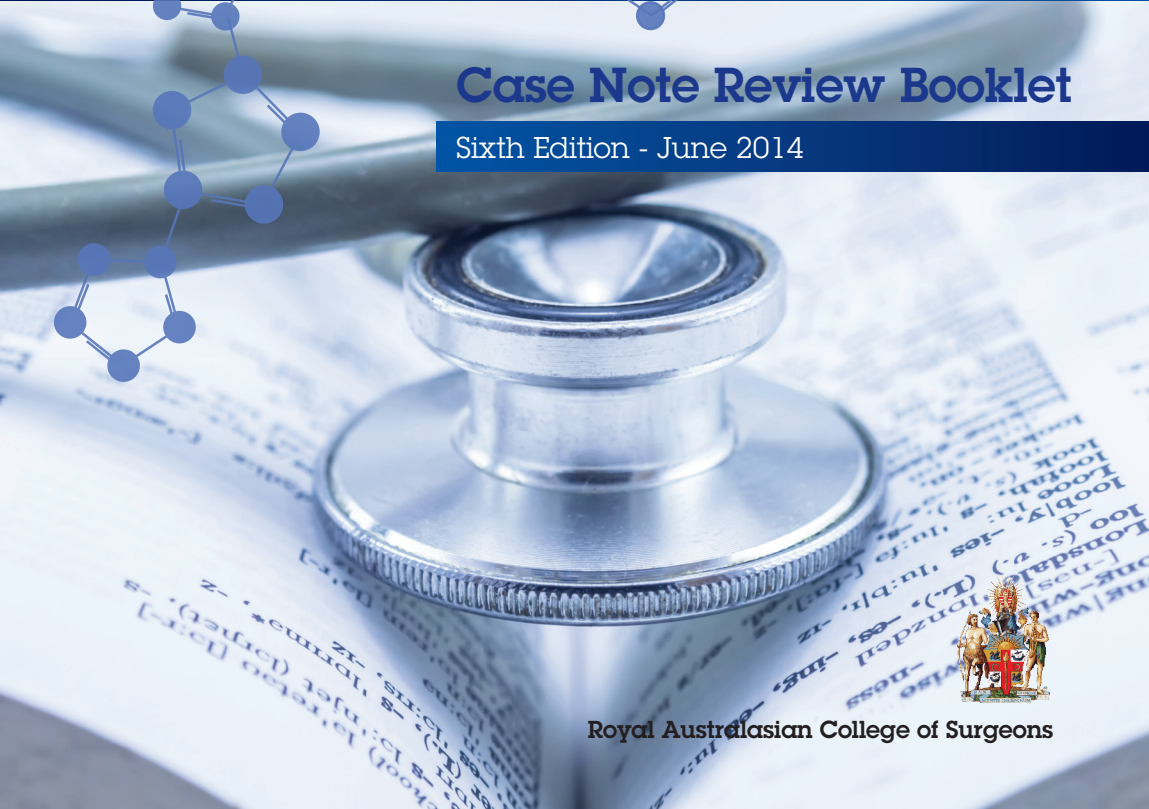


Victorian Audit of Surgical Mortality

Case Note Review Booklet

Sixth Edition - June 2014



Royal Australasian College of Surgeons

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Introduction

The audits of surgical mortality review deaths that occur while patients are under the care of a surgeon in the public or private hospital sectors. As this peer review process is intended as an educational exercise, we have selected a number of cases which highlight specific clinical issues. The cases do not necessarily relate to the period since the last booklet. They do, however, contain topical and timely lessons for all surgeons and clinical team members. In successive years repeated issues of management appear, particularly delay in diagnosis and treatment of the deteriorating patient, and deficiencies in postoperative management. These are again highlighted in this sixth edition of surgical cases.

All cases selected have gone through a second-line assessment (case note review) by a Fellow from either the Royal Australasian College of Surgeons or the Royal Australian and New Zealand College of Obstetricians and Gynaecologists.

The cases document critical incidents, often involving system issues rather than issues that are the responsibility of the treating specialist surgeon alone. The assessments have been edited to ensure that the patient, hospital, treating surgeon and assessor remain anonymous.

Qualified Privilege (QP) prevents the audit from sending assessment feedback to anybody other than the treating surgeon. This means that hospital management only receive indirect feedback on cases of patients who died in their hospital. As a consequence, this publication presents a valuable learning tool for surgeons, hospitals and clinical care teams. This publication is produced in the hope that it will be freely shared amongst these groups, providing all health-care providers with important insights into the issues presenting in the health-care system.

We feel that, as there are important lessons in this publication, it should be made available to all those responsible for delivering the care that resulted in the outcomes presented. We recommend that it be used as a teaching aid. Additional copies of this publication can be provided as necessary.

Audit staff would like to take this opportunity to thank all surgeons and hospitals participating in this educational activity. We hope you find this publication of value.



Emerging issues and recommendations to VASM clinical stakeholders

Objectives to consider by hospitals and health professionals are:

Improved leadership in patient care

- In complex cases there must be clear, demonstrable leadership in patient management.
- The treatment plan for each patient should be understood by all involved with the patient's care. There should be a low threshold in calling for assistance from colleagues during a lengthy operation to avoid fatigue.
- The leader must be present, responsive, prepared for challenges, and must focus on patient care.

Better documentation of clinical events and plans

The case record is an essential tool for identifying clinical trends and management plans. It must contain clear and accurate documentation of events and plans. A repeated issue for reviewers is the lack of adequate, legible documentation.

Action on evidence of clinical deterioration

- Clinical deterioration is an issue that is recognised throughout Australia and the rest of the world.
- When clinical deterioration of a patient occurs and there is no clear cause, the cause may be related to something outside your specialty knowledge base.
- Clinical findings must be considered along with the results from any investigations.
- Clinical deterioration must be acted upon and not just recorded.

Improved preoperative management

Appropriate preoperative preparation and management may decrease operative complications and promote successful recovery. Delay for unnecessary preoperative investigations can have fatal consequences. However, preparation and management should include:

- Evaluation of both physical and psychological preparation.
- Complete medical history and physical examination procedures.
- Consent for the surgery and discussion of potential outcomes.
- Appropriate documentation and communication of findings with clinical and surgical teams.



Improved postoperative management

- The patient should be discharged to the ward with comprehensive orders.
- Preventative measures are to be implemented for reducing complications.
- Instructions must be given about further management if the patient is discharged from a clinical or surgical team.
- The potential outcomes from the probable clinical diagnosis must be considered when developing a treatment plan.
- The patient should be transferred to a medical unit if elderly and at high-risk, and medical issues are assessed as being the prominent clinical factor during the admission episode, providing that the surgical postoperative care can be performed appropriately in that setting.

Improved awareness of surgical emergencies and sharing of care

The audit revealed that surgical emergencies are at greater risks for patients where care is shared. All health professionals should increase their awareness of these risks and improve the quality and safety of patient care.

Improved communication

All health professionals and institutions should actively collaborate and communicate to effectively support an appropriate interchange of information and coordination of patient care at all stages during the admission episode.





Cardiothoracic Surgery

Case 1: Multiple injury to the lung parenchyma and diaphragm requiring repair

Clinical details

This case was referred by a medical registrar from another hospital following further investigations.

A patient with a history of heavy smoking had three weeks of coughing with purulent sputum, fevers, sweats and dyspnoea on exertion. Comorbidities included pulmonary and spinal metastases. Some improvement with antibiotics occurred. A mass in the right lower lobe with a loculated pleural effusion was located, however attempts at aspiration and drainage were unsuccessful.

A right thoracotomy was performed to establish a diagnosis and decortication with limited incision and without rib resection. The difficult operation took seven hours with two litres of blood loss with the patient not being very tolerant of one-lung ventilation. Multiple injuries to the lung parenchyma required repair and there was injury to the diaphragm. There is no evidence of senior consultant involvement in the preoperative or operative phase.

The patient was unstable at the end of the procedure and required inotropic support and transfer to an Intensive Care Unit (ICU). The patient required ongoing ventilation. Continued positive pressure ventilation (PPV), positive end expiratory pressure (PEEP) and other support were also required. There was a continued air leak and persistent pneumothorax.

With continued deterioration in the presence of metastatic spinal disease, treatment was ceased.

