CASEBOOK 2018

CHASM

Collaborating Hospitals
Audit of Surgical Mortality

DISCLAIMER

All identifying information has been omitted to preserve anonymity.

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NSW GOVERNMENT

CLINICAL EXCELLENCE COMMISSION

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CHAIRMAN'S FOREWORD

For my first edition as Chairman we have explored a new format for the CHASM casebook. The Casebook contains six clinical reviews conducted by members of the CHASM Committee based on the details provided by the operating surgeon and the feedback provided by the independent peer assessor. These exchanges are included in the Casebook to provide additional depth and context for each clinical review and its clinical lessons.

Presenting the casebook in this way shares the candid account of the operating surgeon, and the considered opinion of the independent peer assessor. I believe bringing together the viewpoints of these peers in one publication underlines the complexity of surgical decision-making and demonstrates the quality of the feedback provided to the operating surgeon.

I believe that together we can enable clinical growth by developing a culture in which we can share our experiences. As a new initiative to discuss these cases and the issues involved in more depth, CHASM will hold a virtual discussion panel for each case. As Chairman, I will be the facilitator for each panel, and I will be joined by the independent peer assessor for the case, and the CHASM Committee member providing clinical review.

I would like to thank the surgeons of New South Wales for their participation in this valuable peer review program, and I would encourage you to take advantage of the opportunity that CHASM offers to reflect in the care we offer our patients. We all have increasing amounts of paperwork and forms to fill in - I invite you to consider CHASM not just as another form in this ever-growing pile, but as a chance to consider not just the technical aspects of our care, but also the non-technical considerations, such as communication and decision-making, that go into looking after our patients. Without your views on patient care and your impartial assessments, I would not be able to share these unique surgical stories with you.

I would also like to extend my gratitude to those members of the CHASM Committee conducting clinical review and providing their expertise to explore the surgical issues in this publication.

I hope you find value in the cases presented and the discussions generated.

Dr David Robinson

CHASM CHAIRMAN

CHASM COMMITTEE

The Collaborating Hospitals' Audit of Surgical Mortality (CHASM) in New South Wales is a state-wide program which aims to improve surgical care in public and private hospitals through reflection and peer review. The program is overseen by its Ministerial Committee, with members appointed under delegation by the Secretary, NSW Health, and is administrated by the Clinical Excellence Commission. The CHASM Chairman also participates in the Australian and New Zealand Audit of Surgical Mortality (ANZASM) Steering Committee and the National Clinical Directors Meetings facilitated by the Royal Australasian College of Surgeons (RACS).

CHASM COMMITTEE & STAFF

COMMITTEE MEMBERS

As per photographs; left to right & top to bottom.

Dr David Robinson, Chairman - Vascular Surgeon

Ms Carrie Marr - Chief Executive, CEC

Dr Ken Loi, Deputy Chair - General Surgeon; Bariatric

Dr Anthony Drew Dixon - Orthopaedic Surgeon and Medico-Legal Consultant

Dr Robert Costa - Cardiothoracic Surgeon

Professor Mark Sheridan - Neurosurgeon

Professor John Ireland - Orthopaedic Surgeon

Dr Shehnarz Salindera - General Surgeon; Breast and Oncoplastic

Dr Melinda Van Oosterum - General Surgeon; Breast and Oncoplastic

Dr Susan Valmadre - Obstetrician and Oncogynaecologist

Dr Ruth Collins - Urological Surgeon

Associate Professor Julie Howle - Surgical Oncologist

Professor Mark Wiggins - Organisational Psychologist

Dr Andrew Armstrong - Anaesthetist

Dr Ming Loh - Perioperative Geriatrician

Dr David Blomberg - General Surgeon; Colorectal

CHASM OFFICE

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Program Manager

Ms Katherine Asher
Audit Co-Ordinator

Mr John Carrick
Program Analyst

Ms Kerrie Jones
Audit Case Officer

Ms Ewelina Matkowska
Audit Case Officer

Ms Luana Oros
Project Officer

THANK YOU

To all the dedicated Health Practitioners and Professionals located throughout the state who work tirelessly to support this valuable program for the purpose of patient safety, clinical governance and continuous improvement.

Your efforts are acknowledged and appreciated.

PROGRAM INFORMATION

HISTORY & GOVERNANCE

- On 26 May 1994, the NSW Minister for Health initiated a Special Committee Investigating Deaths Associated With Surgery (SCIDAWS). Its purpose was to collate surgical mortality data submitted voluntarily, for the purpose of educating surgeons and health care providers.

- Following recommendations from the Morey Report, in 2004 SCIDAWS was transferred to the Institute of Clinical Excellence to improve the reporting and investigation of surgical deaths.

- In July 2006 the functions of SCIDAWS was expanded to enable a more systematic and comprehensive audit, including cases where no operation was performed.

- On 7 November 2007 the Minister for Health approved a name change, and SCIDAWS became CHASM. The focus of the name change was to promote the collaborative nature of the audit and to elicit greater participation from hospitals and surgeons alike.

- The Minister also confirmed in Government Gazette No. 169 that special privilege provided under the *Health Administration Act 1982* for SCIDAWS would continue for CHASM

The governance framework and operational structure for the CHASM program is administered by the Secretary, NSW Health. The program is overseen by the CHASM Committee, established under section 20 of the *Health Administration Act 1982*. The Chairperson and members of the Committee are appointed by the Secretary, NSW Health, as delegated by the Minister for Health.

Remuneration for the Committee is determined by the Public Service Commission's *Classification and Remuneration Framework for NSW Government Boards and Committees*, guidelines announced in Premier's Memorandum 2012-18.

The *Appointment Standards* for NSW Government Boards and Committees are largely principles-based, issued by the Public Service Commissioner, pursuant to section 11(1)(g) of the *Government Sector Employment Act 2013*.

The Clinical Excellence Commission manages the surgical and anaesthesia mortality audits for New South Wales through the Special Committees Program. Data collection and patient information is provided by public and private hospitals, and registered medical practitioners throughout the state.

PEER REVIEW METHODOLOGY

CHASM provides a safe environment in which to share the surgical journey of a patient and promote further reflection on the techniques used, the decisions made, and the clinical care provided during the patient's admission. Through the process of peer review both the surgeon and assessor benefit from the process of reflection.

Peer reviews are undertaken as a double-blind review by the First Line Assessor. This is to ensure there are no preconceived perceptions about the surgeon involved in the case, or of the hospital / facility where the surgery was performed. It also ensures the anonymity of the patient.

