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Audits of Surgical Mortality

# National Case Note Review Booklet

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# Chair's report

This latest copy of the National Case Note Review Booklet provides information on mortality for the relatively small specialties of Paediatric Surgery, ENT, Plastic Surgery and Cardiothoracic Surgery. These specialties, although conducting a substantial amount of surgery, fortunately have few cases that lead to surgical mortality. Nonetheless, the lessons that can be learnt from these specialties are considerable and are well documented in this edition of the booklet.

The lessons are very similar to those learnt from the groups contributing far more surgical mortality, such as Vascular Surgery, General Surgery, Orthopaedic Surgery and Neurosurgery. Sometimes the deaths in the smaller mortality specialties are treated as exceptional and perhaps the opportunity to draw important lessons are lost. This particular case note review collection certainly highlights that the problems and improvements remain similar for all surgical specialties.

Hopefully the experiences highlighted will be of use to all surgeons and groups having to assess patients prior to surgery, manage the surgical intervention and, most importantly, the postoperative care decision-making. As we see repeatedly, strong consultant involvement and communication leads to better outcomes for our patients and certainly needs to be emphasised and maintained, whether in the public or private system.

Constructive feedback is always welcome and responded to.



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**Guy Maddern**

Chair, ANZASM Steering Committee

# Case Studies

## Case 1: On-table myocardial infarction in a patient with sepsis secondary to viscus perforation

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### General Surgery

#### CASE SUMMARY

A 78-year-old woman presented to the emergency department (ED) with a 6-day history of worsening generalised abdominal pain. She had not passed flatus or opened her bowels for the last 4 days. Her past medical history included atrial fibrillation (AF), hypertension and hypercholesterolaemia. She was routinely taking dabigatran; however, not for the previous 4 days due to nausea and vomiting.

A computed tomography (CT) scan of the abdomen and pelvis showed significant pneumoperitoneum, a dilated stomach and small bowel loops leading to a right femoral hernia. The patient was seen by the surgical registrar who arranged for her to have an urgent laparotomy for a viscus perforation. Preoperatively, she was noted to be hypothermic (temperature 35.5°C) and bradycardic (heart rate 60 beats per minute (BPM) and in AF with intermittent runs (10–15 beats) of ventricular tachycardia. Her blood pressure (BP) was 105/56 mm Hg; serum cardiac troponin I was 0.108 µg/L (normal range 0.02–0.08 µg/L). The patient was critically unwell, unstable and had a life-threatening condition; she required urgent surgery and admission to intensive care unit (ICU). Her husband was advised of this by the general surgical and intensive care team.

With the induction of general anaesthesia the patient became unstable, requiring noradrenaline up to 40 µg/minute with adrenaline boluses to maintain mean arterial pressure. Surgery commenced but was abandoned secondary to instability after the skin incision. An electrocardiogram (ECG) showed widespread ST elevation. Echocardiogram showed markedly decreased global contractility. A large on-table myocardial infarction (MI) with cardiogenic shock was diagnosed.

The patient was transferred to ICU. The general surgeon and the intensivist informed the family that the patient had had a massive MI in theatre and the surgical team had been unable to proceed with treatment for her abdominal catastrophe. The decision was made to palliate the patient and she passed away a few hours later in the presence of her family.

## DISCUSSION

This patient was rapidly assessed by the surgical, anaesthetic and intensive care team and taken to the operating theatre within an hour. It was identified and clearly communicated that the patient was high-risk. It was decided to proceed because there was a clearly identifiable potentially remediable cause for the sepsis—viscus perforation.

Apart from AF, the patient had no other cardiac or respiratory comorbidities. She did have mildly elevated serum troponin preoperatively; however, a mild elevation is frequently seen in sepsis in the absence of acute coronary syndrome. The patient's coagulation profile was normal (international normalised ratio 1.1) and she was not acidotic (pH 7.4) preoperatively.

There are 3 areas of consideration in the management of this patient, principally related to the ED management:

- Early notification of the general surgical team for a patient with an acute abdomen and sepsis. The notes indicated that the patient was in the ED for 2 hours before the general surgical team was notified.
- Aggressive intravenous (IV) fluid resuscitation in a hypotensive and oliguric patient. The patient was rapidly administered 2 L of normal saline in the ED; however, this was then slowed to a rate of 100 ml/hour despite the patient continuing to be hypotensive and oliguric.
- Commencement of IV antibiotics in the ED in the setting of sepsis. The patient was only started on IV antibiotics upon review by the general surgical registrar.

Nevertheless, it is doubtful these factors would have made any difference to the outcome for this patient.

## CLINICAL LESSONS

This case highlights the importance of non-technical skills, such as consultant-driven decision-making, particularly if patients have obvious peritonitis and septicaemia. In patients with urosepsis or suspected septicaemia, a blood and urine specimen should be sent to the laboratory and IV antibiotics commenced in the ED. In addition, the hypotensive oliguric patient requires early and appropriate IV fluid resuscitation.

## Case 2: Delayed secondary haemorrhage results in death at home

### Otolaryngology Head and Neck

#### CASE SUMMARY

A 69-year-old man was diagnosed with a T1N0M0 squamous cell carcinoma of the left lateral tongue base. He was a smoker with a significant history of carcinoma of the lung and rheumatoid arthritis. He was taking methotrexate, hydroxychloroquine and prednisolone.

His case was presented at a head and neck multidisciplinary team meeting after histological confirmation of the diagnosis and appropriate workup, including CT and positron emission tomography for local and distant metastases. Given a choice between radiotherapy and surgery, the patient requested surgery.

Trans-oral laser-assisted resection of the tumour, including the left lingual tonsil, was performed. Intraoperative bleeding was minimal. It was noted at the time that an arterial wall had been exposed in the bed of the surgical resection. Frozen section margins were clear.

The following day, a CT angiogram was indicated to confirm the position of the external carotid artery. The angiogram confirmed the presence of a tortuous left lingual artery. After consulting with colleagues, the treating surgeon decided that clipping or ligation of the lingual artery was not required.

The patient was discharged on postoperative day 2 and continued to progress well until the evening of the 10th postoperative day when he suffered a severe haemorrhage (per orally). He subsequently collapsed and died at home with a significant clot in his airway, despite the presence of paramedics and the treating surgeon.

#### DISCUSSION

The reporting surgeon notes that ligation of the lingual artery may have prevented this fatal complication.

A review of contemporary literature concerning the incidence of bleeding and fatal outcomes following this type of surgery suggests that attention to vessels at the time of surgery by clipping may reduce the volume of a postoperative haemorrhage.

A small but meaningful risk of bleeding after trans-oral robotic surgery for trans-oral pharyngeal squamous cell carcinoma exists particularly among anticoagulated

or previously irradiated patients. Prophylactic external carotid artery ligation did not significantly impact the overall incidence of postoperative bleeding but may reduce the risk of severe (life-threatening) bleeding.<sup>1</sup>

In a series of cases, the overall death rate from haemorrhage was approximately 0.3%. The rate of postoperative haemorrhage varied from 3% to 16%.