Comments

Areas of concern were:

- It is not clear from the notes how much or if any involvement there was from a consultant surgeon during the preoperative assessment and operative procedure. This was a difficult procedure. The patient may have benefited if someone with more experience had been involved in the operative procedure. Although the patient did have a terminal illness, reasonable palliation may have been achieved with a modified approach.
- A preoperative diagnosis may not have changed the approach but there was time to have acquired the information, with the patient having been in hospital for five days as well as being an inpatient at another hospital. The preoperative recognition of spinal metastases may have altered the treatment.
- Embarking on surgical palliation carries significant responsibility and it is unfortunate when the limited final days of life are spent in this way, even accepting that this outcome is sometimes unavoidable.



Cardiothoracic Surgery

Case 2: Aortic valve replacement with progressive postoperative deterioration

Clinical details

The case was of a middle-aged patient who died following urgent aortic valve replacement for severe aortic regurgitation. The patient had an echocardiogram two and a half weeks prior to presentation with acute pulmonary oedema. It revealed severe aortic regurgitation. A coronary angiogram was performed on the day after admission. An aortic valve replacement was performed a day later.

The initial recovery was smooth with good cardiac output and stable haemodynamics. There were issues with respiratory dysfunction. The patient remained in the ICU for non-invasive ventilation and physiotherapy. The patient had a productive cough with copious sputum and had a persisting sinus tachycardia from the second postoperative day. The creatinine was noted to be elevated on the morning of the third postoperative day. The urine output was initially satisfactory, but deteriorated over the course of that day.

By 0200hrs on the fourth postoperative day the creatinine had climbed to 334 $\mu\text{mol/L}$. A renal medicine review was sought. Around 1000hrs atrial fibrillation developed and an amiodarone infusion was commenced. At 1500hrs it was documented that the surgeon was made aware that the 'patient is getting sicker'. The International Normalised Ratio (INR) doubled during that day and the lactate dehydrogenase (LDH) was markedly elevated. Overnight the decision was made to

commence haemofiltration and insert arterial and central venous lines for monitoring. A noradrenaline infusion was commenced with a total of 6.5mg of metaraminol in 0.5 mg boluses being administered to maintain the blood pressure (BP). At 0515hrs on the fifth postoperative day the arterial blood gases showed mild hypoxia and an acidosis. The lactate was elevated and at 0730hrs the patient was more hypoxic with a pO_2 of 56.8mmHg, and the lactate had risen to 7.6mmol/L.

At 0800hrs the patient arrested with a bradycardia. Cardiopulmonary resuscitation (CPR) and emergency intubation were performed. Multiple doses of adrenaline were administered and at 0825hrs the chest was opened. There was no pericardial collection (documented in the VASM report, although there was no record of the operative findings in the patient's file). An echocardiogram showed akinetic left and right ventricles. The resuscitation was discontinued and the patient died.

Comments

- There is significant evidence of a steady clinical deterioration in this case. The postoperative course outlined above indicates a gradual deterioration with multi-organ failure. The initial persisting sinus tachycardia may have been an early indication of problems. The development of acute kidney injury and hepatic dysfunction in this young patient following cardiac surgery may be an indicator of low cardiac output. An assessment of cardiac function such as echocardiography or invasive monitoring with a Swan Ganz catheter would have been helpful.



- An infusion of noradrenaline was commenced and metaraminol boluses were given. Having a measure of cardiac output would have been useful in guiding the appropriate choice of inotropic therapy, as a positive inotrope rather than a vasoconstrictor may have been indicated. The patient had worsening hypoxia and lactic acidosis. There was evidence from the arterial blood gas results that the patient was failing non-invasive ventilation and intubation may have been indicated.
- While the reporting surgeon stated that the 'patient was again stable and clinically well', the information from the record suggests the patient was already in a parlous condition. There appears to have been a gradual deterioration in the clinical condition ultimately resulting in cardiac arrest and death.
- It is likely that the patient's death was multifactorial with low cardiac output and respiratory failure contributing. The signs of these problems seem apparent from the third postoperative day with the benefit of retrospective analysis. Certainly by the fourth postoperative day there was strong evidence of a significant clinical deterioration. There appears to have been a relatively slow response to the assessment and treatment of the possible causes of this deterioration. This may have contributed to the patient's death.
- The level of documentation is of concern. There is little or no documentation by the surgical team in the notes. The preoperative consult, surgical postoperative assessment, and the course of events at the arrest (including the re-exploration) are not in the notes provided.





Cardiothoracic Surgery

Case 3: Minimally invasive mitral valve repair with femoral cannulation resulting in IVC trauma and exsanguination

Clinical details

A middle-aged patient with mitral regurgitation and significant coronary artery disease (CAD) underwent elective minimally invasive mitral valve repair via a right thoracotomy using peripheral vessel cannulation.

A satisfactory repair was achieved but the patient deteriorated with progressive hypovolaemia over four hours due to retroperitoneal and intra-abdominal haemorrhage from damage to the Inferior Vena Cava (IVC).

Return to theatre partially controlled the haemorrhage but the patient did not tolerate IVC clamping while in a state of severe hypovolaemia. Despite further attempts at resuscitation, including standard cardiopulmonary bypass and clotting factor replacement, death occurred.

Comments

Problems identified were:

- Failure to recognise injury to the IVC either at the time of insertion or until the massive blood loss; there were clearly problems with insertion of the femoral catheters which seem to have been performed percutaneously.
- The surgeon's notes state that they did not have adequate assistance during the femoral cannula insertion and this should not be allowed to happen in the future. Femoral cannula insertion by any method

is well known to have potential serious dangers and an experienced assistant should always be present, particularly in an elective situation. Presumably there was another surgeon present who was opening the chest and they should always help with the cannulation.

- At least four hours elapsed before returning to theatre and the appropriate ICU notes are not present. It appears the patient required an excessive amount of intra-vascular filling without blood loss or other explanation. Time was wasted getting a Computed Tomography (CT) scan and in consultations with several groups of surgeons. It would have been beneficial for the patient to have been returned to theatre several hours earlier.
- There was a significant stenosis in the Left Anterior Descending (LAD) artery. A questionable decision was made to not graft the LAD because 'the patient preferred a minimally invasive approach'. The logic and responsibility behind this decision is troubling. The resultant persistent ischaemia of the heart may have contributed to the inability to resuscitate in the setting of hypovolaemia.
- This should have been a very low risk procedure. It could have been carried out without the threat of fatal complications if a standard sternotomy had been used. The benefits of a minimally invasive approach to the mitral valve have not been demonstrated and this should be balanced against the risks demonstrated here (for example, long bypass and cross clamp time, peripheral vessel cannulation, poor exposure, inability to graft the coronary arteries). Noradrenaline and Milrinone seem to have been used for resuscitating someone with hypovolaemia.



General Surgery

Case 4: Injury to pancreas during hemicolectomy with delayed diagnosis and transfer

Clinical details

This was the case of an elderly patient who underwent an elective resection for a carcinoma of the transverse colon. The case file had no information about how the diagnosis had been reached or the preoperative investigations performed. The patient was recorded as being a healthy American Society of Anesthesiologists (ASA) 2. They were seen in a pre-admission clinic (PAC) eight days prior to the procedure although there were no medical notes at this stage. The planned operation was a colonoscopy and bowel resection.

A colonoscopy was performed which confirmed a colon carcinoma. A laparotomy was then performed where a large mass in the proximal transverse colon (with some features of obstruction with a dilated caecum) was found. The mass was recorded as invading into the mesocolon, the head of the pancreas and the liver, and was close to the Inferior Vena Cava (IVC) and the aorta. The operation consisted of a resection of the mass with what was recorded as a difficult dissection of the tumour from the head of the pancreas, although the tumour was reported to be dissected off the pancreatic tissue. A major bleed occurred from the IVC requiring suture repair and a portion of the right lobe of the liver was removed by wedge excision. A primary anastomosis was performed. Subsequent histology confirmed a poorly

differentiated adenocarcinoma with one positive lymph node. Two drains were placed at the end of surgery.

Postoperatively, the patient's progress was initially satisfactory, but three days postoperatively the patient had episodic atrial fibrillation which was intermittent over the next 24 hours. There were no ICU facilities at the original hospital and the patient was transferred to another hospital for ICU care. The transfer appears to have been organised at research medical officer (RMO) or registrar level with no direct contact between referring and receiving consultant.