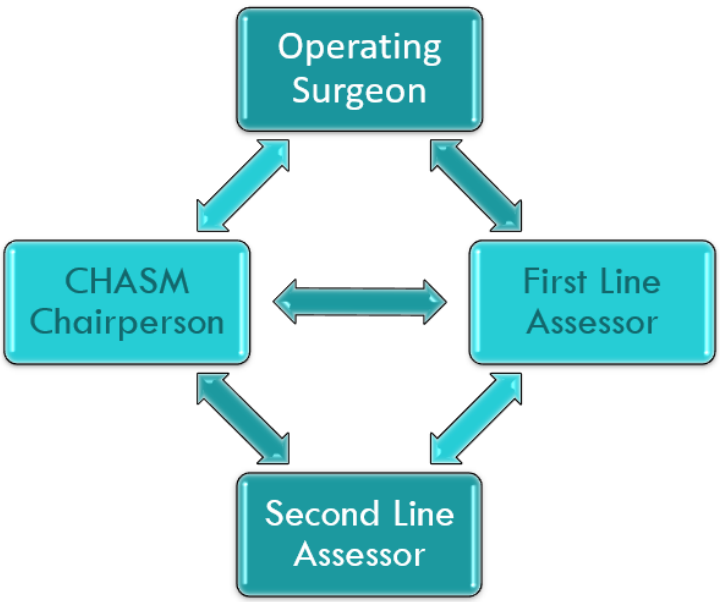
When full case note review is recommended, it is undertaken as a single-blind review by the Second Line Assessor. This enables the assessor to comment more freely and raise any concerns there may be associated with the clinical management of the patient - surgical or otherwise.

The CHASM Committee also completes a double-blind review on all full case note reviews, following the completion of the Second Line Assessor's comments / feedback. Members discuss the case and raise any additional issues that may need to be considered, such as alternate surgical options.

When the Chairperson reviews the final feedback letter for issue to the surgeon it becomes an open peer review to allow the provision of more thoughtful critiques, if required.

However, as the surgeon has a right of reply to the feedback received, this part of the process proceeds as an interactive review. This allows for an active exchange to unfold where further viewpoints can be clarified in email or discussed with the Chairperson.

Figure 1: Peer Review Communication flow diagram



PARTICIPATION IN CHASM

Participation in CHASM for surgeons in New South Wales has always been of a voluntary nature and in a collaborative spirit. It is not the intention of the program to be performance driven, but to inform and initiate conversations that drive improvement, from both the confidential feedback provided to participating surgeons and the program's shared clinical lessons.

In November 2007 the focus of the Committee changed and the scope of the program broadened. The Committee (SCIDAWS) evolved into the Collaborating Hospitals' Audit of Surgical Mortality (CHASM) program, headed by the CHASM Committee. A request for surgeons to participate in the program was issued, and by June 2009, 563 surgeons were participating in CHASM; with 261 of them also agreeing to participate as first line assessors, and a further 185 as second line assessors [1].

Nine years later, CHASM has over 1,900 surgeons registered as participants, including almost 520 first line assessors and 390 second line assessors. This increase in participation is a testament to the commitment of surgeons throughout New South Wales to provide quality information to a peer review program developed by surgeons, for surgeons.

Moving forward, it is important that this valuable program increases its participation levels to remain an effective means of timely and constructive feedback, as well as an accurate dataset for mortality research. As the numbers of surgical intervention rise each year, so does the requirement for surgeons to participate in CHASM. The introduction of the online reporting system in 2018 has reduced the time taken to complete a surgical case form and process it for assessment. CHASM is now able to close the peer review loop in as little as one week, in some instances.

Surgeons are encouraged to:

- Activate their online accounts for the Fellows' Interface
- Ensure their contact details are up-to-date, and
- Register their participation as an assessor with CHASM

FELLOWS' INTERFACE

ACCESS TO CHASM

When accessing the online reporting system to complete a surgical case form, surgeons must go to: https://anzasm.surgeons.org

Surgeons should navigate to the "Assigned Cases and Assessments" tab to access (1) Surgical case forms, (2) Delegated cases, (3) Assessments and to (4) Self-notify, by clicking "create new case". Also, by using the "Accounts" tab surgeons can update their personal details, surgical specialty, email address and can elect to become a First, or Second, Line Assessor.

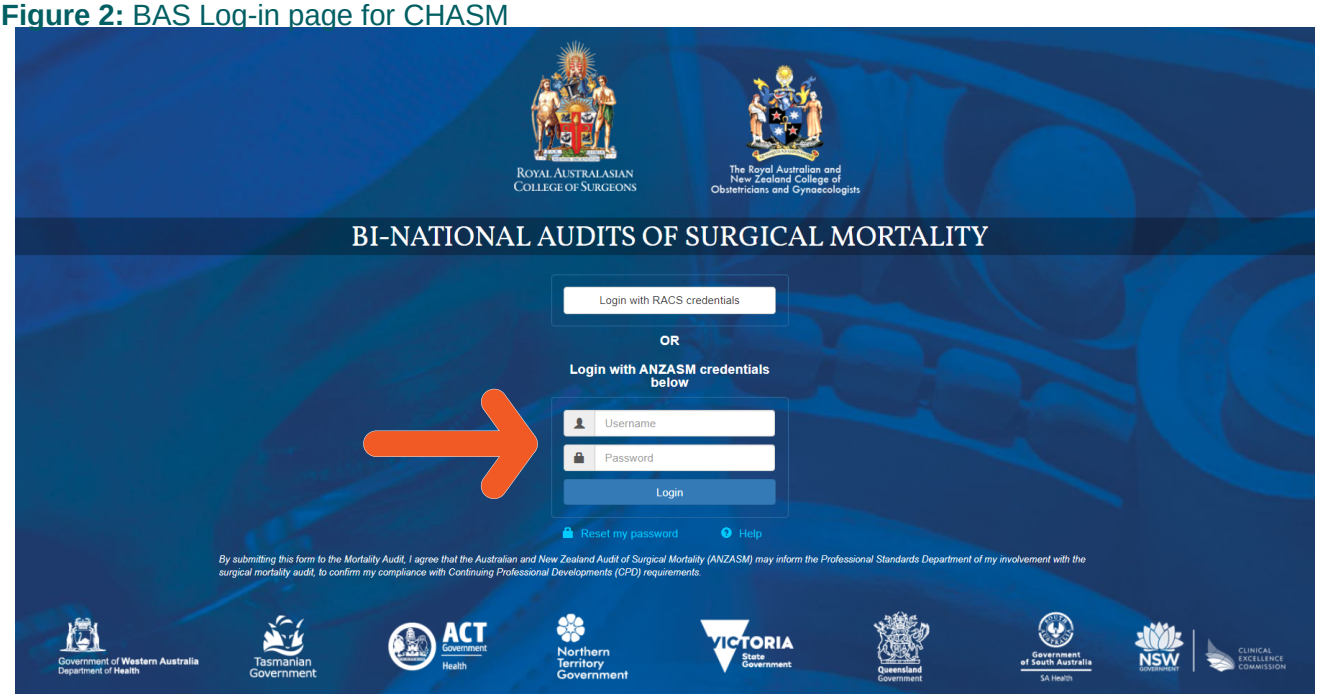
Self-notification is encouraged as close to the event as possible so that the recall is fresh in the operating surgeon's mind. There is also the option to delegate a case to a junior surgeon for completion. However, the operating surgeon must review the case before submitting it to CHASM.

