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COLLEGE OF SURGEONS

QASM

Queensland Audit of Surgical Mortality



Northern Territory Audit
of Surgical Mortality

LESSONS from the AUDIT

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Introduction

Fluid balance has to be carefully considered in every patient. A fluid imbalance can be fatal, especially in the older, compromised patient.

Lessons from the Audit (Volume 16) looks at five cases in which the care pathway was disturbed by fluid balance issues.

The opportunity to learn from these case studies has resulted in recommendations (see page 3).

In the elective patient, fluid balance can be an issue. Careful consideration must be afforded all patients at every stage of their in-hospital care, especially in the postoperative period. If comorbidities are added to postoperative challenges, then even more careful assessment must be considered to ensure effective fluid balance management.

In the emergency patient, a marked disturbance in fluid balance may exist prior to admission. It is paramount to formulate a suitable plan to return each patient to a reasonable fluid balance status as soon as possible.

Thank you to all the Queensland Audit of Surgical Mortality (QASM) assessors who carefully consider cases and contribute valuable feedback for their peers.

We trust that these five case studies will contribute to the art of managing fluid balance in surgical patients.

Yours sincerely

John North
QASM and NTASM Clinical Director

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.



Shortened forms

CT	computed tomography
ERCP	endoscopic retrograde cholangiopancreatography
HDU	high dependency unit
ICU	intensive care unit
QASM	Queensland Audit of Surgical Mortality



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Overall recommendations:

- Chart input and output of fluid.
- Act on minor fluid imbalance early.
- Deal with the cause of the fluid imbalance.
- Recognise that comorbidities often complicate the fluid imbalance.

Case (1)

- If haemoglobin is dropping in the postoperative period, look for the site of the blood loss.
- Fluid balance management in the postoperative period is critical and remains a priority for all surgical patients.
- Consultant-driven care must be mandated in the critically ill patient.

Case (2)

- Hip fracture patients require a multidisciplinary team management approach.
- Significant blood loss for surgical procedures in elderly hip fracture patients is routinely underestimated. Careful assessment of haemoglobin is essential.
- Fluid balance management and management of haemoglobin are essential in postoperative care of these patients.

Case (3)

- Surgeons must carefully consider whether non-life-threatening surgery is indicated in patients with multiple comorbidities.
- Fluid balance assessment at all stages of intraoperative and postoperative care is critical in the patient with only one functional kidney.
- Paralytic ileus following spinal surgery is common. Accurate fluid balance demands careful assessment of “fluid in – fluid out” in every case at very regular intervals.



Case (4)

- Preoperative planning is essential for all elderly patients.
- During the planning process for elective patients, consideration should be given to postoperative admission to an intensive care unit (ICU) or high dependency unit (HDU) so that all aspects of care can be managed at consultant level.
- Paralytic ileus is always associated with fluid imbalance and requires a comprehensive care process.
- Situational awareness by the surgeon in elderly patients post- colonoscopy is critical and early recognition of any complications is essential.

Case (5)

- Fluid balance management must include charting of input and output with appropriate handover.
- Guidelines for anticoagulation must be carefully considered in every elderly patient and the risks weighed against potential benefits for every individual.
- Gentamicin is nephrotoxic and alternatives must be considered in elderly patients with some renal impairment.



General Surgery

Case study 1: *More things are missed by not looking than not knowing.*

The QASM assessor stated: “this patient died due to the failure to recognise he was not well following laparoscopic surgery; it took over a week for an intra-abdominal catastrophe to be diagnosed and managed.”

The patient:

- was male (mid-70s).
- was an emergency admission.
- had comorbidities (diabetes and ischaemic heart disease).

What happened at the hospital?

- The patient presented to the emergency department malnourished and deeply jaundiced. He had an abdominal computed tomography (CT) scan which reported Mirizzi syndrome, but the radiologist’s report described a stone impacted in the cystic duct.
- On admission, he was treated with intravenous antibiotics and vitamin K. He was referred for endoscopic retrograde cholangiopancreatography (ERCP) but the procedure was unsuccessful.
- Three days postadmission, he had laparoscopic surgery. The bile duct stone was removed via a long anterior choledochotomy. A fundectomy of the gallbladder was performed. The surgeon documented the desire to avoid a hepaticojejunostomy.