After transfer the patient was found to be in sinus rhythm, was generally in a satisfactory state, and was discharged from the ICU within 24 hours. Progress remained slow and the drains remained in situ with persistent drainage. Thirteen days after the operation (eight days after the inter-hospital transfer), measurement of lipase and amylase in the drain fluid revealed high levels and the diagnosis of pancreatic fistula was made. The patient had a CT scan showing features of an ileus but no suggestion of an anastomotic leak. It was apparently decided to transfer the patient again, to a tertiary level hospital for management of the pancreatic fistula. It is recorded that two hospitals accepted the patient but neither had any beds and therefore the patient was not transferred. Sixteen days after the original operation the patient was reported as being distended and a CT scan showed pleural effusions, ascites and an ongoing ileus. Later that day a family meeting was held and the family requested no further treatment and withdrawal of care for palliation. The patient died within 48 hours.



In summary, this elderly patient underwent an elective resection of a large proximal transverse colon tumour with local spread involving the front of the pancreas, liver and the IVC. Postoperatively, the patient developed a pancreatic fistula. By the time it was recognised the patient's general state had deteriorated and the family requested withdrawal of care.

Comments

Areas of concern were:

- Preoperative planning: there is little information in the hospital notes. However, it is likely that a CT scan would have been performed. The size of the tumour should have been apparent on the scan. It should have been clear that this was unlikely to be a routine right hemicolectomy. The decision to proceed with what was likely to be a difficult right hemicolectomy in a hospital with no ICU facilities is highly questionable.
- Conduct of the operation: the tumour was fixed to the liver, pancreas and involved retroperitoneal structures. The decision to go ahead and resect this tumour caused an injury to the pancreas which caused the pancreatic fistula. It also resulted in an injury to the IVC that was managed appropriately. It would have been better to regard this tumour as irresectable, leave it in situ and perform a side to side bypass.
- Postoperative care: this patient had abdominal drains remaining in situ for nearly two weeks. They drained fluid for the whole time. Given the history of surgery involving the pancreas it would have been

prudent to check the lipase or amylase in this fluid much earlier.

- Communication and transfer: when transfer was required for ICU care, communication should have occurred at a consultant to consultant level. In particular, the exact details of the operation including the proximity of the pancreas, the liver resection and the vena cava injury should have been clearly communicated to the second surgeon. Apparently this did not occur. In the second hospital, the identification of the pancreatic fistula could have been aided by better communication.
- Finally, the request for assistance from a tertiary hospital was met with acceptance in principle but the patient was not transferred due to a lack of beds. During the delay waiting for a bed, the patient deteriorated. It is entirely possible that had the second transfer occurred in a more timely fashion the outcome might have been different.



General Surgery – Colorectal

Case 5: Sigmoid volvulus with decompression then resection without covering stoma

Clinical details

An elderly patient presented with large bowel obstruction (LBO), on a background of recurrent sigmoid volvulus. Comorbidities included aortic valve replacement, hypertension and hypercholesterolaemia.

The current episode was initially treated with endoscopic decompression with rigid sigmoidoscopy and rectal tube. Three days later, a semi-elective sigmoid colectomy was performed with primary colorectal anastomosis without covering stoma.

Postoperative day three, the patient deteriorated and became increasingly septic with associated abdominal distension and was returned to theatre for an exploratory laparotomy. An anastomotic leak was identified and an abdominal washout and Hartmann's procedure were performed.

Following the second procedure, the patient was transferred to an ICU where, despite significant support, progressive multiorgan failure developed. Palliation occurred after a family meeting and the patient died on day six following the second operation.

Comments

The hospital notes provided were reasonably comprehensive. There was a sound account of the course of events and investigations performed, especially after ICU admission following the second procedure.

There were, however, several deficiencies:

- The rationale and the timing of the first operation (sigmoid colectomy) were unclear.
- There was no clear documentation regarding who had been involved in the decision process and no clear indication regarding discussion of risks and benefit of the definitive procedure for recurrent volvulus, considering the patient's comorbidities. Furthermore, it was unclear whether the patient was decompressing well with the rectal tube or whether the sigmoid colectomy was required three days after the initial presentation due to incomplete de-torsion. There was some evidence in the operative notes that this might be the case ('the sigmoid had retorted and distended with gas').
- The state of the colon including calibre, wall thickness, serosal tears, ischemic patches and whether there was proximal faecal loading were not commented on in the operative report from the first operation. Colon condition would have been a key factor in determining whether the operation performed was appropriate and whether covering stoma was indicated.
- The exact nature of the anastomosis was unclear from the operative report but it is reasonable to assume, judging by the stapler used, that it was a functional end to end anastomosis. It was unclear which staple line was affected by the reported staple misfiring.



Areas of consideration were:

- Timing and choice of initial operation: it was unclear whether the timing of the procedure was influenced by inadequate decompression by the rectal tube. While the decision for a definitive procedure for recurrent volvulus was not in question, considering the patient's comorbidities were reasonably well managed and that volvulus was likely to recur, a greater interval from the episode of obstruction may have allowed restoration of colonic wall integrity and decreased the risk of anastomotic leak.
- The choice of the procedure was reasonable given the colon integrity and good blood supply. However, considering the operation notes indicated that the colon had re-torted and was grossly distended, there remain questions regarding the wall integrity and the appropriateness of primary anastomosis.
- Role of on-table colonic lavage: while evidence on colonic lavage/bowel preparation on prevention of anastomotic leak is controversial, distal left colon anastomosis in the setting of a LBO with likely proximal faecal loading may be associated with higher risk of anastomotic leak. Such risks may be reduced by the use of on-table colonic lavage and may reduce proximal colonic distension.
- Delay in the recognition of patient deterioration following the first procedure: following the first operation, the patient had several Medical Emergency Team (MET) calls for low urine output. As early as postoperative day one, the patient was noted to be diaphoretic and the abdomen was becoming increasingly distended.

- The complaint of increasing lower abdominal and back pain was dismissed in favour of an acute pulmonary oedema diagnosis. Furthermore, inflammatory markers had been increasing daily following the first operation until recognition of the anastomotic leak after the resection. It appeared that senior staff had not been involved in reassessing the patient in their continuing deterioration and the registrar had failed to recognize the early warning signs, especially taking into account technical issues with staple misfire during the anastomosis formation. Early recognition of signs of deterioration may have resulted in an earlier return to theatre which in turn may have prevented progression to multi-organ failure and death.

Areas of concern were:

- Decision not to use a covering stoma: In the setting of significant abdominal distension and possible proximal faecal loading from ongoing LBO, the use of a covering stoma should have been strongly advised if primary anastomosis was under consideration.
- Loop ileostomy would have been reasonably easy to perform (and reverse) with relatively few morbidities. This would have reduced the patient's risk of anastomotic leak, particularly if combined with on-table colonic lavage. Sometimes the decision not to perform a stoma is based on the belief that it may adversely impact on the patient's quality of life and ability to manage at home. This often results in an increased risk to the patient due to an anastomotic leak and ultimately results



in greater morbidity. Adequate stomal care including attention to electrolyte and fluid balance would reduce the problems associated with ileostomies in most elderly patients.

Further comments

The decision for definitive management of recurrent sigmoid volvulus with sigmoid colectomy was appropriate. Without full information on the state of the sigmoid colon, the appropriateness of primary colorectal anastomosis cannot be faulted and Hartmann's procedure in the first instance may not necessarily have been preferable.

However, if primary anastomosis was contemplated, the decision should have taken into account the state of the colon including its wall integrity, distension and blood supply.

This case shows that in emergency situations where the condition of the bowel may not be optimal, strong consideration should be given to measures to reduce the risk of anastomotic leaks such as creating a diverting stoma and on table colonic lavage. Impact of a stoma on patient's quality of life is important but should not take precedence over safe surgical decision-making. Most issues relating to a covering stoma are temporary and can be addressed with appropriate stomal care and education.

Another potential area of improvement is the training of junior staff in recognizing early but subtle signs of clinical deterioration, and greater involvement of senior staff in cases where a patient is failing to progress. Multiple MET calls on the same patient over a short period of time should alert staff to the

possibility of a more serious problem than just fluid imbalance. In this case, earlier re-assessment by senior medical staff may have resulted in earlier recognition of the surgical complication and earlier intervention which may have yielded a different outcome.