There are units around the world that do not prophylactically perform preoperative neck dissection that would necessarily involve clipping of vessels.

## CLINICAL LESSONS

Attention to exposed vessels at the time of surgery is the preferred option.

In addition to clipping the exposed vessels after tongue resection, they could also be oversewn. A haemorrhage in this area, though uncommon, has a relatively high mortality. Multiple layers of protection are better than relying on just one method of haemostasis. Being immunosuppressed indicates a slower than normal wound healing by secondary intention. This may have prompted the surgeon to use multiple haemostatic techniques, rather than relying on the laser resection alone.

## REFERENCES

1. Gleysteen J, Troob S, Light, T, Brickman D, Clayburgh D, Andersen, Gross N. The impact of prophylactic external carotid artery ligation on postoperative bleeding after transoral robotic surgery (TORS) for oropharyngeal squamous cell carcinoma. *Oral Oncology*. 2017;70 1–6. <https://doi.org/10.1016/j.oraloncology.2017.04.014>

## ADDITIONAL READING

Stokes W, Ramadan J, Lawson G, Ferris F. R. L., Holsinger F. C, Turner M. T. Bleeding complications after transoral robotic surgery: A Meta-Analysis and Systematic Review. *Laryngoscope*. 2021; 131(1), 95–105. <https://doi.org/10.1002/lary.28580>

Pollei T. R, Hinni M. L, Moore E. J, Hayden R. E, Olsen K. D, Casler J. D, Walter L. C. Analysis of postoperative bleeding and risk factors in transoral surgery of the oropharynx. *JAMA Otolaryngology - Head and Neck Surgery*. 2013; 139(11), 1212–1218. <https://doi.org/10.1001/jamaoto.2013.5097>

Crawford J. A, Bahgat A. Y, White H. N, Magnuson J. S. Hemostatic options for transoral robotic surgery of the pharynx and base of tongue. *Otolaryngologic Clinics of North America*. 2016; 49(3), 715–725. <https://doi.org/10.1016/j.otc.2016.03.002>

## Case 3: Perioperative myocardial infarction and management

### Cardiothoracic

#### CASE SUMMARY

A 65-year-old man was admitted from the ED after sustaining a non-ST segment elevation myocardial infarction (NSTEMI). A coronary angiogram showed severe diffuse triple vessel disease. Symptoms continued for 8 days, at which time a coronary artery bypass graft (CABG) was undertaken. The patient was initially reviewed by one surgeon; a different surgeon performed the operation. The records show that the surgery was difficult due to advanced coronary artery disease (CAD). The patient suffered a cardiac arrest in theatre, requiring insertion of a balloon pump and a second pump run. A postoperative angiogram showed a blocked graft to the right coronary artery, which was treated with stents. Further stents were inserted in the left anterior descending artery (LAD), although the reason is unclear. The patient had a difficult course in ICU with severe biventricular dysfunction requiring extracorporeal membrane oxygenation (ECMO) support. There were no signs of improvement throughout the patient's 7-day stay in ICU. The ICU notes mention ongoing ST elevation and a rise in troponin. Stent thrombosis was suspected but an angiogram was not done.

The patient developed multiorgan failure requiring nitric oxide, ECMO, continuous veno-venous haemodialysis and high-dose inotropic support. An attempt at weaning from ECMO was unsuccessful. With ongoing deterioration and no signs of improvement, the patient was taken to theatre for a one-way wean from ECMO. He passed away shortly after separation from ECMO.

#### DISCUSSION

Graft failure resulting in perioperative NSTEMI is unsurprising for a patient with an angiogram showing very advanced CAD. Grafting in such patients is difficult and graft failure rates are often high despite the best efforts of surgeons. Delay in surgery may have contributed to the events in theatre or afterwards.

For a patient such as this, with complex coronary anatomy, it would have been helpful to assess graft flow with flowmetry, which is readily available. Graft flow assessment in theatre would have provided guidance for revision of the graft, possibly preventing establishment of an NSTEMI and the spiral of multiorgan failure.

The patient had a stormy course in ICU with severe biventricular failure. The notes mention suspected stent thrombosis, yet no angiogram was undertaken. Due to the complexity of the case, the outcome may not have been any different, but nevertheless an angiogram should have been performed to evaluate the stents. An ischaemic and infarcted ventricle is unlikely to improve without timely revascularisation.

## CLINICAL LESSONS

This case highlights the management of perioperative NSTEMI. Intraoperative graft assessment may have helped to prevent the downward spiral of events. In addition, delaying surgery in a patient that was still symptomatic despite medical therapy was not ideal, and consideration should have been given to expediting the revascularisation and exploring all other options; that is, percutaneous coronary intervention or hybrid approaches to reduce the risk of perioperative events from grafting vessels with high risk of early graft failure.

## Case 4: Intraoperative technical problems during off-pump coronary artery bypass grafts causes severe heart failure

### Cardiothoracic

#### CASE SUMMARY

A 63-year-old man was admitted with unstable angina. An angiogram revealed severe triple vessel disease. The patient's background comorbidities included chronic renal failure, known CAD, previous right coronary artery stent, and ST-elevation myocardial infarction (STEMI) with ventricular fibrillation arrest. This patient was discussed in a cardiology multidisciplinary team meeting and CABG was favoured.

An off-pump CABG procedure was performed shortly after admission. The left internal mammary artery (LIMA) was grafted to the LAD artery and skipped to a diagonal branch. Saphenous vein was used to graft a left ventricular branch and skipped to the intermediate vessel. Another saphenous vein was grafted to the acute marginal vessel. The caliber of the distal vessels was good. The patient had significant hypotension during the last distal anastomosis, which reverted with some pressor support and return of the heart to the pericardium. The procedure was completed with no ECG changes initially reported.

After protamine infusion to reverse heparin, the patient developed hypotension, ECG changes and an intraoperative regional wall motion abnormality. He required significant inotrope support to revive global left ventricular (LV) function and mechanical support using intra-aortic balloon pump (IABP). The surgeon reported pulsations were felt in the grafts, giving a sense of graft patency. As the LV function further deteriorated on IABP support, coronary assessment—including graft patency—was done by angiography after transfer to the catheterisation lab. The IABP was subsequently removed with concerns about ischaemia to the right lower leg.

Angiography revealed distal native occlusion in all grafted vessels with severe spasm, but not in non-grafted vessels. The interventional cardiologist was not able to cross the vein graft anastomoses with a Sion blue guidewire, meaning that—technically—the anastomoses were occluded.

The patient was placed on a second mechanical support, being venoarterial ECMO, and transferred to ICU. His deteriorating clinical condition, complications associated with weaning from ECMO and the expected bad outcome were discussed in a multidisciplinary team/family meeting. At day 7 after admission,

the patient died after weaning from ECMO, the likely cause being global myocardial ischaemia and ventricular fibrillation arrest.