- Day one postoperatively, the patient was oliguric despite having received 5 L of normal saline.
- Day two postoperatively, he received frusemide due to fluid overload.
- Day three postoperatively, he received crystalloid and frusemide due to oliguria.
- Day four postoperatively, he was hypoxic and wheezy, with pitting oedema up to his knees. After medical and renal review, albumin, frusemide and fluid restriction were recommended.
- Day five postoperatively, with ongoing oliguria, intravenous fluids were recommenced and a renal ultrasound scan was performed to exclude obstruction. There was a drop in his haemoglobin concentration to 86 g/L.
- Day six postoperatively, he was still oliguric. Liver function tests worsened and lipase was tested for the first time. Lipase was elevated and haemoglobin had fallen to 80 g/L. Later in the ICU, haemoglobin was noted to have fallen to 61 g/L.
- There was no external bleeding, haematemesis or malaena. He was given vitamin K, fresh frozen plasma and prothrombinex to treat the coagulopathy. Heart failure was confirmed biochemically.



- A calculus obstructing the distal bile duct was suspected on magnetic resonance cholangiopancreatography but was not found at ERCP performed later that night. A biliary stent was placed. At the conclusion of the ERCP, the patient had a hypotensive cardiac arrest and required three minutes of cardiopulmonary resuscitation.
- Day seven postoperatively, after four units of blood were transfused, his haemoglobin was 102 g/L. However, he remained in multi-organ failure.
- Day nine postoperatively, there was an ongoing vasopressor requirement, a drop in haemoglobin and a minor gastrointestinal bleed. This was investigated by oesophagogastroduodenoscopy, which found the expected oesophageal ulceration due to nasogastric tube and an ooze at the sphincterotomy site. A laparotomy was performed where a 1500mL haemoperitoneum was found. A larger piece of Surgicel (10 x 20 cm) was placed in the gallbladder fossa at the bleeding site.
- Over the following seven days, in the ICU, the patient's liver function tests continued to improve but his haemoglobin continued to fall. He received eight units of packed cells.
- Day 16 postoperatively, his treatment was withdrawn following discussions with his family. He passed away the same day.

What issues are highlighted by this case?

- Poor management of, and failure to recognise, an unwell patient following laparoscopic surgery.
- Poor management regarding fluid balance and falling haemoglobin.
- Day one postoperatively, the consultant surgeon was not available.
- It took more than one week for an intra-abdominal catastrophe to be recognised.



Orthopaedic Surgery

Case study 2: Hip fracture patients always need appropriate fluid balance management.

The QASM assessor stated: “Any elderly patient suffering this type of fracture, followed by surgery, has a huge physiologic load placed on their system. This often exposes underlying and previously undiagnosed cardiac abnormalities.”

The patient:

- was female (late 80s).
- was an emergency admission.
- was admitted after a fall.

What happened at the hospital?

- The patient was taken to theatre on the day of admission after diagnosis (perthrochanteric fracture neck of femur).
- The operation (insertion of a long locked intramedullary nail) took three hours using spinal anaesthesia.
- No intraoperative difficulties were noted. The estimated blood loss was 450 mL. The operating surgeons were listed as a consultant and a registrar.
- Postoperatively, the patient was alert and oriented but with a persistently low blood pressure. This was despite a large volume of crystalloid resuscitation (in the emergency department she had systolic pressure of 125 mm Hg; postoperation it was 80 mm Hg).

- The morning after surgery, the patient had a precipitous drop in blood pressure that partially responded to a saline bolus. Her electrocardiogram showed ST depression. Her haemoglobin was 57 g/L (116 g/L preoperation). A transfusion was ordered.
- The patient was reviewed by the ICU service registrar and transferred to the ICU. She was 2,300 mL “positive” in terms of fluid balance. She was diagnosed with a non-ST elevation myocardial infarction secondary to anaemia, as a consequence of fluid overload.
- The patient went on to develop pulmonary oedema. She became dependent on continuous positive airway pressure and inotropic support, and died 10 days after surgery.



What issues are highlighted by this case?