The patient had acceptable cardiac function in spite of the aortic valve replacement (AVR) and preoperative BP appeared to be under control. Preoperative physician input may have reduced perioperative risks from the first procedure but would have been unlikely to have influenced the outcome as deterioration was attributable to gross sepsis from the leak and subsequent progression to multi-organ failure.





General Surgery and Gynaecology

Case 6: Delay in treatment of uterine sepsis with peritonitis

Clinical details

A young female patient presented to the private rooms of the surgeon with malaise, diarrhoea and possible abdominal pain. The patient was examined and told to attend the Emergency Department (ED) if the condition worsened. She was taken to the ED later that day. The time is not noted but was probably around 2300 hrs. Her temperature was 38 degrees, pulse rate 160/min, BP 80mmHg systolic and SpO₂ 88%. Her abdomen was slightly tender and peripheries mottled.

She was diagnosed with being in septic shock and resuscitation was commenced. She was not referred to the Surgical Unit until 0245hrs on the following day where her condition was unchanged. The surgical registrar discussed the patient with the surgeon at 0400hrs who advised further resuscitation, a CT scan of the abdomen and transfer to an ICU. The patient does not seem to have been reviewed by the surgical team until 0930hrs when the surgeon found her still in the ED. The patient was described as being moribund. The surgeon called the on-call surgeon and arranged an urgent laparotomy with both attending the procedure. At operation, it was found there was one to two litres of pus in the peritoneum. The omentum, gallbladder and appendix were ischaemic and were excised.

There was pus oozing from a defect in the left cornu of the uterus. An intraoperative gynaecological consultation was arranged and a hysterectomy was not advised. Vaginal

examination revealed pus exiting the cervical os. It was noted that the vagina was small and easily traumatised. The peritoneum was lavaged. It is not stated if the muscle layers were closed and a vacuum-assisted closure (VAC) dressing was applied. The patient was transferred to the ICU but, in spite of vigorous attempts at resuscitation, died at 0645hrs on the day after surgery.

Comments

General surgical review

Adverse events were:

- Delay in arranging surgery.
- Delay in referring to hospital: it may be that the patient should have been referred to hospital when first seen by the surgeon.
- Delay in referring to the Surgical Unit: it is unclear at what time the patient presented to the ED but was admitted at 2300hrs. The surgical registrar was not called until 0245 on the following day.
- Delay in referral for surgery: the seriousness of the patient's condition was either not recognised by the surgical registrar or not communicated to the surgeon.

It appears the patient required an immediate laparoscopy or laparotomy and this should not have been delayed in order to get a CT scan. It seems that the surgical registrar and the ED were waiting for the CT scan to trigger the next event, which was transfer to the ICU and review of the patient. As the CT was not done the patient was not transferred to the ICU and was not reviewed by the surgical team until 0930 on the day of surgery when she was noted as being moribund.



The delay in arranging a CT scan should not have happened, but at night a CT scan will generally take one to two hours to arrange, perform and be reported on. Even this delay would have been too long. The patient should have been assessed by a surgeon soon after admission and undergone a laparoscopy or laparotomy. The delay in operating on the patient is an adverse event that contributed to the death of the patient, and the initial delay would be an area for consideration. The second delay would be an area of concern.

The third, and final, delay in this escalation of seriousness was an adverse event. Delays in decision making while waiting for CT scans and other imaging is an increasingly common problem. There seems to be reluctance, especially amongst junior staff, to make a diagnosis without some form of imaging. The surgery was appropriate. The assessor discussed the question of the hysterectomy with a gynaecologist who described a general reluctance to perform hysterectomies on young adults. It was also the gynaecologist's belief that pelvic inflammatory disease could be managed conservatively with antibiotics. Further, a hysterectomy would have increased the operative time.

If all the non-viable tissue was removed, the peritoneum lavaged and adequately drained, the pelvic inflammatory disease should not have increased the risk significantly. It was not stated if the peritoneal cavity was closed. A VAC dressing was applied but it was not stated if this was just a wound dressing or a general peritoneal VAC dressing. Closing the peritoneal cavity in the presence of an uncontrolled source of infection would have increased the risk of an adverse outcome.

Gynaecological review

- A 'defect in the left cornu of the uterus' suggests iatrogenic trauma during a termination of pregnancy. Clostridial infection could explain the rapid demise.
- Peritonitis arising from the female genital tract is almost always from a sexually transmitted infection (Chlamydia or Gonorrhoea) or pregnancy complication, both possible in this case.
- The reviewer noted agreement with the comments in the surgical case on the use of CT in the differential diagnosis of the acute abdomen. The reviewer was confounded by the apparent modern trend to rely on CT and the use of antibiotics empirically.
- These kinds of cases are still managed best with a careful history, including menstrual history (very relevant here) and clinical examination including gynaecological and rectal examinations. If the patient is virgo intacta, a bimanual rectal examination is almost as informative as a bimanual vaginal examination. If doubt remains, laparoscopy can be performed before laparotomy.
- Hysterectomy is unlikely to have been helpful in this case unless Clostridium was responsible. However, dilatation and curettage are mandatory if there is any suspicion of products of conception. If a complicated termination of pregnancy (TOP) was the cause, the likely mechanism for the peritonitis is bowel damage from a curette or sponge holder (through an unrecognised uterine perforation).



General Surgery and Gynaecology

Case 7: Death resulting from laparoscopic bowel perforation with delays in diagnosis and treatment

Clinical details

An elderly lady who underwent laparoscopic total abdominal hysterectomy, bilateral salpingo-oophrectomy and radical lymph node dissection for an endometrial carcinoma died 26 days later from multi-organ failure secondary to intra-abdominal sepsis due to intraoperative bowel perforation.

Comments

General surgical review

No notes were available for this patient's treatment from the time of the laparotomy until her transfer to a hospital with an ICU following her second laparotomy. The only history available for examination is a summary by the surgeon from the second hospital who was not present at the previous laparotomies. The remainder of the patient's stay at the second hospital is fully documented and has clear and thorough notation. The following issues have arisen following a review of these notes:

- The mechanism of intraoperative bowel injury.
- A delay in a second re-look laparotomy/laparoscopy in the presence of ongoing and increasing pain after a laparoscopic procedure.
- A possible lack of appropriate technical expertise at the first re-look laparotomy.

- A delay of ten days before laparotomy was undertaken following the patient's transfer to the second hospital's ICU.

A re-look laparotomy was performed at the second hospital and was followed with six further staged laparotomies in quick succession as planned re-look procedures. Throughout this period there was aggressive surgical management, adequate debridement and lavage, the abdominal wound was left open for re-looks, and bowel resection was performed without any anastomosis until the fourth re-look laparotomy at the second hospital.

Unfortunately, the outcome was probably predictable at the time of the first re-look laparotomy at the second hospital. The patient had been in intensive care for nearly ten days with multi-organ failure secondary to sepsis as demonstrated by: the need for haemofiltration with renal failure; deteriorating liver function tests; coagulopathic with rising international normalized ratio (INR); a need for intubation and ventilation; and a significant requirement for inotropic support.

This sick and septic lady demonstrated some of the pathologies seen in the intensive care setting with acalculous gangrenous cholecystitis and multiple areas of ischaemia in the small bowel. These are often irretrievable end points.

It is possible this patient's death could have been prevented by an understanding of the mechanism of perforation that occurred during the first operation. It may be, though it is uncertain from the scant notes provided, that there were two perforations. Whether this represented an injury at a port site or an



intraoperative injury due to dissection or a thermal injury is unknown.

Inadvertent injury can occur but a desirable high level of technical expertise should make such injuries rare.

Early recognition of a complication will often lead to a speedier recovery and a minimization of contamination and sepsis. Following a laparoscopic procedure, increasing pain in the first 24 hours is often a sign that an adverse event is occurring or is about to occur. When undue pain and tachycardia occur, an urgent re-look with a laparoscope (which can be a minimal intervention if negative) should be seriously considered. At this early stage, CT scans have little to offer in the decision making process for re-laparoscopy.