## DISCUSSION

This patient suffered a major adverse event during his bypass surgery operation. Intraoperatively, there were clear indications of global myocardial ischaemia, demonstrated by a triad of significant ECG changes, escalating inotrope requirement despite mechanical support and new global regional wall motion abnormality. Unfortunately, there is no detailed documentation of this in the operation notes, making it difficult to assess. It was documented elsewhere that the grafts appeared to be flowing with good pulsation; however, no formal dynamic flow assessment using devices such as Medistim to check the flow in grafts was reported. The angiographic findings suggested these pulsations gave an erroneous assessment of patency. Transient hypotension is understandable in off-pump surgery due to positional dynamics of the heart during the procedure. With the changes during performance of the last graft, there were clear indications for a conversion of off-pump surgery to on-pump surgery and assessment of all the anastomoses. One wonders whether this was given any consideration rather than taking an unstable patient to the angiography suite.

A number of areas of concern arise from this case.

- Significant hypotension during the performance of the last graft would indicate the need for conversion to on-pump surgery. This may have alleviated the global ischaemia which appears to have developed.
- Without a definitive flow study, the graft pulsations gave the surgeon erroneous information regarding the false patency of the graft. This led to a lost opportunity to redo the grafts in a patient with global ischaemia. In the instance of global LV dysfunction and ECG changes, placing a vein graft to LAD should have been considered.
- Removal of IABP with concerns about ischaemia to the right lower leg is correct in principle, but not in view of intraoperative ECG changes, hypotension and intraoperative transoesophageal demonstration of a regional wall motion problem.
- During angiography, the physician was unable to pass the wire across all the anastomoses, which suggests a technical problem. There is potentially a chance of graft failure secondary to technical issues, even in the best surgical hands. Given that adenosine and glyceryl trinitrate administration did not open up the spasm, a technical problem is likely. Severe spasm was reported distally in the grafted vessels but the angiography report also mentions stagnation of contrast

in the grafts, suggesting poor runoff. Thrombosis, vasospasm and local coronary dissection are other possible causes.

- The operative notes were lacking in details of preoperative ventricular function and issues that may have arisen intraoperatively, making assessment of the case difficult.

## CLINICAL LESSONS

In this case there was a lack of insight that intraoperative global ischaemia was happening on the table during an off-pump bypass procedure. A decision to place the patient on cardiopulmonary bypass, complete the surgery and rest the heart as well as assess the patency of all grafts may have avoided the problem of global myocardial dysfunction and its consequences, which led to a further downhill course for the patient requiring mechanical support and angiography.

# Case 5: Death from urinary sepsis following endoscopic procedure

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## Urology

### CASE SUMMARY

A 35-year-old female with spina bifida and a poorly functioning left kidney initially presented with an infected and obstructed right kidney. This required ureteric stenting as it was her single functioning kidney. In her left kidney she also had a staghorn calculus thought to be related to chronic infection. It is understood that she self-catheterised. Other medical comorbidities included previous augmentation cystoplasty, severe restrictive lung disease and a history of urosepsis requiring intensive care admission.

The patient was admitted to hospital with urosepsis related to the right upper ureteric calculus causing obstruction to the right kidney. She was resuscitated in intensive care and a right ureteric stent was placed. Urine cultures showed evidence of *Proteus* and *Escherichia coli* infections. The infectious diseases service was involved; vancomycin and meropenem were prescribed and the patient was discharged from hospital.

The patient re-presented 2 weeks later for cystoscopy, ureteric stent removal, a right pyeloscopy and laser lithotripsy. No preoperative urine sample was taken, but 3 hours preoperatively she was given vancomycin as prophylaxis for the procedure. The operation went smoothly with no reported issues or areas of concern.

Evidence of sepsis subsequently developed, with tachycardia and fever. She was treated appropriately with gentamicin and cefepime on the recommendation of the infectious diseases service. Subsequently, evidence of *Pseudomonas* growth within her urine and blood cultures was found.

Unfortunately, the patient did not respond to the measures taken for urosepsis treatment. She had a dramatic deterioration and passed away from multiorgan failure 6 days later.

### DISCUSSION

The only real area of concern in this case is the antibiotic prophylaxis prior to the second procedure. It appears that no gram-negative cover was provided by the prescribed antibiotics. No urine culture prior to the operation was available;

however, given the patient's history of multi-resistant organisms it would have been appropriate to provide gram-negative cover in addition to the vancomycin used preoperatively.

There are no concerns with other components of her care. Obviously, it is unclear whether preoperative treatment with gram-negative antibiotics would have altered her clinical course; bacteria often persist in the urine despite these measures, especially when stents and stones are involved.

## CLINICAL LESSONS

Patients with complex neurological deficits, those who self-catheterise, patients with stones and stents and those with recent infections are at higher risk of urosepsis with subsequent surgery.

Preoperative urine checks and appropriate antibiotic prophylaxis are critical for urological patients undergoing instrumentation, as the preoperative urine can be infected, stones can harbour bacteria and infection can be introduced. Although bacterial culture may change, antibiotic prophylaxis should at least cover recently cultured organisms' sensitivities.

## Case 6: Perioperative deep vein thrombosis/pulmonary embolism in a high-risk patient

### Urology

#### CASE SUMMARY

A 54-year-old man with a history of multiple episodes of deep vein thrombosis (DVT) and pulmonary embolism (PE) underwent a complicated transurethral resection of a 3 cm papillary bladder tumour. He was on anticoagulation, which was withheld for 4 days prior to the operation.

Due to the location of the bladder tumour, the left ureteric orifice could not be identified during the operation. Postoperatively, the patient remained in hospital due to unusual and persistent abdominal and flank pain. While the index of suspicion for left ureteric injury or obstruction from the surgery was high, hydronephrosis was not identified from serial ultrasounds or CT scans. On postoperative day 3, the original surgeon handed over to a covering surgeon. On day 7, a percutaneous nephrostomy tube was inserted as obstruction became more evident on CT imaging. The patient developed fever post-procedure, requiring IV antibiotics. In addition, he complained to the night nursing staff of difficulty walking due to tightness in his calves. It was not noted whether this information was conveyed to the treating surgeon.

The next day, the patient had another radiological intervention—insertion of a ureteric stent and left nephrostogram. On day 9, a confirmatory nephrogram was performed with removal of the nephrostomy. On postoperative day 10, he suffered a massive PE and could not be revived.

#### DISCUSSION

A patient with documented DVT and PE underwent a transurethral resection procedure but required a prolonged hospital stay with further radiological procedures. Thromboembolic deterrent stockings were used during the hospital admission, although neither a sequential compression device nor subcutaneous prophylactic anticoagulation was used. The lack of subcutaneous prophylactic anticoagulation was most likely in view of ongoing anticipation of the patient being discharged and the subsequent need for radiological procedures. Given the initial risk of haematuria and clot retention, then subsequently performing a nephrostomy, was there a time when it was reasonable to use anticoagulants?