- Surgery in the elderly patient places a physiologic load on their system and may expose underlying cardiac abnormalities.
- The operation time was longer than would be expected.
- There was a lack of awareness regarding the amount of bleeding that can occur from neck of femur fractures.
- There was a substantial delay in giving blood products.
- The importance of recognising the cause of low blood pressure is paramount. Too much emphasis seems to have been placed on the spinal anaesthetic as a contributor to the low blood pressure.
- This patient and her issues needed to be escalated up the referral chain much earlier to a multi-disciplinary team assessment.



Neurosurgery

Case study 3: Predicting possible fluid balance issues in the elective patient.

The QASM assessor stated: “Given that the patient only had one kidney, providing adequate intravenous access for fluids was essential. Subcutaneous administration of intravenous fluid, particularly in the presence of what appears to be an unrecognised paralytic ileus, was inadequate and inappropriate.”

The patient:

- was female (late 60s).
- was an elective admission.
- had comorbidities (obesity, diabetes and a history of nephrectomy for carcinoma of the kidney, a mastectomy for carcinoma of the breast and hysterectomy for carcinoma of the uterus).

What happened at the hospital?

- The patient presented with a history of lower back pain and a recent history of increasing pain, numbness and weakness in her legs. A neurological examination was normal.
- Subsequent magnetic resonance imaging of the lumbar spine showed stenosis of the spinal canal below lumbar 3, with a degenerative spondylolisthesis of lumbar 4 on lumbar 5.

- The patient had a 5-hour operation (three level lumbar decompression, with interbody fusion and segmental fixation to the pelvis). The estimated blood loss was 1,200 mL. Postoperative haemoglobin was 8.9 g/dL.
- The blood loss over 24 hours (including the operation) was 2.8 to 3.0 L.
- Day two postoperatively the patient was reported as being unwell. She had poor intravenous access and was receiving parental fluid through subcutaneous cannulae. Oral fluids were being encouraged. Total urine output had only been 66 mL. Blood tests at the time showed a moderate increase in serum creatinine and consequently a moderate decrease in estimated glomerular filtration rate.
- Day two postoperatively (early evening) the patient showed signs of respiratory failure. The urinary output had not improved. Two peripheral intravenous catheters were inserted. A short time later the patient started vomiting and became unrousable.
- The patient had a cardiac arrest which was reversed with defibrillation.
- The patient was transferred to the ICU.
- Investigations showed marked deterioration of renal function with a steep rise in creatinine and fall in estimated glomerular filtration rate.



- Chest x-rays showed the consolidation of the left lower lobe of lung with an effusion. Abdominal radiology showed distended loops of small bowel (consistent with paralytic ileus).
- The patient did not regain consciousness while in the ICU. 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 acute respiratory distress syndrome with bilateral pleural effusion).
- The patient died on day 11 postoperatively (multi-organ failure with evidence of general sepsis).

What issues are highlighted by this case?

- Given the patient's history of nephrectomy, effective management of postoperative fluid balance was paramount.
- When a patient's general health is suboptimal, consider a lesser operation or no surgery.
- Unrecognised paralytic ileus creates extra demands. This patient had a prolonged period during which the urine output was substantially diminished. Subcutaneous administration of intravenous fluid (particularly in a presence of unrecognised paralytic ileus) was inappropriate.



General Surgery

Case study 4: Fluid overload in the elderly with comorbidities is never easy to manage.

The QASM assessor stated: "I believe there should have been more consideration given to the fact that this elderly patient was undergoing a significant surgical procedure and, in the light of his multiple comorbidities, arrangements should have been put in place for a plan to treat him in a high dependency or intensive care unit, at least in the immediate postoperative phase."

The patient:

- was male (early 80s).
- was an elective admission.
- had comorbidities (atrial fibrillation, peripheral vascular disease, hypertension and chronic obstructive pulmonary disease).
- had ischaemic heart disease (two diagnosed anterior myocardial infarcts in the past but no recent episodes of angina prior to surgery).

What happened at the hospital?

- The patient was admitted for investigation of anaemia.
- Colonoscopy was performed and multiple polyps were found within the sigmoid colon (one polyp was malignant).
- Surgery was arranged because of rectal bleeding and a further fall in his haemoglobin level.