When a patient requires re-operation for a complication, there is no doubt the outcome is improved by involving an additional surgeon who is not subject to the disappointment and bias of having been the cause of an adverse outcome. During the first intervention is the best time to address any complications; with each succeeding operation the chance of success markedly diminishes. With delayed recognition and repeat laparotomies, sometimes the best that can be hoped for is damage control laparotomies with frequent re-look laparotomies (which, in this case, occurred at the second hospital).

Anastomoses in these situations should be avoided even if it means multiple stomas need to be formed. During the ten days after this patient was transferred from another hospital, the treating unit who had not been involved with the initial procedure or the re-look laparotomy should have considered

earlier intervention if only to rule out a missed injury or other complications. In this case, throughout the ten day period there was a sustained level of elevation of the lactate, although this is not specified above.

Gynaecological review

Inadvertent bowel injury is a recognised risk of abdominal surgery and is something surgeons should be mindful of in any deteriorating patient. While it has benefits, endoscopic surgery carries a risk of injury outside the view of the surgeon. CT in the immediate postoperative period is helpful but may not always be diagnostic of either bowel or urinary tract injury. In this case, the surgeon was right to maintain a high level of suspicion in a patient not recovering from a seemingly uncomplicated procedure. Unfortunately, a hole in the small bowel may be sufficient to trigger a series of adverse events, regardless of the quality of the care.

Small bowel ischaemia may be due to extrinsic mechanical pressure (unlikely in this case) but can also occur due to either micro thrombi (in spite of prophylaxis) or (more likely) hypoxia due to hypotension/hypoperfusion in the context of a deteriorating ICU patient. Once established, ischaemia is very difficult to treat. In this instance, the overall impression is of a conscientiously managed case with an unfortunate outcome.



Neurosurgery – Paediatric

Case 8: Lumbar puncture in the presence of an unsuspected intracranial mass

Clinical details

An 11-month-old patient was admitted to hospital 'A' Emergency Department (ED) after being unwell for five days. Glasgow Coma Score (GCS) on admission was 11/15. Meningitis was suspected and lumbar puncture (LP) was performed.

The patient continued to deteriorate after the LP with extension posturing and was intubated and had a CT scan that showed a posterior fossa mass and hydrocephalus.

The patient was transferred to hospital 'B'. On arrival, both pupils were dilated and nonreactive. The patient was taken to the Operating Room (OR) for an external ventricular drain (EVD) that subsequently blocked and had to be replaced. In the following 24 hours the patient was taken to the OR for excision of the tumour.

Neurological status did not improve post-operatively and palliative care commenced.

Comments

The patient deteriorated immediately after the LP and a subsequent CT showed a posterior fossa mass and hydrocephalus (both relative contraindications for an LP).

The major area of concern was the failure of the team treating the patient in hospital 'A' to consider the possibility of an intracranial mass and obtain a CT prior to the LP (assuming that CT was readily available at the time of the LP).

CT, magnetic resonance imaging (MRI) or ultrasound (US) should be performed (if available) prior to an LP in a non-febrile child with progressive neurological deterioration. Brain tumours and, in particular, posterior fossa tumours are not uncommon in the paediatric population.

Equally, in the absence of access to imaging studies, an LP should not be delayed in a patient with suspected meningitis.

Overall, the care provided by the neurosurgical team was adequate. The patient deteriorated as a result of an unnecessary lumbar puncture performed in the ED.

The prognosis of the patient was already poor before any surgical intervention. In the absence of fever/sepsis it would be hard to justify the indication of an LP without a US/CT/MRI scan to rule out a posterior fossa mass.

The assessor does not believe that the management of the EVDs had any impact on the outcome.



Neurosurgery – Paediatric

Case 9: Highly malignant posterior fossa tumour intubation after possible brain death

Clinical details

This teenage patient was admitted with an eight-week history of right facial palsy which had been initially diagnosed as a Bell's palsy. Over the two weeks prior to admission the patient developed nausea and vomiting. Headache and ear pain had developed over the week prior to admission. On examination there was evidence of right 7th and 8th nerve palsies as well as dysarthria and an absent gag reflex indicative of bulbar dysfunction.

A magnetic resonance imaging (MRI) scan demonstrated a mass lesion involving the right 7th and 8th nerves at the internal acoustic meatus. There was also enhancement of the left 7th and 8th nerve and bilateral enhancement of the 9th, 10th and 11th nerves intracranially. Furthermore, there was evidence of oedema of the brain stem and diffuse leptomeningeal spread over the cerebellum. The patient was initially admitted under the Neurology service that performed a number of tests including lumbar puncture and undertook treatment for a range of intracranial infections. After a week, a planned repeat MRI scan was performed which demonstrated progression of the lesions. Given the absence of positive evidence to support the original plan, surgical referral was made and the patient proceeded to biopsy.

During the initial period the patient required urgent admission to the ICU eight days

later due to aspiration after an anaesthetic for a lumbar puncture and was able to be discharged two days later.

There was a further ICU admission four days after the initial ICU admission for episodes of apnoea. The bulbar palsy seemed to progress clinically.

The next day the patient underwent craniotomy and biopsy of the right cerebellopontine (CP) angle as well as the leptomeninges overlying the cerebellum. This demonstrated a diagnosis of atypical teratoid rhabdoid tumour. A lumbar drain had been inserted to aid with the surgical procedure. The procedure was complicated by retention of a portion of this lumbar drain within the lumbar spine. This complication did not prove to be clinically significant.

Postoperatively the patient recovered well from surgery. Pre-hydration for methotrexate therapy commenced four days postoperatively. This led to worsening of the breathing pattern and lower lobe atelectasis requiring readmission to the ICU the following day and ventilation commenced at 1700hrs. At that time the patient was hypertensive. After intubation the first examination of the pupils at 1930hrs demonstrated that these were fixed and dilated. An urgent CT scan demonstrated acute hydrocephalus. The patient was also noted to be hyponatraemic (sodium 125mmol/L), presumably due to the hydration mentioned above. An EVD was inserted urgently but the patient remained deeply unconscious. The next day brain death was confirmed and treatment was ceased after discussion with the family.



Comments

The reporting surgeon volunteered two areas for consideration. Firstly, they suggested that an earlier biopsy of the lesion may have led to an earlier diagnosis, with which the assessor agrees. The clinical and radiological features of the case did not readily fit with any of the diagnoses for which the patient was treated over the first 10 days in hospital. However, the differential diagnosis of tumour was always high on the list and a strategy for an earlier planned MRI scan was made. This led to a clear indication in favour of surgery which was performed reasonably soon thereafter. Given the safety of modern intracranial surgery, one wonders whether such a conservative approach remains appropriate.

Secondly, the treating surgeon raised concerns about the management after the patient was intubated in the ICU for respiratory failure in the context of a known progressive and substantial intracranial disease. In this context, the pupils should have been examined immediately after intubation and monitored closely. In this case, two and a half hours elapsed between the intubation and the first examination of the pupils, which were found to be fixed and dilated.

The tubing left in the lumbar spine made no difference to the outcome of this case. However, it does highlight an important general point in surgery: every time an additional step is added to a procedure, additional complications may arise. Most neurosurgeons find no need to use a lumbar drain in posterior fossa surgery. Unfortunately, this patient's early death was determined by the highly malignant nature of the tumour. The rapid clinical progression was

indicative of this. Atypical teratoid rhabdoid tumours are usually highly malignant and poorly responsive to therapy.

The above concerns did not substantially influence the outcome of this case.





Neurosurgery

Case 10: Untreated hydrocephalus and second untreated aneurysm rupture

Clinical details

This elderly patient presented after a collapse following which a CT scan showed subarachnoid haemorrhage (SAH), likely secondary to a right middle cerebral artery (MCA) aneurysm.

The earliest angiogram or scan report available described a large amount of subarachnoid blood involving both cerebellar hemispheres, with the suprasellar cistern opacified with acute blood. Subarachnoid blood was also seen throughout most cisterns, and over the surface of the cerebral hemispheres, with signs of early hydrocephalus. A 2cm aneurysm (considered small) was identified at the bifurcation of the M1 segment of right MCA. Subarachnoid blood also appeared most concentrated in this region. No other aneurysm was identified.

Curiously, the next endovascular procedure on the same day at 1959hrs involved the coiling of an anterior communicating artery/left A2 junction aneurysm 1.5mm in size. No mention of a right MCA aneurysm appears in the case notes although there is reference to diffuse vessel irregularity most likely related to atherosclerotic disease involving the right posterior cerebral artery (PCA) and the right MCA.