RACS has a statement on the prevention of venous thromboembolism, which

recommends that in patients with known risks, low-molecular-weight heparin or low-dose unfractionated heparin should be considered for low-risk operations. Despite this, due to the risk of postoperative bleeding and the anticipated short admission for transurethral resection of bladder tumour, chemical prophylaxis is not generally used.

In this difficult clinical situation, a physician or perioperative review may have been useful. There may have been a clinical sign of DVT that was not addressed. The patient complained of calf pain a few days prior to the fatal event, although there were no further comments regarding this. There may have been an issue with handover of clinical information between nursing and medical staff.

### CLINICAL LESSONS

This case highlights the importance of thorough handover. In a complex situation in patients with known risk factors, multidisciplinary care may be helpful.

In the immediate postoperative period for a transurethral resection, there is a risk of vesicular bleeding and clot retention and therefore chemical prophylaxis is not typically used for transurethral resection procedures. Also, the patient's legs are elevated intraoperatively in lithotomy position and the risk of clot is thus minimal.

However, in patients who have a high risk of DVT there should be a plan to recommence anticoagulants and this should be communicated clearly to the incoming team.

# Case 7: Air embolus—a rare and possibly unavoidable complication

## Obstetrics and Gynaecology

### CASE SUMMARY

A 48-year-old woman who was fit and well underwent a 7 mm cervical dilatation, hysteroscopy and resection of a 3 cm submucosal fibroid or polyp that was distorting the endometrial cavity and causing menorrhagia.

Routine general anaesthesia was administered. The patient suffered an intraoperative collapse just after dilatation. On commencing resection she suddenly became bradycardic and hypotensive, with a fall in expired CO<sub>2</sub>, oxygen saturation and cyanosis. Glycine was used as the irrigating fluid, and by the end of the procedure there was a 200 ml deficit remaining. Surgery was abandoned immediately. The patient was intubated, and cardiopulmonary resuscitation (CPR) commenced for pulseless electrical activity (PEA) arrest. Good resuscitation resulted in return of circulation.

Transfer was arranged to hospital A ICU for initial investigations and then to hospital B ICU for ongoing management. Two further PEA arrests occurred; ECMO commenced. With no meaningful neurological improvement after weaning from ECMO and inotropic support, it was decided to withdraw active support due to hypoxic brain injury.

### DISCUSSION

This case appears to be a rare and unexpected complication with a known high mortality rate. There was no evidence of intraoperative anaphylaxis. Contemporaneous record-keeping was good, with clear documentation of care being taken to ensure no air bubbles in tubing. There are no areas for concern in the management of the patient in either hospital A or B or by the surgeon or anaesthetist involved in the intraoperative care and preoperative planning. Some post-resuscitative complications occurred during ICU management but these did not appear to contribute to the outcome.

Autopsy showed diffuse infarction of the brain due to air or fat embolism. There was no probe patency of the foramen ovale but there are demonstrations in the literature that show pressurised patency of the foramen ovale.<sup>1</sup>

Consideration could be given to cervical preparation in situations where dilatation

may be difficult, although the evidence for prostaglandin use shows no benefit. Minor difficulty of dilatation is documented but no perforation or false passage of the uterus at autopsy was found. Collapse occurred just after cervical dilatation, but this was possibly related to cervical shock. There could have been large vessels and sinuses within the uterus or a fibroid that allowed large volume emboli to enter, but no significant bleeding was noted during the procedure. Anaesthetic documentation suggests no utilisation of nitrous gas, but this and other volatile agents such as the sevoflurane used may cause vasodilation that can increase pressure gradients.

Other suggestions in the literature for prevention of air or gas embolism include avoiding repeated instrumentation (which can introduce air into the uterus) and avoiding steep Trendelenburg position (which can cause negative pressure in pelvic veins).<sup>1</sup> There was no Trendelenburg positioning in this case. Emergency management of suspected embolism—if warning signs allow prior to arrest—can include reverse Trendelenburg positioning to avoid further air entrapment, packing the vagina with wet gauze, and left lateral decubitus Trendelenburg positioning to prevent air moving from right heart to lungs and decompression.

## CLINICAL LESSONS

In future practice it is worth considering the potential for air embolism, especially in common benign obstetric and gynaecological procedures involving Trendelenburg positioning and lateral tilt, which can create pressure gradients in a very vascular setting. Automated mechanical fluid pump and pressure monitoring systems can avoid overload and high uterine pressures. There is moderate quality evidence to show that misoprostol is effective and reduces hysteroscopic complications, but it is not licensed for this use in Australia.<sup>2</sup>

Despite our patients often being young and otherwise healthy with benign disease, even minor surgical procedures are not without some risk, and we should be reminded to ensure the best possible preoperative assessment and aim (as in this case) to offer the safest and most minimally invasive surgical or medical treatment available.

## REFERENCES

1. Verma A, Singh MP. Venous gas embolism in operative hysteroscopy: A devastating complication in a relatively simple surgery. *J Anaesthesiol Clin Pharmacol*. 2018;34(1):103-106. doi:10.4103/joacp.JOACP\_235\_15
2. Ying Hua et al. The use of misoprostol for cervical ripening prior to hysteroscopy: a systematic review and analysis. *Drug Des Devel Ther* 2016; 10: 2789 - 2801

## Case 8: Preoperative assessment lacking in detail

### Plastic Surgery

#### CASE SUMMARY

A 68-year-old man was admitted for excision of large cutaneous malignancies on his right forearm and left leg. The patient had a history of metastatic squamous cell carcinoma (SCC) requiring an axillary clearance in the preceding months. He also suffered from psoriasis, for which he had been treated with ultraviolet light therapy. The patient was hepatitis C-positive; however, the notes suggest that treatment for this had been declined due to the prognosis related to the patient's SCC. He had a chlorhexidine allergy.

On preoperative admission, the patient had a systolic BP of 90 mm Hg and oxygen saturation of 94%. His heart rate was regular and his chest was clear. The patient was noted to have neck pain preventing hyperextension. His daughter had informed nursing staff that he had had diarrhoea overnight and had been lethargic for a week. The surgical team was informed; it was decided to proceed.

The patient was given 30 ml of 1% lignocaine plus adrenaline to the lesions and donor site. The surgical procedure was performed without any surgical issues. Anaesthetically, the patient was hypotensive from onset requiring ephedrine boluses (nil metaraminol response). At the end of the procedure, the patient was in supraventricular tachycardia (atrial fibrillation) and was profoundly hypotensive, unresponsive to vasopressor but responsive to adrenaline. His condition was initially managed as a possible anaphylaxis to chlorhexidine. He was given 4 L of crystalloid fluids, adrenaline 600 µg, 2 minutes of CPR and hydrocortisone. Intralipid was also given. Direct current cardioversion for AF was performed twice (unsuccessfully). A central venous line was inserted, and a noradrenaline infusion started. BP stabilised but the patient remained in AF. He was transferred to ICU. An ECG showed inferolateral STEMI and an elevated troponin I was noted. The patient was then transferred to the catheterisation laboratory at another hospital.