- Preoperative staging, which included a positron emission tomography scan, did not identify any evidence of metastatic disease.
- He had a laparoscopic-assisted partial sigmoid colectomy with hand-sewn anastomosis. There were no intraoperative complications.
- Postoperatively, he was not admitted to the HDU or ICU.
- Postoperatively, he had a prolonged and difficult convalescence. This included paralytic ileus, fluid overload with acute pulmonary oedema, pneumonia involving the left lower lobe, congestive cardiac failure, bilateral pleural effusions, episodes of tachycardia (related to his atrial fibrillation) and hypoxia. He was also anaemic.
- A CT pulmonary angiogram was performed which excluded pulmonary embolism.
- In the postoperative period, medical improvement was intermittent and variable.
- He was transferred to a rehabilitation unit once he was considered medically stable, but died three weeks post-surgery as a result of multi-organ failure.



What issues are highlighted by this case?

- There was a need for comprehensive preoperative assessment and planning, and review by a consultant surgeon.
- All post-colonoscopy complications should receive HDU or ICU care.
- Recognition of fluid balance issues and early appropriate management of those issues is critical in the older patient.
- In this case, situational awareness was lost soon after the colonoscopy. Remedial action was indicated but did not take place.



General Surgery

Case study 5: *Appendicitis can be fatal, especially in the elderly. Fluid imbalance can often be a significant factor.*

The QASM assessor stated: "Various surgery options were available. However, 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:

- was male (early 80s).*
- was an emergency admission.
- had comorbidities (obesity, diabetes, cardiovascular disease, chronic renal failure, dementia and advanced malignancy).

What happened at the hospital?

- The patient was admitted with four days of right iliac fossa pain.
- CT confirmed appendicitis.
- Surgery was considered appropriate.
- Preoperatively, one dose of gentamycin was given prophylactically.
- The laparoscopy was converted to an open procedure with right iliac fossa incision.
- Initial bloods* (haemoglobin 128 g/L; white cell count 9.6 x10⁹ L; urea 14.9 mmol/L; creatinine 150 mmol/L; albumin 31 g/L).
- Postoperatively, the patient was managed in the ICU but remained hypotensive requiring vasopressor support.

- Fluid balance was not mentioned as a possible cause of the hypotension.
- Early recommencement of anticoagulation therapy was considered due to cardiac status.
- On day two in the ICU, the patient was discharged to the ward with asymptomatic hypotension, having had poor urine output on days one and two.
- Day five postoperatively, the patient was changed to oral antibiotics and was tolerating a full diet.
- Day six postoperatively, the patient had worsening acute renal failure (creatinine increased from 140 to 230 mmol/L, haemoglobin 88 g/L, white cell count 13.4 x10⁹ L, oedema despite diuretics). There was a medical review for fluid status and the fluid balance chart was restarted.
- Day seven postoperatively, the patient had worsening renal failure (creatinine 289 mmol/L) and the renal team became involved. Gentamicin toxicity was considered. An indwelling catheter was reinserted to aid fluid balance accuracy (urine output approximately 50 mL/h for 24 hours).
- Day eight postoperatively (evening), the patient deteriorated. The observations were as follows: oxygen saturations 91-92% 3 L (which triggered a medical emergency team call); oliguria; worsening renal function. Intravenous Tazocin was commenced and sepsis queried (but source unclear). A CT abdomen showed a



large abdominal wall collection (drained haemoserous fluid only), and minimal intra-abdominal fluid in paracolic gutters.

- Day eight postoperatively (morning), the patient was admitted to the ICU because of further hypotension (Tazocin changed to Meropenem); working diagnosis of septic shock and multiple organ dysfunctions; possible hospital-acquired pneumonia; query infected haematoma; query urinary tract infection.
- Situation discussed with family to establish a ceiling of care. (noradrenaline 30 mg/min; intravenous antibiotics; not for resuscitation)
- Patient died day 10 postoperatively.

What issues are highlighted by this case?

- Fluid balance management (including documentation in fluid balance chart) was poor for a patient in this condition.
- Inappropriate anticoagulation appears to have caused significant morbidity and contributed to mortality.
- Usage of gentamycin contributed to avoidable serious renal failure.

***Reference ranges for this adult male:**

Haemoglobin: 130 g/L or higher

White Cell Count: refer to laboratory reference range

Urea: 3.0 to 8.0 mmol/L

Creatinine: refer to laboratory for >60 years

Albumin: 32 to 45 g/L



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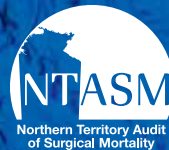
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