If a surgeon believes a case has been incorrectly assigned, the case be rejected or the surgeon can contact the CHASM Office to clarify the situation. The case can then be removed and reassigned to the correct operating surgeon.

Surgeons need a unique username issued by the CHASM Office and need to set their own password. For assistance with access, navigation, initiating an account, or for forgotten passwords, please telephone the Audit Co-Ordinator on (02) 9269 5511 or email: CEC-CHASM@health.nsw.gov.au

Note: The online reporting system is not able to delegate First Line Assessments, access Second Line Assessments, or provide surgeons with information regarding their CPD points awarded by CHASM.

Figure 2: BAS Log-in page for CHASM



NOTIFICATION PROCESS

The CHASM Program relies on the strength of the mortality screening system in place at each hospital. To support the screening process throughout the public hospital system, the Clinical Excellence Commission developed an Admitted Patient Death Screening Tool – or the *Death Review Database*.

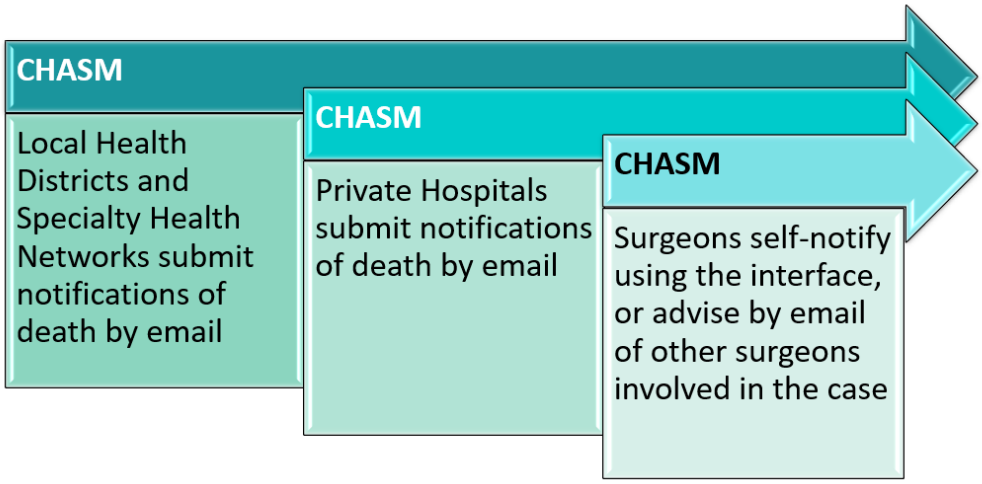
The majority of Local Health Districts and Specialty Health Networks in New South Wales use this system to ensure appropriate mandatory reporting and review of patient deaths, and to enable the referral of all deaths which meet the criteria for the CHASM program.

The CHASM Committee's Terms of Reference determine the criteria for the mortality audit as:
Deaths that occur within 30 days after an operation or during the last hospital admission under the care of a surgeon, irrespective of whether an operation has been performed or not.

Notifications of deaths (NODs) are generally managed on a 45-day cycle which synchronises with the mortality screening conducted by public hospitals using the database tool. Private hospitals use alternate methods of screening and use a reporting period that aligns with their systems. Generally, the responsibility for screening lies with patient safety and/or clinical governance departments. Dedicated Health Professionals email a list of NODs to CHASM for each calendar month. They also clarify any screening details or provide additional information when required.

After the NODs for each hospital are vetted by the CHASM Office, they are entered into the Bi-National Audit System (BAS). The BAS database generates a unique case identifier which links the operating surgeon to the case. A request is then emailed to the surgeon to complete a Surgical Case Form (SCF). Once the form is submitted, it is reviewed and coded by the CHASM Office, and then progressed for peer assessment.

Figure 3: Responsible Notifiers for CHASM Deaths



COMPLETING A SURGICAL CASE FORM

All the information provided by the surgeon in the Surgical Case Form and the subsequent peer review assessments is protected under the *Health Administration Act 1982* as specially privileged information and can only be disclosed with authorisation from the Minister for Health.

When completing a surgical case form it is important to complete all fields and radio buttons as it is designed with program logic to auto-populate the Bi-National Audits of Surgical Mortality database.

Extra attention should be given when completing **Question 9** - *Please describe the course to death.* The response to this question allows the surgeon to share their unique surgical journey.
The information provided in Question 9 forms the basis of the Peer Review undertaken by the First Line Assessor (*Appendix 1*). The quality and amount of information provided helps to determine if there is a concern, consideration or adverse event which may require further review by an independent Second Line Assessor. Each surgical case form attracts one point, and each first line assessment attracts 2 points, for CPD compliance with the Royal Australasian College of Surgeons.

Second Line Assessment (*Appendix 2*) is when a participating surgical peer is selected from the same specialty (and often sub-specialty) and is provided with the patient's medical record and the surgical case form. Second Line Assessors are required to review the full case to address the area of consideration, area of concern or the adverse event which was identified by the First Line Assessor, and to provide a written report for feedback to the surgeon. Each second line assessment attracts 4 points for CPD compliance with the Royal Australasian College of Surgeons.

Some cases are referred to Second Line Assessment because there is insufficient information or enough detail provided by the surgeon for the First Line Assessor to determine if there are any extenuating circumstances. To avoid unnecessary referrals, these cases are referred to the CHASM Chairperson, with a copy of the operation report and discharge summary. A review then occurs in an effort to clarify the details of the case prior to requesting a Second Line Assessment.

The other important question on the surgical case form is **Question 25** - *In retrospect, would you have done anything differently?* This is where the surgeon has the opportunity to reflect on the events of the case and share any insights that become apparent with hind-sight. Self-reflection supports further learning through self-assessment of competency. It encourages evaluation of practise with the potential for skill enhancement [2].

MULTI-SURGEON CASES FOR CHASM

The surgical audit for CHASM differs from the rest of the country with the inclusion of multi-surgeon cases. These are cases where:

- More than one surgeon of the same specialty has been involved in the clinical management of the patient
- More than one surgical specialty has been involved in the clinical management of the patient
- The patient has been readmitted after discharge from a surgical admission
- The patient has been transferred from one hospital to another - whether rural to metro, private to public, or multiple transfers between hospitals.