The angiogram findings showed diffuse vasospasm only. The sequelae of intraoperative and postoperative events were: multiorgan failure, acute kidney injury requiring dialysis, ischaemic liver, seizures and gradual loss of skin integrity/infection of surgical sites.

Fourteen days after surgery, the patient passed away in ICU from overwhelming *Pseudomonas* sepsis unresponsive to antibiotic therapy and meticulous wound care by nursing staff.

## DISCUSSION

This case highlights the need for thorough preoperative evaluation of each patient to justify any anaesthetic given for elective surgical procedures. While the outcome may not have varied, there appears to be no explanation as to why this patient went into cardiogenic shock during his anaesthesia for excision of skin lesions.

The patient had received general anaesthesia uneventfully 4 months prior to this procedure, so it was reasonable to assume he would be fit enough to proceed with this operation. Despite the guarded prognosis after an axillary clearance for metastatic SCC, it is not uncommon to remove very large, fungating tumours in patients to assist with pain and wound care.

The patient was noted to be lethargic for a week and experiencing diarrhoea the night before surgery. One wonders if these were significant findings. Without preoperative bloods it is difficult to determine if there was a preoperative condition that may have been worsened by a general anaesthetic. If the patient had not had the surgery or a local anaesthetic had been used instead, the outcome may have been different.

## CLINICAL LESSONS

Issues arising from this case stress the need to ensure the following:

- Each procedure performed on a patient is necessary and justifiable in view of their prognosis and comorbidities.
- Each patient anaesthetised for a procedure has received a thorough preoperative evaluation—including re-evaluation if new history emerges in the lead-up to surgery—and the appropriate anaesthetic is chosen.
- Continuity of care is maintained, if possible, for longstanding patients of particular consultants.

## Case 9: Multiple comorbidities contribute to postoperative complications

### Ear, Nose and Throat (ENT)

#### CASE SUMMARY

A man in his 60s was managed for a mass in the oral cavity eroding into the mandible, presumed to be oral carcinoma. Further workup demonstrated enlarged neck nodes likely to represent metastatic disease. The patient was admitted to hospital for an elective resection of the oral lesion, segmental mandibulectomy, neck dissection and a fibular free flap (combined surgery with ENT and Plastics). The patient had unintended weight loss and cachexia. He had a background of heavy smoking, emphysema and alcohol abuse, and known risk factors for major surgery. He was admitted to the high dependency unit (HDU) after surgery.

On postoperative day 1, progress and parameters were as expected. The wound site and perfusion of the free flap were good. The patient had an alcohol withdrawal chart and was given thiamine. Pain was managed via patient-controlled analgesia and he had daily reviews from the acute pain service.

On day 2, the patient was noted to have episodes of breathing difficulty associated with desaturation and tachypnoea, presumably related to either the patient's background of COPD or anxiety. Urine output reduced and fluid boluses were given. The plastics team also recognised that the leg drain suction was incorrectly attached, resulting in loss of suction.

On day 3, increasing oxygen requirements overnight led to a chest X-ray confirming pulmonary oedema. Frusemide was given. The patient was agitated at times. On the morning ward round, the ENT team requested management of alcohol withdrawal. Only daily entries in the alcohol withdrawal chart were completed. Throughout the evening, pulmonary oedema worsened, with fluid overload, and confusion increased. An anaesthetic review was completed in the evening, with a plan for intubation if respiratory function deteriorated. The patient remained hypotensive the following day, with worsening desaturations and confusion. Ischaemia developed in the foot of the donor leg. Pulmonary oedema persisted despite diuresis and hypovolaemia. The patient was intubated in theatre for respiratory failure, and inotropes commenced. A CT angiogram of the lower limb demonstrated peripheral vascular disease with advanced arterial stenoses.

On postoperative day 5, the patient developed multiorgan failure with oliguria and respiratory acidosis. IV albumin was given to restore intravascular volume. Lower limb ischaemia continued to worsen. A family meeting was convened and the

patient was offered bilateral lower limb amputation and dialysis. This treatment was refused. During a second family meeting with ENT and ICU teams, a palliation plan was confirmed. The patient died that afternoon.

## DISCUSSION

This case adheres to a reasonable care pathway. The patient was presumed to have an oral cavity cancer, but the preoperative investigations and biopsy were not available in the notes. In the setting of bony invasion and neck node metastasis, radiation and chemotherapy is much less effective unless given with an oncological resection. The surgery performed was appropriate for the condition.

A long operation time and respiratory failure secondary to emphysema was the first major complication, which led to other complications, ultimately resulting in multiorgan failure. There were some deficiencies in the documentation and recognition of alcohol withdrawal as a contributing factor to postoperative complications and agitation. The alcohol withdrawal chart had only 5 entries over 5 days in HDU/ICU and the dates and times of those entries were either incomplete or erroneous in several instances. HDU management of the drains was also suboptimal. On one occasion, the drain tubing was found to be connected to a blind end, effectively leading to no suction on the drain. Neither of these issues are believed to have altered the patient outcome.

## CLINICAL LESSONS

This patient was at very high risk of complications because of comorbidities and history of excessive alcohol and tobacco use. Alcohol withdrawal as a contributing factor to postoperative complications and agitation should be considered. A preoperative palliative care assessment may be helpful in cases such of these.

# Case 10: Giant omphalocele complicated by sac rupture, congenital pulmonary hypertension and cardiac anomalies

## Neonatal Paediatrics

### CASE SUMMARY

A 34-week-gestation baby with known giant omphalocele was born by emergency caesarean for premature labour and foetal distress. The birth was attended by senior neonatology staff in the delivery suite. During delivery, a 5 cm rupture of the sac occurred. The baby was ventilated and admitted to a quaternary neonatal ICU (NICU) in the same facility. The sac rupture was sutured by paediatric surgeons in the NICU.

In addition to the sac rupture, the baby had multiple comorbidities including severe pulmonary hypertension (suprasystemic pulmonary artery pressures on echo), pulmonary hypoplasia, a double outlet right ventricle with subaortic ventricular septal defect with right-to-left shunting, chronic renal impairment and low birth weight.

On day 3, a silo pouch was placed during daytime hours in the paediatric emergency theatre. A reduction in the silo pouch occurred on day 14. Despite maximal intervention for both the pulmonary hypertension and the hypoplasia the baby was unable to be oxygenated. In consultation with neonatologists, the parents decided to provide comfort care on the last day of the baby's life.