Magnetic resonance imaging (MRI) was performed three days after admission. A further Computed Tomography Angiography

(CTA) was performed nine days after admission, and by this stage there was a well-defined aneurysm at the right MCA bifurcation measuring 3.3mm. There were still signs of vascular spasm. A comment was made that the right MCA aneurysm was amenable to endovascular treatment but would require angioplasty and stenting in addition to coils. The interventional radiologist wanted a particular stent which was not immediately available and thus the patient was not stented and coiled, and a further SAH occurred nine days after the CTA. A meeting was then held with the family and a decision was made to begin palliative care. The patient died eight days after the second SAH.

Comments

It seems fairly clear that the right MCA demonstrated in the first CTA was not demonstrated at the time of interventional neuroradiological angiography later that same day. Whether this was due to technical error is not clear. However, the aneurysm was again demonstrated on the second CTA, leading the interventional radiologist to initiate not only coiling but stenting. Because a particular stent was not available in the hospital at that time no treatment was delivered to the right middle cerebral aneurysm. Almost certainly this was the aneurysm which ruptured again, ultimately causing the patient's death.

The progress notes indicate that nimodipine was given.

The cerebral ventricles remained mildly dilated on four post-coiling CT scans and the last scan showed the new haemorrhage: a new intra-axial haematoma in the right frontal lobe extending into the ventricular system.



In conclusion, the second-line assessor (SLA) agrees with the first-line assessor (FLA) that there seems to have been no adequate recording of the patient's neurological status and in particular the GCS status prior to intubation in the ICU. Nevertheless, it appears from the scan reports that this patient had suffered a significant SAH and went on to develop vascular spasm despite nimodipine medication. Unfortunately, during the first endovascular procedure the right middle cerebral aneurysm was not able to be visualised by the operator and was not dealt with. At the second cerebral angiography when the aneurysm could be seen, the operator was unable to deal with it at that time, possibly due to the lack of the appropriate stent.

No written accounts were found of any dialogue which should have occurred between neurosurgeon and interventional radiologist on assessment of the patient's first angiogram, to determine the optimal treatment mode. Nor could any account of rationale of the ongoing treatment be found or any recognition that, despite the EVD, the cerebral ventricles remained dilated. On-going hydrocephalus is known to reduce cerebral perfusion in the presence of vasospasm.

This patient required everything in their favour in order for a good-quality survival. Unfortunately, it seems that the aneurysm that had ruptured was never dealt with prior to re-rupture. In addition, the hydrocephalus seems to have been inadequately drained for most of the hospital stay. Hydrocephalus combined with cerebral vascular spasm is a potent combination of factors frequently leading to cerebral infarction and death. Induced hypertension could not be used because the

ruptured aneurysm had not been excluded from the circulation.

After the re-rupture the decision for palliative care was appropriate.





Oral and Maxillofacial Surgery

Case 11: Postoperative management issues after facial fracture repair

Clinical details

An elderly patient was involved in a low speed motor vehicle accident.

Following treatment by paramedics, the patient was transferred to the ED of hospital 'A' where they arrived at 1730hrs the same day. A provisional diagnosis of facial fractures was made and appropriate investigations were carried out. The patient was reviewed by the maxillofacial registrar at 2330hrs and was admitted to the ICU for observation overnight and planned for theatre the following day.

The operation, open reduction internal fixation (ORIF) of facial fractures, was uneventful and the patient was returned to the ICU. The patient was moved to the ward at 1600hrs the following day. Nursing staff sought the night resident's review of the patient due to confusion/agitation and was duly reviewed, but settled without intervention.

The patient was readmitted to the ICU the next day following an apparent cardiorespiratory arrest on the ward following administration of Diazepam for agitation. While in the ICU, restraints were applied due to persistent agitation which continued throughout the ICU stay.

The patient was discharged to the ward two days later. Almost immediately, a MET call was made due to deteriorating oxygen saturation.

This improved with deep breathing. Later the same day, a further review was performed by the hospital medical officer (HMO) at the request of nursing staff for the same reason. The following day, nurses again requested a review due to delirium/agitation. No treatment change was made, however a neurological/neuropsychological review was suggested. There is no record of enquiry into the possibility of alcohol abuse.

The patient remained on the ward until the 10th postoperative day when they were found on the floor in cardiac arrest. The patient failed to respond to resuscitation and was pronounced dead.

Comments

The first area of concern relates to a perceived failure to consult early with a general or geriatric medical team to assist with or take over management. Once this patient had returned to the ward on the first occasion postoperatively, there was ample reason to at least involve a medical team. Certainly after the second ICU admission it was clear that the facial fractures were becoming a secondary problem and management in a medical rather than a surgical ward would have been appropriate.

The content of the medical record is the second area of concern. Documentation by the ICU/surgical teams was suboptimal with medical entries made primarily at the request of nursing staff. The reviewer could find no documentation relating to the apparent arrest that resulted in readmission to the ICU. There is record of a neuropsychiatric consultation being suggested but no results were found



in the notes. The absence of such important documentation in the case of a patient who subsequently died leaves open serious questions around the nature, extent and appropriateness of care.

Thirdly, clearly no overall management plan was documented and thus the patient's care appears to have been reactive rather than proactive. There is no indication in the case notes that senior staff members were involved at any time. Without their involvement and with no formal plan, it is debatable who, or which team, were responsible for this patient. The initial impression was that this patient was admitted under the oral and maxillofacial surgical team and they certainly carried out the surgery. However, they do not feature in the postoperative period during the patient's stay on the ward. It would seem that postoperative care was left to nursing and junior general surgical residents. This may not have been the case but the notes again lack information and thus fail to demonstrate any senior involvement.

Three lessons can be drawn from this case. Firstly, medical teams should not hold back from consulting widely when there is uncertainty around the path a patient is taking. Fresh eyes, as well as diverse medical backgrounds, can prove helpful.

The second lesson is contained in the maxim 'if it's not written down, it didn't happen'. The medical notes in this case were poor and incomplete. In the absence of thorough and quality notes it is difficult to know what colleagues were thinking or doing.

Thirdly, there must be clarity of responsibility. Those who are ultimately responsible – that

is, the admitting consultant(s) – should take a leading role in the direction and oversight of patient management.





Orthopaedic Surgery

Case 12: Postoperative management issue following hip fracture

Clinical details

An elderly patient was admitted with a displaced subcapital fractured left neck of femur following a mechanical fall on that day. The patient was mentally alert and independent. There was a history of atrial fibrillation medicated with Warfarin and intermittent asthma/bronchitis. Medication included Lasix and Carvedilol for controlled hypertension. The patient was also taking Sinemet for restless legs.

Screening blood tests indicated adequate platelets, normal haemoglobin, urea of 10.7mmol/L and creatinine of 100 μ mol/L. The serum potassium was slightly elevated (5.5mmol/L). The patient was given Vitamin K to neutralise the effects of the Warfarin and was prepared for theatre on the following day for a bipolar hemiarthroplasty. A small dose of Prothrombin was administered just prior to the procedure because the INR was very slightly elevated at 1.5. The patient had a combined spinal and general anaesthetic. There is no mention of blood loss or any particular problems with the operation or the anaesthetic, and upon return to the ward the patient was alert and able to have something to eat that evening. The patient was seen at 1850hrs by the covering surgical intern because of a low urine output and was ordered a 500ml bolus of intravenous fluid. At that time the patient appeared well, was afebrile and had stable observations. There is no mention of wound problems.

The last observations appeared to be taken at 0200hrs on the first postoperative day but the patient was found deceased later that morning at 0510hrs.

Case note: there was no mention whether urine output had improved and there is no mention of this in the 0200hrs observation report. At that time all observations appeared normal and the patient was alert.