The CHASM Program endeavours to capture the whole patient journey through the information provided on the patient's surgical journey. This process is improved by having multiple viewpoints.

Multi-surgeon cases help the CHASM Committee to further understand the complexities that are experienced by surgeons in the operating environment and include; communication issues, delays in patient transfer or available resources, challenges in decision-making for the deteriorating patient, and inadequate pre-operative assessment. All these issues impact the delivery of surgical services to the patient, and on occasion, contribute to a poor patient outcome.

The multi-surgeon workflow relies on the collaborative nature of the CHASM Program and its participating surgeons. When a multi-surgeon case is created in the online system a "principal surgeon" should be identified for the case. All surgeons named in the case thereafter are designated by the CHASM Office as "Associate Surgeons".

Sometimes it is necessary to determine the level of involvement the surgeon has in the case, so that unnecessary requests to complete forms are not made of surgeons with little-to-no involvement in the clinical management of the patient. This is an important exchange of information with the CHASM Office that improves the overall quality of the submission. Once all of the surgical case forms are submitted and vetted, the case is progressed to a First Line Assessor for review.

First Line Assessors completing multi-surgeon cases have access to a deidentified copy of each surgical case form in Fellows' Interface to enable a thorough assessment on the patient's course to death, using as much information as possible from the operating surgeons' accounts.

CLINICAL LESSONS

CASE EXAMPLE 1

Neurosurgery

Case Summary

- *An 84-year-old lady presented with long standing back pain, dating back to an accident in the 1960s and further injuries requiring surgery 30 years later.*
- *Her condition had deteriorated over the last 18 years with low back pain and right-sided sciatica.*
- *The patient was bed-bound for most of the last two years.*
- *She was frail and had ischaemic heart disease.*
- *There was also significant kyphosis and scoliosis, and foraminal stenosis at right L5/S1.*

Surgeon's description of course to death

The operating surgeon suggested that due to the scope of the surgery, it would potentially be beneficial and less physiologically straining if the patient was to undergo the operation in a two-part approach. Surgery was agreed upon and scheduled, with the patient aware of the risks.

Part 1

The first part of the operation was performed which involved a paramedian approach through the posterior part of the patient's spine. She had undergone bilateral L3-S1 and a right-sided L1/2 transforaminal interbody fusion. The surgery was uncomplicated that day; the patient had minimal blood loss and recovered in the Intensive Care Unit.

The second day after surgery, the patient remained well, and she was coherent. The electrolytes and blood counts were stable.

Part 2

On post-op day 2, the second part of the operation commenced. The operation planned was a pedicle screw fixation from T10 to the iliac crest. Cement augmentation of the vertebral bodies was also planned, due to the patient's age and the presence of osteoporosis. After having the K-wires inserted with the use of fluoroscopy from T10 to the iliac crest, cement augmentation was performed from T6 to T9. No adverse reaction was identified. The pedicle screws were all inserted from T10 to the iliac crest. During this time, the patient remained stable.

The next part of the operation involved injecting the acrylic cement into the patient's iliac crest and the S1 vertebral body. This resulted in an episode of hypotension and the patient suffered a cardiac arrest. After approximately 10 minutes of resuscitation and CPR, she responded and remained stable for a short period of time.

During this time, the patient had all the screws exposed and the spine remained unstable. The decision was made to not abandon the operation completely, but to attempt cementing the L2 and L3 screws at the apex of the curvature, and perhaps have cement augmentation of the T10 and T11 levels, at the top of the construct, to give the best fixation.

When the surgical team commenced the cement augmentation of the L2 and L3 vertebral bodies, there was no adverse event, and the patient remained stable during the cement injection. We then proceeded to inject cement into the T10, T11 and L1 vertebral bodies, and within 10 minutes of commencing of the third stage of the cement injection, the patient suffered another hypotensive episode which resulted in a second cardiac arrest.

On this occasion, resuscitation with CPR was performed for almost 30-40 minutes in the prone position. The decision was to close the wound rapidly and turn the patient to the supine position to continue with the resuscitation. Once the patient was in the supine position, she gained some stability in her blood pressure.

The operating surgeon contacted the patient’s family and communicated the events that occurred in the operating theatre. The patient remained in the operating theatre for approximately 25 minutes before she was subsequently transferred to the Intensive Care Unit, intubated.

After arriving at the Intensive Care Unit, the patient remained extremely unstable. Unfortunately, she had multiple episodes of haemodynamic instability, resulting in her demise that night.

Additional note: These are the events that occurred during the operation. The operating surgeon was doubtful that the cement augmentation was the cause of the hypotension; and was suspicious that the patient may have had a primary cardiac event that resulted in the hypotensive event.

Surgeon’s Reflections

1. Consider not operating on the patient
2. Consider a longer time period between part 1 and part 2 of the operation
3. Consider ceasing cement augmentation after the first reaction
4. Consider peri-operative cardiac involvement / consultation

Peer Report

Addressing the first line assessor's questions

These questions included:

- Why the operation was performed in such an elderly patient?
- Why was acrylic cement augmentation needed?
- Why correct a deformity in an 84-year-old? and,
- What were the risks discussed?

It was also asked:

- Why was such a large multi-stage operation performed?
- Why was the second stage so soon after the first stage?
- Why was it decided to proceed with the cement after she had already arrested? and,
- What was her medical workup prior to the surgery?

This case presents quite a difficult situation for the surgeon. He had advised against surgery, but the patient herself, supported by her family, had indicated that her quality of life was so poor that she was prepared to take the risks involved.

Once the operation had commenced, there was a commitment to proceed until the completion of both stages. Not to have done so would have meant that the patient was exposed to the not inconsiderable risks of such major surgery on an elderly, osteoporotic, patient.

Having proceeded to this point, the spine would have been further weakened. If the procedure had been aborted at that point, her disability would have been even worse than it was prior to the operation.

Assessor's Opinion

There was evidence that the patient had an adverse reaction to the injection of the cement. However, without such cement augmentation the operation would have failed in the early post-operative period, almost certainly with substantial screw back-out, rendering it impossible to gain any purchase with any future screws.

In my view, the only alternative available to the surgeon was to refuse to perform the operation in the first place, despite the patient and her family advising him in no uncertain terms that they wished to proceed.

Once the initial surgery commenced, the operating surgeon was committed to completing the procedure despite the risks.

COMPLICATIONS OF ACRYLIC BONE CEMENT

CLINICAL REVIEW
BY DR JOHN IRELAND,
ORTHOPAEDIC SURGEON

The surgeon was at pains to explain the risks, which the patient and her family accepted.

The patient underwent a two-stage spinopelvic fusion. She underwent the first stage; bilateral L3-S1 plus a right L1/2 transforaminal interbody fusion. I note she required 3-units of packed red blood cells and 2-units of fresh frozen plasma.