### DISCUSSION

The chances of survivorship for this infant were low. The paediatric surgery team attended the NICU on arrival of baby after birth and the senior consultant paediatric surgeon performed all surgical procedures. Neonatology staff notes were comprehensive, allowing for clinical continuity of care. Support for and involvement of the parents in the decision-making were excellent. There were multiple family meetings with senior clinicians to outline events, explain decisions and define limits of intervention. These multiple disciplinary team discussions were well documented in the NICU chart.

The children's operating theatres are physically linked to the NICU facility but use a different record system. It was noted by the second-line assessor that not all information for analysis was available to the first-line assessor (FLA). None of the copious NICU notes, including records of surgeon ward rounds, were provided to the FLA. The only available information was the hospital operation record and

consent. The operation notes lacked detail and did not record that the infant was under NICU care or indications for surgery (sac rupture), they only listed anatomical details of the intra-abdominal organs and the technical details of silo formation. The condition of the sac (thickness, integrity, rupture) and details of the rupture repair should have been included in the findings. The inability to enter detailed preoperative diagnoses into the integrated electronic Medical Record (ieMR) operative notes for paediatric surgical pathologies is a well-known flaw of that electronic record system.

The consent form was of insufficient standard. It failed to detail the condition and indications for the procedure and consideration of the infant's severe comorbidities, nor did it detail discussions with the family of the mortality risk and multiple issues associated with silo placement in an exomphalos major, including silo replacement, tissue necrosis, ongoing fluid loss and failure to close the abdominal defect. This was misleading for the FLA or any others scrutinising this document.

The literature documents that a giant omphalocele associated with sac rupture, pulmonary hypertension, pulmonary hypoplasia, cardiac anomalies and low birth weight is associated with a poor outcome and high expected mortality rates and morbidity compared with those infants with a giant omphalocele and no sac rupture or pulmonary hypertension.<sup>1,2</sup> This infant was managed with maximal appropriate NICU interventions and with full family involvement in determining and reassessing limits of care.

## CLINICAL LESSONS

This case highlights a senior consultant-led multidisciplinary approach to decision-making and clinical management for infants with multiple neonatal and congenital anomalies.

Consultants should supervise the obtaining of consent by junior team members and entry of documentation into the electronic record for surgical ward rounds to ensure that the complexity of decision-making and anticipation of complications is accurately recorded.

The ieMR does not support complex congenital diagnoses within the operative notes. This should serve as a lesson for all health services or jurisdictions to implement new electronic health records that will provide some flexibility to allow this important surgical information to be included by the surgical team.

## REFERENCES

1. Nolan HR, Wagner ML, Jenkins T, Lim FY. Outcomes in the giant omphalocele population: A single center comprehensive experience. *J Pediatr Surg*. 2020. 55(9):1866-1871. doi: 10.1016/j.jpedsurg.2020.04.019. Epub 2020 May 3. PMID: 32475506.
2. Partridge EA, Hanna BD, Panitch HB, Rintoul NE, Peranteau WH, Flake AW, et.al.,. Pulmonary hypertension in giant omphalocele infants. *J Pediatr Surg*. 2014. 49(12):1767-70. doi: 10.1016/j.jpedsurg.2014.09.016. Epub 2014 Nov 14. PMID: 25487480.

# Case 11: Preoperative respiratory viral screen may have avoided catastrophic hypoxic ischaemic brain injury in an infant

## ENT/Paediatric

### CASE SUMMARY

A 10-month-old non-syndromic boy was admitted for elective cleft palate repair and insertion of ventilation grommets. The cleft lip had been successfully repaired at the age of 4 months without any problems.

Preoperative assessment by the consultant anaesthetist noted a one-day history of clear rhinorrhoea with a mild cough; the patient was afebrile and the lungs were clear. Increased work of breathing was noted on induction before he was intubated with a grade 1 airway. The consultant plastic surgeon and ENT registrar performed the surgical repair and grommet insertion in a straightforward and timely manner.

The patient was extubated in theatre and had severe laryngospasm requiring IV propofol. Once spontaneously breathing, he needed significant bag mask ventilation and positive end-expiratory pressure (PEEP) to maintain good oxygen saturation; severe sternal recession was noted. He was transferred to the post-anaesthesia care unit, where he was CPAP- and oxygen-dependent. Chest auscultation revealed crepitations throughout both lung fields. When he awoke, he started crying with blood pooling in his mouth and his oxygen saturation dropped below 70%. The consultant plastic surgeon examined the palate repair and was happy with the level of oozing. Supine chest X-ray showed some haziness in the right lower lobe and bilateral perihilar capacities. He was admitted to paediatric ICU (PICU) for a trial of high-flow oxygenation but, despite this, he continued to desaturate. The consultant anaesthetist decided to reintubate. Prior to intubation there was significant work of breathing with sternal retraction; blood staining was noted of the grade 2 larynx and blood-stained secretions were suctioned from the endotracheal tube (ETT). An ETT sample was sent for bacterial and viral studies.

Overnight ventilation was difficult, requiring deep sedation and muscle relaxation. The patient required ETT suction when he coughed, as fresh blood was coming up the tube and he profoundly desaturated. He had 4 splinting-like episodes on the ventilator—he would become more awake and agitated and move his arms vigorously and squirm. On 3 occasions, he settled with sedation, suction and bagging. During the fourth event, he was increasingly difficult to bag; his oxygen

saturation rapidly fell below 60% and he had bradycardia of 50 bpm. A MET activation was made due to ongoing refractory cardiac asystole requiring CPR and an extracorporeal membrane oxygenation (ECMO) call-out was made within 10 minutes of this event.

Clinical confirmation of the ETT placement during CPR was supported by auscultation of breath sounds, presence of end tidal CO<sub>2</sub> and observation of chest wall movement on hand ventilation. At 42 minutes after hypoxic cardiac arrest and during CPR an open right transcervical extracorporeal life support (ECLS) venoarterial ECMO was established, likely requiring manipulation of the neck. During CPR, air and blood (++) was coming from the nose and mouth. Massive gaseous abdominal distention was noted despite aspiration via the orogastric tube. Oesophageal displacement of the ETT was noted at the time of tube change at 20:08 hours.

The infant was supported on ECMO until improvement in cardiorespiratory function permitted decannulation the following day (day 2 post-surgery). Unfortunately, he developed clinical signs of severe neurological injury (i.e. fixed dilated pupils, GCS2) and diabetes insipidus; this was further corroborated by isoelectric electroencephalogram, CT and MRI brain scans.

It was the consensus view that this severe hypoxic brain injury was most likely unsurvivable. The infant's parents were counselled that further intensive care would offer no option for meaningful recovery, and they accepted the withdrawal of futile therapies. Ventilatory and IV support was withdrawn at 17:26 hours on the fourth postoperative day, and the infant died at 17:50.

## DISCUSSION

When major surgery is planned in children, a low threshold for obtaining preoperative rapid polymerase chain reaction (PCR) viral screening for respiratory viruses should be considered if there is a history of mild cough and runny nose, as was present in this case. Analysis of the ETT aspirate on admission to PICU on the day of surgery confirmed rhinovirus and scant *Staphylococcus aureus*. If the operation had been postponed for an anaesthetic respiratory consideration, the sequence of events leading to death would have been averted.