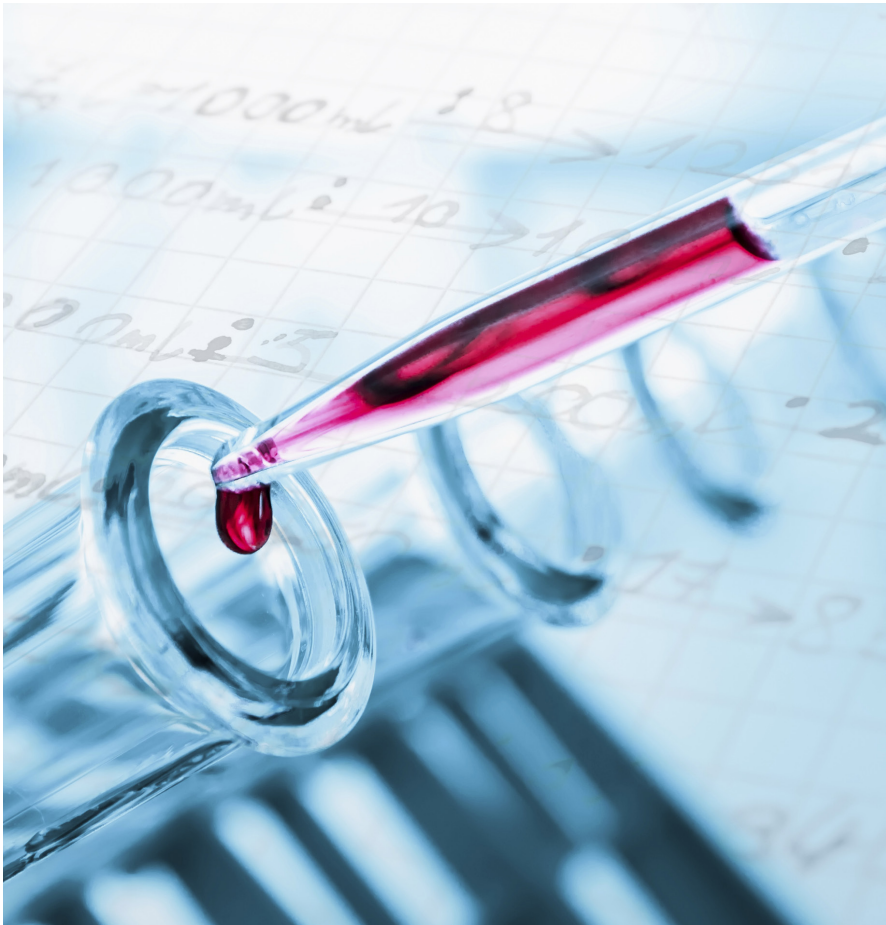
Comments

The likely cause of the sudden and unfortunate death of this patient was probably of cardiac origin (for example, arrhythmia/cardiac arrest, or possibly due to a massive stroke). It is doubtful that this could have been prevented under the circumstances, particularly as the patient appeared to be doing well when seen at 0200hrs.

The assessor is critical, however, of the failure to mention the urine output following the bolus of fluid given at 1850hrs the previous evening and believes it would have been appropriate for this patient to have been reviewed on at least one occasion by the covering medical staff to assess the urinary output problem and general state. This would most likely have happened had the patient been in a High Dependency Unit (HDU). It is highly doubtful, however, that this patient's death was the direct result of a poor urine output, unless they became extremely hypotensive between the time of the last observation at 0200hrs and death at 0510hrs. If this patient was in an HDU, better monitoring would have occurred and resuscitation may also have been attempted.



A lesson learned from this unfortunate case is that the low postoperative urinary output may have predicted ongoing problems that would have justified closer supervision throughout the evening and night. A special area in the ward for postoperative cases to allow this would have been appropriate, as would have a transfer to an HDU.





Vascular Surgery

Case 13: Missed mesenteric embolus with bleeding complications following failed peripheral thrombolysis

Clinical details

This patient was admitted to hospital with a history, provided by the ambulance officer, of bilateral hip pain which subsequently substantially resolved to a cold, numb, pale, pulseless right lower leg and lesser changes on the left. The patient had a past history of coronary artery bypass surgery, possible chronic renal failure and a ureteric stent. There was no past history of atrial fibrillation or peripheral vascular disease.

The patient was treated with Heparin infusion initially and had an angiogram which showed that a distal popliteal embolus was present. An arterial Urokinase infusion was then instituted and the patient was transferred back to the ward with increased nursing care.

The same evening the patient was noted to have developed a haematoma in the right groin and when this extended to produce right flank pain the Urokinase infusion was stopped. Subsequent investigations showed that the haematoma had extended into the right flank.

The patient was subsequently stated to have developed worsening pain in the right leg and as a result of this underwent popliteal artery exploration, embolectomy and fasciotomy.

After this operation the patient was transferred to an ICU where ventilation, haemofiltration and inotropic support occurred. The patient's haemoglobin was shown to be 7.7g/dL. This

was treated with blood transfusion.

The following day the patient was noted to have abdominal pain and a subsequent CT scan showed ischaemic gut, confirmed by the presence of elevated lactate in the blood. A laparotomy was performed which showed extensive ischaemic gut from the proximal small bowel to ascending colon and this was judged to be inoperable. With consent of the family, the patient was kept comfortable and subsequently died two days after admission.

Comments

This patient presented to hospital with a surgical condition which was treated by attempted thrombolysis. This process resulted in a significant complication of groin and retroperitoneal haematoma. Additionally, the patient had a history of chronic renal failure and despite this underwent two CT scans, presumably with contrast, and lower limb angiography. This may well have resulted in deterioration of their renal function requiring haemofiltration. The treating unit appeared to concentrate solely on the lower limb ischaemia whereas the ambulance history suggested that both lower limbs were affected initially.

The patient developed worsening renal failure as well as gut ischaemia suggesting that there was the possibility of a shower of emboli rather than a single embolus affecting the right lower limb. No distal thrombus was retrieved from the right lower limb when popliteal embolectomy was performed.

It was noted that during the embolectomy procedure, the patient was given a further 100,000 units of Urokinase which, given the extensive retroperitoneal bleed which



occurred with the previous Urokinase infusion, may have exacerbated the problem. It may have been prudent to have explored the groin and ensure that the bleeding site was well controlled beforehand.

The operative procedures, both embolectomy and laparotomy, were otherwise carried out in a sound manner.

As far as the history itself is concerned, there are a number of deficiencies. It appears that the initial assessment concentrated solely on the right leg. No pathology results were shown of the renal function when the patient presented to hospital, nor were pathology results available to show the level of myoglobin in the blood or urine, given that the patient had a significantly ischaemic leg. The presence of lactate in the blood was noted prior to the patient having a laparotomy. No consent forms for any of the procedures were shown, but as they were done under emergency conditions it is assumed that these were deemed unnecessary. The notes are also deficient in that there is no history of the discussion with the radiologist prior to performing angiography and certainly no discussion about the pros and cons of thrombolysis in this situation.

Furthermore, there is no record of the lead up to the patient undergoing formal popliteal exploration, embolectomy and fasciotomy. The ICU discharge summary suggests that there was deterioration in the leg after the Urokinase infusion was stopped, but there is no information pertaining to this in the history itself.

There is no note in the popliteal embolectomy operation report of the patient undergoing

a formal evacuation of the haematoma, although other documents suggest that this was proposed. The operation itself appears to have been carried out in a satisfactory manner, however, as stated previously, the use of Urokinase may have exacerbated the previously noted haematoma.

The ICU notes show that the patient was looked after in a conventional manner within the ICU situation. It was obvious that the patient's condition was deteriorating throughout his stay.

The FLA's concern was the overall care of the patient, the patient's history at presentation, the peripheral arterial disease status in the other leg, the presence of a raised creatinine kinase, renal function, and past surgical and cardiovascular history. The notes led this patient's surgical team to concentrate solely on the problem of the right leg ischaemia but the presenting history suggested a more generalised problem. That this patient underwent angiography and thrombolysis in the presence of a potentially surgically remedial condition is an area of concern. That the patient underwent popliteal embolectomy and fasciotomy without exploration of the groin haematoma and control of the bleeding site and had additional Urokinase administered is also troubling.

The use of angiography and CT scanning with contrast in the presence of chronic renal failure is also an area of concern, although it is noted that a discussion occurred involving radiologists and Renal Unit staff members while the patient was on haemofiltration in the ICU.



It is not clear whether the deteriorating renal function was due to contrast, hypotension or microscopic emboli.

In conclusion, this patient would not have had the groin and flank haematoma complications had they undergone a formal popliteal artery exploration and embolectomy as an initial procedure.