Two days later, the patient underwent pedicle screw fixation from T10 to the iliac crest with acrylic cement augmentation. While having cement injected into the iliac crest, she had an episode of hypotension and suffered a cardiac arrest.

She was resuscitated successfully, and the procedure progressed, but a further episode of hypotension while injecting cement led to a second cardiac arrest. Although she was resuscitated, she passed away that night in the Intensive Care Unit.

Clinical Lessons

Acrylic bone cement or polymethyl methacrylate (PMMA) is a powder and liquid copolymer. When mixed together, it produces an exothermic reaction and hardens over a period of several minutes. It has been used in dentistry for decades, but its clinical applications expanded when Sir John Charnley commenced total hip replacements in the 1960s. It was extremely effective at securing the implants in bone and continues in use today. The use in spinal surgery for vertebroplasty and kyphoplasty is more recent. It has proven very effective to augment fixation in osteoporotic bone.

Intra-operative deaths associated with acrylic bone cement were reported in 1972 by Kepes.[3] Hypotension was a common factor, and in one of the cases widespread fat emboli were noted. Pelling [4] reported on the effects of acrylic bone cement in animals in 1973, noting an acute fall in blood pressure within seconds of insertion. In the hip, pressures exceeding 600 mmHg are noted with insertion of the femoral component into cement within the femoral canal.

The pressures associated with insertion into the vertebra and pelvis are less well known. Studies have postulated that PMMA-associated hypoxia, hypotension, anaphylaxis and death may be that the application of PMMA may lead to embolisation of marrow debris and neurogenic reflex, thus adversely affecting cardiopulmonary function.

Allergy to PMMA bone cement or its constituents has been reported in dentistry, dermatology and joint arthroplasty literature.

The incidence of intra-operative mortality in total hip replacement is low, according to Weinrauch,[5] who reported on cemented hemiarthroplasties in elderly patients in 2006, as being 0.14%. The incidence of hypotension and fat embolism is much higher. The incidence in spinal surgery is difficult to gauge but appears to be higher than total joint replacement.

Several studies have reported on extravasation after percutaneous injection of cement in the spine. A study by Lee in 2010 [6] using CT scans, found the rate of local leakage of bone cement was 87.5% for percutaneous vertebroplasty, and 49.2% for kyphoplasty.

- The most common site of local leakage was peri-vertebral soft tissue for vertebroplasty
- The most common site of local leakage was a peri-vertebral vein for kyphoplasty

Complications directly related to spinal injection of cement include:

- Pulmonary infarction and death as a result of embolisation of PMMA that was injected in liquid state following vertebroplasty
- Pulmonary embolisation of fat and thrombus, which is well recognised
- Aortic and renal embolisation is reported and can present with haematuria
- Paraplegia has been reported, although it remains uncommon

The use, timing and extent of usage of acrylic bone cement remains controversial in an inevitably high-risk population. Noting the considerable risk in this clinical scenario, it may have been wise to have a longer recuperative time between stages. The decision to proceed after cardiac arrest and continue to use cement remains questionable.

Recommendation

The specific risks of extensive use of cement should be explained to patients, as well as the overarching risks of the procedure.

Clinical note: The use of pedicle screws with cement is only approved for cancer surgery in New South Wales. The use of pedicle screws with cement in this case was off-label.

CASE EXAMPLE 2

Cardiothoracic & Vascular Surgery

Case Summary

- *A 73-year-old man was admitted to a tertiary referral hospital for an aortic valve replacement and ligation of the left atrial appendage.*
- *The patient had symptomatic, and progressively worsening, exertional dyspnoea due to aortic stenosis and chronic atrial fibrillation.*
- *Echocardiography demonstrated severe aortic stenosis.*
- *A coronary angiogram revealed a non-graftable marginal circumflex branch, and a non-haemodynamically significant stenosis in the right coronary.*
- *Co-morbidities included BMI of 37, chronic airways disease, hypertension, osteoarthritis leading to bilateral knee replacements, gout and the resection of colonic polyps.*
- *Medications on admission consisted of Bisoprolol, digoxin, frusemide, perindopril, Ventolin, Seretide and Spiriva inhalers, Mobic and Zyloprim. Rivaroxoban was ceased three days prior to admission.*

Vascular Surgeon's description of course to death

Cardiac procedure performed by sternotomy; the patient progressed well, was extubated and discharged from Intensive Care to the ward the following day.

Over the following four days, the patient developed deteriorating renal function and abdominal distension, thought to be due to ischaemic bowel. Sigmoidoscopy revealed no abnormality.

I was involved in the case from the day after the initiation of ECMO (extracorporeal membrane oxygenation). The patient was ventilated and had developed an ischaemic left leg.

- Duplex Doppler ultrasound confirmed occlusion of SFA / popliteal into tibial vessel.
- Kink in the return cannula (corrected before surgery). Performed popliteal embolectomy with fasciotomy. Patch to popliteal artery.
- Patient transferred to Intensive Care Unit to continue treatment – rapid increase in inotropes with worsening acidosis and hyperkalaemia.
- After discussion with the family, palliation was instituted.
- The patient passed away on post-op day 15.

Peer Report

Addressing the first line assessor's question

First line assessor indicated that death may be due to a complication related to ECMO.

The commencement of ECMO with femoral artery cannulation almost certainly precipitated the patient's left leg ischaemia, which remained untreated for a period of up to 24 hours. At that stage, urgent left leg popliteal embolectomy and four-compartment fasciotomy was required.

Leg ischaemia, secondary to the placement of ECMO, due to catheter kinking with thrombosis of the device or arterial injury are certainly recognised complications of the placement of an ECMO catheter in femoral vessels.

- Appropriate management was undertaken by the vascular surgeon with popliteal embolectomy and four-compartment fasciotomy.
- The decision regarding leaving the ECMO line in situ was made on the balance of risk and need for continuing cardiopulmonary support.
- Post-operative care was well documented in the notes.
- From the initial vascular operation (embolectomy and fasciotomy), it was evident that with the delay from onset of placement of the catheter and recognition of ischaemia, the limb was unlikely to be salvageable.
- The ongoing muscle ischaemia would contribute to worsening of the ARDS (Acute Respiratory Distress Syndrome), AKI (Acute Kidney Injury) and septic shock.
- Early removal of the ECMO catheter and the establishment of central VA ECMO together with early amputation at the above knee level, would be the only option for increasing chances of survival. Although that form of management would be associated with significant morbidity and mortality.

The complications were an adverse event related to the need for ECMO, which was essential for cardiovascular support of the patient six days following cardiac surgery. At the time of establishing ECMO, it was likely the patient would die from the post-cardiac surgery complication. Early removal of the ECMO and amputation would have had only a small possibility of improving this patient's chances of survival.