General anaesthesia in a young child with an underlying respiratory viral infection would likely explain the increased work of breathing on induction, the severe laryngospasm on extubation, the refractory desaturations despite high-flow oxygen and PEEP in the hours after the anaesthetic. Subsequent reintubation with bloody ETT aspirates could be due to an aspiration event or more likely negative pressure acute pulmonary oedema. Difficulties in ventilating the child in PICU—requiring multiple interventions—culminated in the sentinel event: hypoxic

cardiac asystolic arrest. Temporary displacement and/or blockage of the ETT around this time may well have precipitated the hypoxic cardiac arrest.

The consultant surgeon participated in the open disclosure process together with the Executive Director of Medical Services and the child's parents. The actual surgery was performed successfully. Wound bleeding was not believed to contribute to the possible aspiration episode. The skill of the cardiothoracic team in the open surgical placement of the ECLS arterial and venous lines for ECMO in a small infant undergoing CPR in a cot is to be commended.

The oesophageal displacement of the ETT would have resulted in ineffective ventilation and oxygenation and made abdominal distension worse until it was rectified. It would have been a vicious cycle with fatal outcome universally if not recognised. Clinical confirmation of the ETT placement was adequate initially but with CPR and establishment of ECMO this dislodgement must be considered as a possibility.

This case is currently under investigation as a death that was not reasonably expected as an outcome of healthcare provision or lack thereof. Open disclosure is being employed and the coroner's office will be launching an inquest in due course.

## CLINICAL LESSONS

If there is a history of mild cough and runny nose in children planned for major surgery, a low threshold for obtaining preoperative rapid PCR viral screening for respiratory viruses should be considered. If in doubt, do not hesitate to postpone the case until the child has fully recovered.

Massive abdominal distension almost always indicates misplaced ETT and steps must be taken to rectify any abdominal distension immediately.

## Case 12: Death from urinary sepsis following endoscopic surgery

### Urology

#### CASE SUMMARY

An 87-year-old woman was admitted for elective pyeloscopy and laser lithotripsy for definitive management of an obstructing left pelvic-ureteric junction stone. This occurred around 3 weeks after previous cystoscopy and left ureteric stent placement. She had a history of home-oxygen-dependent chronic obstructive pulmonary disease (COPD), ischaemic heart disease, MI, hypertension, overactive bladder, depression, spinal fusion for scoliosis, cholecystectomy, and endoscopic retrograde cholangiopancreatography/stenting/surgery for a high-grade dysplastic biliary ampullary tubulovillous adenoma. At the completion of laser lithotripsy, a temporary ureteric catheter was placed. This was then removed and she was discharged from hospital 2 days after the procedure.

The day after discharge, she re-presented unwell and febrile. She was admitted directly to the ward from ED. IV fluids, ampicillin and gentamicin were ordered to treat her suspected urosepsis. Blood and urine tests were arranged for evaluation, after which she was reviewed by her urologist. *Proteus* was confirmed in her urine. The urologist discussed with her family the need for ureteric stent or nephrostomy and notified ICU for review. Shortly afterwards, a medical emergency team (MET) call occurred for reduced consciousness, hypotension and low urine output. Significant renal deterioration, and elevated white cell count and C-reactive protein were noted. Following a CT scan and discussion with her urologist and an intensivist, she was admitted to ICU with urosepsis and systemic inflammatory response syndrome leading to acute renal failure; she was monitored and given further fluid resuscitation.

It was confirmed in a family meeting that the patient would not want permanent dialysis and she had a Do Not Resuscitate order in place. The family agreed to renal drainage and ICU support followed by weaning from ventilation. An emergency cystoscopy and left ureteric stent insertion was followed by inotropic support in ICU. Blood cultures the next day confirmed the presence of gram-negative bacilli. After further family discussion and some improvement, temporary dialysis was performed. Anuria persisted. Three days later, the patient requested no further antibiotics or dialysis. She passed away 2 days later.

## DISCUSSION

This patient presented with gram-negative sepsis in the home, 3 days after an endoscopic stone procedure. She was promptly scanned via CT and stented within 2 hours of admission and transferred directly to ICU. She failed to respond to aggressive resuscitation measures and was transferred to a medical ward where she died 2 days later of multiorgan failure. She had appropriate surgical treatment with stenting followed by pyeloscopy, laser lithotripsy and temporary ureteric catheter. Retained stone fragments following laser lithotripsy are usually very small and often pass without complication or intervention.

Urosepsis is a relatively common complication of endoscopic renal surgery and occasionally a cause of postoperative death; it is vital to check preoperative urine and use appropriate prophylactic antibiotics. The medical files received do not include urine cultures prior to surgery nor operating notes describing antibiotic prophylaxis and postoperative management for the patient's initial procedure. The surgeon is remiss in not documenting this, if only to make it clear that these aspects of care were appropriate. The formal report for the CT after re-presentation with urosepsis is likewise not included. Urine cultures collected the day after initial surgery grew 3 potential pathogens (all resistant to amoxicillin but sensitive to gentamicin): *Pseudomonas aeruginosa*, *Proteus penneri* and *Enterobacter aerogenes*.

This case demonstrates the difficulties faced by urologists when elderly patients with multiple comorbidities suffer from obstruction with renal stones. Despite the risks with proceeding with surgical treatment, the benefits of removing the obstructing stone—often colonised with bacteria—are usually greater. *Proteus* species are known to colonise some renal calculi.

## CLINICAL LESSONS

Preoperative urine checks and appropriate antibiotic prophylaxis are critical for urological patients undergoing instrumentation, as the preoperative urine can be infected, stones can harbour bacteria and infection can be introduced.

## Case 13: Respiratory failure following failed perforated duodenal ulcer surgery

### General Surgery

#### CASE SUMMARY

A 63-year-old man presented to hospital with severe abdominal pain after being unwell for one day. He had significant comorbidities including an active smoking history of more than 50 pack-years, chronic obstructive airways disease and severe scoliosis.

On admission, the patient was noted to have signs of peritonitis and severe septic shock. He required 5 L of crystalloid fluid and multiple inotrope infusions. He was anuric with a creatinine of 285 L/min. A CT scan with IV contrast noted a large amount of free air and free fluid. A diagnosis of perforated viscus was made and he was taken to theatre for a laparotomy.

The laparotomy revealed a 2 cm perforated duodenal ulcer with a large volume of purulent free fluid. The abdomen was washed with 9 L of saline and an omental patch repair performed. The patient was intubated and transferred to ICU, where he required ongoing inotropes and renal replacement therapy. He was extubated 5 days postoperatively but required intermittent periods of continuous positive airway pressure therapy (CPAP) and high-flow oxygen for respiratory support. Total parenteral nutrition (TPN) was provided immediately postoperatively and nasogastric feeding was instituted on postoperative day 6.