The ambulance officer notes and the initial finding in the Accident and Emergency Department (A+ED) indicate that the patient's problem was generalised rather than specifically related to the right lower limb. If this had been appreciated at the time of presentation then earlier diagnosis of the chronic renal failure and possible ischaemia of the bowel may have been made. It is possible that even with limited procedures this patient may not have survived.





Vascular Surgery

Case 14: Questionable role of CT imaging in suspected ruptured AAA prior to open repair; call for assistance in prolonged difficult operations

Clinical details

An elderly patient was referred by their local doctor to the ED with an eight-hour history of loin and testicular pain. Initial suspicions highlighted by the general practitioner (GP) were of a urological or vascular cause, presumably renal or ureteric colic, testicular torsion, or ruptured abdominal aortic aneurysm. The GP, considering the patient normotensive and stable, administered morphine for pain and arranged ambulance transfer. The patient's history included chronic obstructive pulmonary disease (COPD), diet-controlled Type 2 Diabetes, hypercholesterolaemia and previous smoking.

No ED or ambulance notes were supplied but it would appear that a history suggestive of a ruptured abdominal aortic aneurysm (AAA) was obtained with ED ultrasound evidence of a large AAA. A non-contrast CT scan was performed confirming a 10cm aortoiliac aneurysm and a contained retroperitoneal rupture.

At surgery a large aortoiliac aneurysm was encountered. Control of the proximal aorta was technically challenging and took some time, attributable to patient obesity. Bypass to the right common femoral artery and left iliac bifurcation was performed as well as a right femoral thrombectomy as part of an eight-hour operation. Postoperatively the patient became

oliguric with dark stained urine and creatine kinase (CK) rose to 117,000. Haemofiltration was commenced in an ICU.

A turbulent postoperative course followed with intermittent rapid atrial fibrillation (AF), oozing from the laparotomy wound, and prolonged intubation with subsequent tracheostomy. Broad-spectrum antibiotics were commenced for sepsis but inotrope requirements increased progressively and CT scans after one week were unremarkable. The patient continued to deteriorate with a rising white cell count (WCC) and required maximal-dose noradrenaline and vasopressin. Despite a family meeting where 80% 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 suggestive 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.

Comments

Areas for consideration:

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 the ED, it would appear that there was



enough information to make a presumptive diagnosis of ruptured AAA based on history and ultrasound evidence of a large AAA.

- 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 (that is, non-contrast for aneurysm extent or confirmation of rupture only, or with contrast for emergency endovascular aneurysm repair (EVAR) 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 EVAR.

Surgical fatigue and the value of senior assistance:

- Ruptured aortoiliac aneurysm requires more complex and prolonged surgery, and carries significantly higher mortality in comparison to a straight-forward 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 inadequate and did not reflect the technical challenge of the procedure as evidenced in the anaesthetic chart.
- The further involvement of experienced staff members may have been beneficial in this case. Surgical colleagues are often able and willing to assist with such cases even when they are not on call. Asking colleagues for support should be

considered an important aspect of patient care, and not a matter of shame, by all surgeons.

Recognition and management of prolonged ischaemia:

- Two main complications arose from the length of the procedure. Firstly, lower limb ischaemia and reperfusion injury with associated myoglobinaemia and metabolic stress, and secondly acute renal failure due to a combination of acute tubular necrosis and myoglobinuria. If suprarenal clamping had been applied then the risk of renal failure would have been increased.
- Prophylactic leg fasciotomies were not performed but may have been beneficial in reducing the potential myonecrotic stress from compartment syndrome.

Advance care planning and limitation of support:

- Over the 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 course 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 receive futile care with results such as prolonged patient discomfort and family anxiety and grief, as well as consuming limited health care resources.



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 laparostomy at the time of initial surgery.





Urology

Case 15: Delay in diagnosis of perineal sepsis after penectomy

Clinical detail

This elderly patient had a carcinoma of the penis. Initially, he underwent a biopsy to confirm the diagnosis, then had a partial penectomy. Nine days later he underwent total penectomy and perineal urethrostomy. Despite seeming to make satisfactory progress after this procedure, however, progress notes and pathology suggest increasing sepsis from day three postoperatively through to the patient's death on the 10th postoperative day.

The white cell count was slowly increasing from $11.2 \times 10^9/L$ on day 3 to $21 \times 10^9/L$ on day 10 postoperatively. C-reactive protein (CRP) showed similar increase. Renal function slowly deteriorated over this time, from a creatinine of approximately 120 to $170 \mu\text{mol/L}$. Blood cultures on day four postoperatively grew both *Enterococcus faecalis* and also *Bacteroides fragilis*. This, should have been a cause for alarm.

Either a special surgical cover or a night surgical resident, who were asked to observe the patient, completed the progress notes from day four to day seven postoperatively. There is no comment made by medical staff from the attending unit. During this time, the patient was showing significant evidence of sepsis.

Little comment is made with regard to the appearance of the surgical wound. The patient had a catheter removed and replaced and there is comment of cloudy urine and infection within the urine. There is no comment about the wound and no comment from the clinical unit responsible for the patient.

The antibiotics that the patient was administered, Ceftriaxone and Ampicillin, were probably inappropriate for the blood cultures which had been obtained. A CT scan that showed gas in the perineal wound was obtained at approximately 1500hrs on the day of death.

The progress notes make no comment with regard to the appearance of the wound leading up to this. At 1700hrs a MET call was made and the patient was diagnosed with septic shock. A Code Blue was called and it was after this that the patient was taken to the operating room.

Comments

It is probable that the patient was already beyond salvage by this stage, but he survived a procedure to debride the wound and was moved into intensive care.

The patient was acidotic, had dilated pupils and only had a blood pressure because of the adrenergic support that he was being given. He had a cardiac arrest and was declared dead at approximately 2040hrs. In summary, there appeared to be evidence of significant sepsis which was under diagnosed and under treated and which appeared to directly lead to the death of the patient.

In retrospect, drainage should have been started earlier and been more aggressive. Antibiotic therapy was not given as early or effectively as it might have been.

It seems from the notes that the attending surgical unit was insufficiently 'hands on', specifically from day four postoperatively onward. The possibility of a symbiotic infection does not seem to have been considered. Appropriate investigations were carried out with regard to the chest and urine, but not enough attention was paid to the actual wound which seems to have been underestimated as the source of sepsis.



List of shortened forms

AAA	Abdominal Aortic Aneurysm	LAD	Left Anterior Descending (artery)
A+ED	Accident and Emergency Department	LBO	Large Bowel Obstruction
ASA	American Society of Anesthesiologists	LDH	Lactate Dehydrogenase
AVR	Aortic Valve Replacement	LP	Lumbar Puncture
BP	Blood Pressure	MCA	Middle Cerebral Artery
CAD	Coronary Artery Disease	MET	Medical Emergency Team
CK	Creatine Kinase	MRI	Magnetic Resonance Imaging
COPD	Chronic Obstructive Pulmonary Disease	OR	Operating Room
CP	Cerebellopontine (angle)	ORIF	Open Reduction Internal Fixation
CPR	Cardiopulmonary Resuscitation	PAC	Pre-Admission Clinic
CT	Computed Tomography	PCA	Posterior Cerebral Artery
CTA	Computed Tomography Angiography	PEEP	Positive End Expiratory Pressure
ED	Emergency Department	PPV	Positive Pressure Ventilation
EVAR	Endovascular Aneurysm Repair	QP	Qualified Privilege
EVD	External Ventricular Drain	RMO	Research Medical Officer
FLA	First-line Assessor	SAH	Subarachnoid Haemorrhage
GCS	Glasgow Coma Score	SLA	Second-line Assessor
GP	General Practitioner	TOP	Termination of Pregnancy
HDU	High Dependency Unit	US	Ultrasound
HMO	Hospital Medical Officer	VAC	Vacuum Assisted Closure
ICU	Intensive Care Unit	VASM	Victorian Audit of Surgical Mortality
INR	International Normalised Ratio	WCC	White Cell Count
IVC	Inferior Vena Cava		

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The information contained in this Case Note Review Booklet has been prepared by the Royal Australasian College of Surgeons Victorian Audit of Surgical Mortality Management Committee, which is a declared quality improvement activity. The Australian and New Zealand Audit of Surgical Mortality, including the Victorian Audit of Surgical Mortality, also has protection under the Commonwealth Qualified Privilege Scheme under Part VC of the Health Insurance Act 1973.