The patient's clinical notes and records are meticulous. There are no deficiencies in care.

Assessor's Opinion

The major learning points for this case are:

- The placement of femoral artery catheters carries significant risk of ischaemia, which will be exaggerated in patients with associated septic or cardiogenic shock.
- When irreversible ischaemia is noted at the time of attempted revascularisation, or in the post-operative period, an early decision regarding definitive amputation may be the patient's only chance of survival.

UNCORRECTED TISSUE ISCHAEMIA AND SEPSIS

CLINICAL REVIEW
BY DR ROBERT COSTA,
CARDIOTHORACIC SURGEON

- The patient was seen in the hospital's Peri-Operative Clinic.
- As well as a general medical review, the patient was referred to the Dental Clinic and given dental clearance to proceed.
- Respiratory function tests were acceptable, being 67% of predicted.
- Carotid duplex scans demonstrated minor disease only.
- Although in the normal range on admission, both urea and creatinine had been elevated in the past. The eGFR was low-normal.
- The patient was deemed to be suitable to be "fast-tracked" in the Anaesthetic Clinic.

Clinical Course

The patient was admitted on the day of surgery. A surgical aortic valve replacement and ligation of the left atrial appendage was undertaken via a median sternotomy employing cardiopulmonary bypass, aortic cross-clamping and cardioplegia. The valve was replaced using a tissue valve. The surgery, cardiopulmonary bypass run, and anaesthesia proceeded without incident. The patient was transferred from the operating theatre ventilated to the Intensive Care Unit, in a stable cardiorespiratory state.

The patient's immediate post-operative progress was uneventful. He was extubated routinely and managed as per protocol for an uncomplicated aortic valve replacement.

On the morning of the first post-operative day, following review by the cardiothoracic and intensive care teams, he was deemed suitable for discharge to the ward, and was transferred early that afternoon.

The following morning, the patient was noted to be comfortable and was able to mobilise with assistance and the use of a FASF (Forearm Support Frame). However, by the late afternoon he was becoming dyspnoeic on exertion with a fall in oxygen saturations. Overnight the patient was not able to lie supine, requiring him to sit upright with an increase in his supplemental oxygen requirements, to maintain adequate peripheral oxygen saturations.

By the following day, there had been further deterioration in his respiratory status. He was noted to be more dyspnoeic, with widespread crepitations on auscultation. The patient also had an episode of an atrial tachyarrhythmia. Intensive care review was sought. The recommendation was to continue nursing the patient on the ward, but to introduce non-invasive ventilation and to induce a diuresis.

Despite these measures, the patient continued to deteriorate from a respiratory viewpoint. He was becoming increasingly fatigued and intolerant of the non-invasive ventilation. He developed abdominal distension which further impaired his respiration, in addition to his body habitus with an already rotund abdomen. A nasogastric tube was inserted with little, to no, improvement.

A decision was made to return the patient to the Intensive Care Unit. He was becoming more dependent on non-invasive ventilation with an increasingly distended tympanitic abdomen.

A general surgical opinion was sought regarding the abdominal distension. A pseudo-obstruction was thought the most likely diagnosis, and a flexible sigmoidoscopy suggested to decompress the abdomen. However, it was considered necessary to intubate the patient to be able to perform the procedure. At sigmoidoscopy, there was no evidence of ischaemic bowel or other issues, and a flatus tube was passed in a further attempt to help decrease the abdominal distension.

A chest x-ray demonstrated increasing right basal consolidation and atelectasis. Following intubation, the patient became haemodynamically unstable, with increasing runs of rapid atrial fibrillation requiring inotropes and anti-arrhythmics to maintain an adequate circulation.

Clinically, there was a rapidly developing scenario consistent with septic shock. Subsequent sputum and blood cultures grew Serratia marcescens.

Over the following 24 hours, the patient became anuric requiring the introduction of renal replacement therapy, as well as becoming increasingly difficult to ventilate and oxygenate. All respiratory recruitment modalities, including prone positioning and inhaled prostacyclin, were attempted.

On post-operative day 6, a decision was made to place the patient on ECLS/ECMO (extracorporeal life support) after discussion with the family, due to the worsening clinical scenario of worsening hypoxia and circulatory collapse. This was undertaken percutaneously via left femoral cannulation. A backflow cannula was also placed in the superficial femoral artery to perfuse the distal aspect of the left leg. Heparin was commenced to reduce the risk of thrombosis.

The following day, it was clinically evident that the left leg was ischaemic. Ultrasound was consistent with widespread arterial occlusion. The consensus was that the backflow cannula was occluded. The patient was taken to theatre by the Vascular Surgery team and a popliteal artery embolectomy performed, together with a four-compartment fasciotomy.

Despite maximal support, the patient showed no signs of improvement. There was progressively worsening multi-organ failure. Radiologically, there was a worsening respiratory situation consistent with ARDS. The patient had a persistent ileus with faecal fluid being aspirated from the nasogastric tube, and progressively worsening hepatic function. Ionotropic support was not able to be weaned. Transthoracic cardiac echo demonstrated depressed ventricular function with a well-seated and functioning aortic valve prosthesis. The left leg was increasingly felt to be non-viable.

Throughout this period, the family was constantly updated regarding the patient's clinical state. They expressed the opinion that the patient would not wish to continue unless there was the prospect of having a better quality of life than pre-operatively. This was increasingly felt to not be the case. A decision was made to decannulate the patient irrespective of the outcome. There was no intention of reintroducing ECMO support in the event of haemodynamic collapse.

Formal decannulation was undertaken in the operating theatre by the Vascular Surgeons on the 15th post-operative day, and the ninth day following the commencement of ECMO. The left leg was found to be non-viable. Following decannulation, the patient was returned to the Intensive Care Unit where he succumbed soon after.

Clinical Lessons

This case highlights the progression to intractable multi-organ failure in the presence of uncorrected tissue ischaemia. In this setting, the need for cardiopulmonary support required to be balanced against the need to correct the malperfusion of the lower limb. The requirement for fasciotomies within 24 hours of the placement of the ECMO cannulae should have precipitated the need to review the perfusion strategy in terms of cannula placement.

The note-keeping in this case was meticulous by all disciplines. The notes were contemporaneous and informative. However, there was never any suggestion of relooking and revising the cannulation site.

Although the easiest to access, and the easiest to manage from a nursing aspect, femoral arterial cannulation poses the risk of causing limb ischaemia. It is for this reason that a femoral “backflow” catheter is used.

The main arterial ECMO cannula is inserted with the flow being directed in a cephalad or retrograde fashion, with the backflow cannula directing flow in an antegrade fashion down the femoral artery.