On postoperative day 8, the patient was noted to have increased pain, a rising white cell count and increasing noradrenaline requirements. A CT scan showed a large volume of free gas and a large collection in the right upper quadrant. A leak from the duodenal patch repair was diagnosed and the patient was returned to theatre where a laparotomy found a large collection of infected bile and an open 2 cm defect in the first part of the duodenum surrounded by viable tissue. The abdomen was washed out and a duodenal exclusion was performed by stapled closure of the antrum and a side-to-side stapled gastrojejunostomy. The duodenal ulcer was controlled by insertion of a T-tube and 2 adjacent Blake drains. A jejunal feeding tube was placed and the patient was returned to ICU intubated and ventilated. He was extubated after 2 days, but reintubated 2 days later for a period of 4 days. The surgical team requested no CPAP due to concerns that it had caused the leak from the initial patch repair.

Following extubation, the patient declared no further intubation and an acute resuscitation plan (ARP) was prepared. Bile noted in the Blake drains was consistent with an ongoing leak from the duodenal perforation. Nutrition was provided by TPN. Enteral feeding had been requested 4 days after the placement of the jejunal feeding tube but did not commence until a week afterwards as a connector was unavailable. The patient made a slow recovery and was transitioned from ICU to the ward. He had several MET calls for tachypnoea. A CT scan showed no significant collections and decreased volume of intraperitoneal free air.

Wound breakdown requiring debridement developed and bile was noted leaking from the wound. The operative drains continued to drain bile. The surgical team spoke with the hepatobiliary team, who accepted the patient for transfer pending bed availability. Two days later the patient was found unresponsive in bed. No resuscitation was attempted in accordance with the patient's ARP.

## DISCUSSION

This patient presented to hospital very unwell with significant comorbidities. He was at very high risk of mortality from the time of presentation. Treatment was prompt and appropriate with aggressive resuscitation and appropriate emergency surgery performed expeditiously.

The risk of breakdown of the duodenal ulcer patch repair was high. The suggestion that the repair failed due to CPAP dislodging the omental patch 5 days postoperatively with a nasogastric tube in situ seems unlikely. There is little evidence in the literature to support this, with the only possibly relevant evidence being from the bariatric surgery literature. (A series of 28 patients undergoing Roux-en-Y gastric bypass had pouch pressures measured showing no increase in pressure in the gastric pouch in 19 patients who had CPAP compared with 9 patients who did not have CPAP.<sup>1</sup> Two large series of patients showed no difference in leak rates from gastric anastomoses following bariatric surgery with and without early use of CPAP.<sup>2,3</sup>)

It is much more likely that the repair failed due to poor wound healing from tissue ischaemia related to smoking history, haemodynamic instability requiring high doses of inotropes, and poor oxygenation related to underlying lung disease. Hesitancy to institute non-invasive ventilation such as CPAP following the second procedure may have compromised the patient's already impaired respiratory function and led to the need for reintubation. This also may have impaired tissue oxygenation and increased the risk of delayed tissue healing and wound breakdown. It seems unlikely that it would have affected the patient's outcome, but it is an area of concern in a patient with severely compromised respiratory function.

During the more than month-long admission, only one consultant ward round was documented by the surgical team. One hopes that this is a documentation error. Patients who are severely unwell benefit from regular consultant review and input into their management. Equally, surgical trainees benefit from regular ward rounds with the consultant.

A feeding jejunostomy tube was placed at the time of the second procedure; however, enteral feeding was delayed for more than a week after it was requested by the surgical team because no connector was available. Enteral feeding has significant benefits over TPN, and delay due to equipment availability is disappointing.

The type of operation chosen at the second procedure deserves consideration. Given the already failed omental patch repair, a distal gastrectomy with gastrojejunostomy and closure of the duodenal stump could have been considered. This may have decreased the chance of ongoing leak from the duodenum, as occurred with the duodenal exclusion and T-tube. Decisions regarding the type of operation can only be made intraoperatively based on the integrity of the tissues, stability of the patient and experience of the surgeon. It may not have been feasible to perform a resection at 9 days following a failed omental patch. In this situation, tube drainage of the duodenal ulcer is the sensible alternative.

## CLINICAL LESSONS

Patient management must be evidence-based. CPAP has significant benefit to patients with respiratory compromise and should be continued unless there is a definite contraindication. A nasogastric tube should negate any concerns over gastric distension due to CPAP.

Both patients and surgical trainees benefit from regular consultant surgeon ward rounds.

## REFERENCES

1. Weingarten TN, Kendrick ML, Swain JM, Liedl LM, Johnson CP, Schroeder DR, et.al.,. Effects of CPAP on gastric pouch pressure after bariatric surgery. *Obes Surg.* 2011. ;21(12):1900-5. doi: 10.1007/s11695-011-0419-9. PMID: 21512817; 21
2. de Raaff CAL, Kalff MC, Coblijn UK, de Vries CEE, de Vries N, Bonjer HJ, et.al., Influence of continuous positive airway pressure on postoperative leakage in bariatric surgery. *Surg Obes Relat Dis.* 2018. 14(2):186-190. doi: 10.1016/j.soard.2017.10.017. Epub 2017 Oct 27. PMID: 29175283.
3. Ramirez A, Lalor PF, Szomstein S, Rosenthal RJ. Continuous positive airway pressure in immediate postoperative period after laparoscopic Roux-en-Y gastric bypass: is it safe? *Surg Obes Relat Dis.* 2009.;5(5):544-6. doi: 10.1016/j.soard.2009.05.007. Epub 2009 Jun 23. PMID: 19640798.

# Abbreviations

AF	atrial fibrillation
ARP	acute resuscitation plan
BP	blood pressure
CABG	coronary artery bypass graft
CAD	coronary artery disease
COPD	chronic obstructive pulmonary disease
CPAP	continuous positive airway pressure therapy
CPR	cardiopulmonary resuscitation
CT	computed tomography
DVT	deep vein thrombosis
ECG	electrocardiogram
ECLS	extracorporeal life support
ECMO	extracorporeal membrane oxygenation
ED	emergency department
ENT	ear, nose and throat specialist
ETT	endotracheal tube
FLA	first-line assessor
HDU	high dependency unit
IABP	intra-aortic balloon pump
ICU	intensive care unit
ieMR	integrated electronic Medical Record
IV	intravenous
LAD	left anterior descending artery
LIMA	left internal mammary artery
LV	left ventricle
MET	medical emergency team

MI	myocardial infarction
NICU	neonatal intensive care unit
NSTEMI	non-ST segment elevation myocardial infarction
PCR	polymerase chain reaction
PE	pulmonary embolism
PEA	pulseless electrical activity
PEEP	positive end-expiratory pressure
PICU	paediatric ICU
SCC	squamous cell carcinoma
STEMI	ST-elevation myocardial infarction
TPN	total parenteral nutrition







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