The ongoing and unrelieved limb ischaemia contributed to, and most likely was, the most significant cause of the progressive multi organ failure. At the time of decannulation, the left leg was deemed to be unsalvageable.

The case also highlights the increased risk of operating on obese patients. This patient’s initial post-operative problem was respiratory in nature leading to the development of a hospital-acquired pneumonia, which then led to generalised sepsis.

Conclusion

In retrospect, this patient with the comorbidities of obesity, arthritis with joint replacements and somewhat impaired respiratory function, was one not to be rushed through the system. Understandably, with the pressure on reducing hospital lengths of stay, clinicians must be aware of the added risk this places on older patients and to consider the whole patient, rather than a set of parameters being either normal, or not.

Recommendation

In cases where lower limb ischaemia is problematical other arterial cannulation sites, such as the axillary artery or even the ascending aorta, need to be considered. Failure to do so in this case contributed to the patient's poor outcome.

CASE EXAMPLE 3

Obstetric & Gynaecological Surgery

Case Summary

- *A 43-year-old woman presented with longstanding but worsening menorrhagia, secondary to uterine adenomyosis/fibroids.*
- *She had sought advice from several gynaecologists.*
- *She was having infertility assessment/treatment as she was desperate to have a child.*
- *She had three previous pregnancies, all resulting in miscarriage.*
- *Previous diagnosis of chronic menorrhagia (anaemic; haemoglobin 35 g/L).*
- *Need to exclude endometrial cancer.*

Surgeon's description of course to death

A 43-year-old female admitted for day surgery (hysteroscopy). Significant PV bleeding during hysteroscopy. Two intra-uterine balloons inserted intra-operatively to stop the bleeding. Cyklokapron was administered in theatre and post–operatively, as per protocol.

Post-op Day 1: Left leg and calf pain. Venous Doppler and CT scan performed: No DVT seen.
Post-op Day 2: Intra-uterine balloons removed uneventfully.
Post-op Day 3: The patient collapsed on the ward secondary to massive pulmonary embolism. Transferred to Intensive Care Unit for ECMO.
The patient passed away on post-op day 4.

Surgeon's reflection

1. Consider review by Vascular Surgeon.
2. Consider venogram or view of IVC +/- common iliac vein, as the patient had a large 26/40 uterus, to exclude DVT. Note: Venous Doppler results -> NAD.
3. Tranexamic acid dose was checked and appropriate.
4. The patient had continuous calf compressors, TEDs and Clexane post-operative.

Peer Report

Addressing the first line assessor's question

The Assessor indicated that there was not enough information provided on the pre-operative management of this patient and the preparations for day surgery.

This 43-year-old female with significant menorrhagia (haemoglobin 35 g/L) and known fibroid uterus, was booked electively for hysteroscopy and endometrial sampling to exclude cancer. She had a recent history of blood transfusion, aspirin, Provera and tranexamic acid (TXA) may have added to pre-operative risk.

Procedure 1:

- Hysteroscopy and sampling with heavy bleeding requiring two intrauterine balloons / IDC
- Blood transfusion – 3 units packed cells; 2-units FFP (fresh frozen plasma)
- Tranexamic acid 1 gm IV
- DVT prophylaxis undertaken SCDs (sequential compression device) and Clexane

Procedure 2:

Post-op Day 2

- Removal of balloons in theatre
- Further bleeding requiring bi-manual compression
- Tranexamic acid and flow seal to cease

Post-op Day 4

- Signs of brain death noted
- Appropriate withdrawal of care after discussion with family
- Patient passed away at 16:42
- Case referred to Coroner

Assessor's Opinion

This case highlights the difficulties of care when there is potential for thrombosis in the context of life-threatening bleeding.

I could find no deficiencies of care but agree a venogram may have diagnosed thrombosis a little earlier. However, I do not see how this could have changed outcome unless a filter could have been inserted in the IVC. This is, of course, with the benefit of retrospect.

Attention to the dosing of tranexamic acid was given and I could find no evidence of its use being anything but entirely within usual protocols. As far as I could see, the only other alternatives, if bleeding had not stopped with balloon catheters, would have been to either embolise the uterine arteries, or perform a hysterectomy in an unconsented 43-year-old woman who had no children.

Both procedural alternatives would not necessarily have prevented the risk of a thromboembolic event in this patient.

SADDLE EMBOLUS IN AN ANAEMIC WOMAN

CLINICAL REVIEW
BY DR SUSAN VALMADRE,
OBSTETRICIAN & GYNAEONCOLOGIST

The prospects for fertility for this patient were remote, due to her age and the fact that her uterine size was about 24 weeks in proportion.

The patient presented to Emergency with menorrhagia and haemoglobin of 32 g/L. She was transfused with packed cells and discharged on Provera and tranexamic acid. Outpatient gynaecological review was arranged, but she defaulted on this appointment.

Approximately 7 weeks later, the patient again presented to Emergency, with menorrhagia and haemoglobin of 36 g/L. At that time, she was under the care of a different gynaecologist. She was again resuscitated with a blood transfusion and commenced on Provera and tranexamic acid.

Clinical Course

- The patient was reviewed one week later as an outpatient, and her very heavy bleeding had settled.
- A hysterectomy was strongly recommended, in light of the patient's frequent presentations to Accident and Emergency and multiple blood transfusions.
- As she was undergoing investigations and possible treatment for infertility, the patient refused a hysterectomy but agreed to having a hysteroscopy and uterine curettage to exclude a malignant process.

This procedure was booked for the following week.

- The patient was admitted, hysteroscopy and uterine curettage was performed.
- Findings at surgery included a 24-week sized uterus, and after some difficulty due to uterine size and a poor view, an endometrial biopsy was taken. This resulted in major bleeding which required two balloons to be inserted in the uterine cavity to tamponade the bleeding.
- The bleeding eventually settled – approximately one litre was lost during the procedure.
- A 4-unit blood transfusion was started, and tranexamic acid was administered.
- Post-operatively, the patient's haemoglobin was 74 g/L.

Post-op Day 1:

- The patient was stable but informed of the very serious situation she was in, and again the option of undergoing a hysterectomy was discussed. Again, the patient refused.
- 20 mg Clexane was started in the morning.
- The patient had continuous calf compression with TED stockings, started post-operatively.
- A CT scan of the abdomen and pelvis was obtained. It did not show any intraperitoneal bleeding or uterine perforation.

- There was evidence of compression of her common iliac vein by her pelvic masses (she was also noted to have ovarian cysts on the CT scan).
- There were no thrombi seen in the major pelvic vessels.
- The plan was to remove the intrauterine balloons the following day.

Post-op Day 2:

- The patient complained of left lower leg swelling and pain.
- Lower limb duplex ultrasound was organised promptly but did not show any thrombus.
- The tranexamic acid was ceased because of the concern regarding a possible DVT.
- The intrauterine balloons were removed uneventfully as planned. The patient's haemoglobin post procedure was 88 g/L.

Post-op Day 3:

- Just prior to discharge in the morning, the patient collapsed with what was eventually found to be a massive saddle embolus.
- Resuscitation was promptly undertaken, and the patient was placed on ECMO.
- Percutaneous embolectomy and thrombolysis with tissue plasminogen activator (tPA / PLAT) was attempted.
- Subsequently the patient started bleeding profusely from her vagina, and again required intrauterine balloon tamponade to stem the bleeding.

Life support was withdrawn, and the patient passed away on post-op day 4.

Clinical Lessons

- This case demonstrates the difficulty of managing heavy vaginal bleeding in a patient who was refusing the appropriate treatment, i.e. hysterectomy.

- The patient's frequent blood transfusions, treatment with moderately high doses of Provera and tranexamic acid may have contributed to her tendency to experience a VTE. It is noted however, that using Provera in those doses plus tranexamic acid is generally regarded as appropriate management of heavy vaginal bleeding.

- If a VTE of the left leg was suspected, despite a negative lower-leg duplex and CT scan, a venogram could have been obtained. In addition to this, vascular surgery input may have been helpful.

CASE EXAMPLE 4

General Surgery

Case Summary

- *Patient was a 75-year old male, presenting to Emergency with abdominal pain.*
- *Co-morbidities listed as cardiovascular and renal. Recently admitted for diverticulitis.*

Note: This is a multi-surgeon case. Information from two surgeons involved in the clinical management of this patient were submitted for peer review.

Surgeon A's description of course to death

Acute renal failure and coagulopathy - On Day 2 the patient was transferred from Public District Hospital A to Public Base Hospital B. Reviewed by surgical registrar, inguinal hernia noted, and reduced. The patient was operated on (inguinal hernia repair) by another surgeon, admitted to the Intensive Care Unit, and intubated subsequently. The patient had worsening acid-base status and he previously expressed 'not for dialysis'.

In the Intensive Care Unit, the patient had a leukemoid reaction with neutrophilia, and had acute-on-chronic renal failure. He then quickly went to full MODS (Multi-Organ Dysfunction Syndrome) on Day 2 post-operatively. The patient was not for haemodialysis from previous Advance Care Directive, so he was palliated and subsequently passed away.

Surgeon B's description of course to death

• Elderly patient admitted under the Acute Surgical Unit with irreducible left inguinal hernia.
• Known chronic renal failure but had declined dialysis; wanted "nature to take its course".
• Hernia reduced and patient treated for diverticulitis.

The following day the patient was planned for hernia repair after the weekend (I covered for the consultant over weekend).

Day 2:

- A CT scan showed thick walled sigmoid. Sigmoid in hernia sac. White cell count 40 x 109/L, C-RP 344.
- Patient developed acute abdomen late Friday (pm) evening. Possible perforation of colon detected on CT scan.
- Laparotomy (21:00 hours) loop of sigmoid reduced. Sigmoid thickened but not obviously ischaemic (transmural). No diverticulitis. Changes in sigmoid involved more than that involved in hernia. Both hernias repaired by simple suture.
- Patient transferred to Intensive Care Unit. Plan for re-laparotomy if the patient deteriorated.
- He remained haemodynamically unstable with acute renal failure coagulopathy.
- Family discussion with decision to palliate.

Surgeon B's Reflection

In retrospect, it is possible this patient had ischaemic colitis, which in itself could have been treated conservatively, initially, as many resolve.

In addition, it may be possible the "ischaemic sigmoid" was not related to the incarcerated colon in the hernia. Sigmoid colectomy was not indicated at the operation. The CT scan was performed in the afternoon before his laparotomy.

Peer Report

Addressing the first-line assessor’s questions

These questions included:

- There is no obvious diagnosis made even with hindsight of operative findings. Patient admitted with inguinal hernia, but main issue appears to be ischaemic colitis. What was the diagnosis?
- Clarify the CT and operative findings. There appears to be different interpretation of CT and operative findings.

1. Clarify diagnosis

I suspect this patient had ischaemic colitis and his timing for surgery was critical. The other thought would be a strangulated hernia but that doesn’t match the operative findings.

2. Clarify CT findings

Given his medical co-morbidities, IV contrast would have been vital to make a pre-operative assessment. Although he had CRF, IV contrast would have helped obtained information that would have guided timing and planning for surgery.

3. Interpretation of findings

Ischaemic colitis is a difficult diagnosis to make as it is one of exclusion. Given the appearance of the bowel at surgery, I would have repaired the hernias, performed possibly a sub-total/left-sided colectomy, placed a vac dressing and brought patient back in 24 to 48 hours for a relook laparotomy.

Assessor's Opinion

This patient was high-risk and I suspect ongoing ischaemic colitis/bowel led to his demise.

CASE EXAMPLE 5

General Surgery

Case Summary

- *A 79-year-old male presented as an emergency through the GP rooms by ambulance, with a three-day history of not opening bowels, pain and vomiting.*
- *Past co-morbidities included TIA, GORD, osteoarthritis, chronic obstructive airway disease and vascular dementia. The patient was an ex-smoker and there was a history of alcohol excess.*
- *Total admission time was 20 days.*

Surgeon's description of course to death

Day 1: An elderly male presented to Emergency Department with strangulated inguinal hernia. Co-morbidities listed as cardiovascular and respiratory.

Day 2: The patient was taken to the operating theatre (17:40) for attempted laparoscopic repair. Upon opening the small bowel (strangulated), changed to laparotomy and bowel resection, primary anastomosis and mesh insertion.

- The patient had ST depression and NSTEMI intra-operatively and was admitted to HDU for monitoring.
- He gradually deteriorated during the period post-op day 3 to post-op day 9 (ischaemic bowel).
- Palliative Care services became involved and the patient was palliated.
- The patient passed away on post-op day 18.

Surgeon's Reflections

An earlier intervention may have avoided bowel ischaemia. In addition, consideration of a two staged procedure may have altered outcomes.

Peer Report

Addressing the first-line assessor's questions

More information regarding the pre-operative management of this patient, as well as the choice and time of operation, would have been preferred.

The patient was assessed in casualty and the intern noted a tender lump in the groin. Adequate management was instituted, and a CT scan arranged.

The CT scan suggested incarcerated inguinal hernia and possible strangulation of the small bowel. This report was available in the early evening.

Next day there was an addendum and the finding of inguinal hernia was changed to femoral hernia. The patient was assessed by the surgical registrar, but it seems he had not been assessed by the consultant on call.

There is no mention whether the CT scan was reviewed and discussed, and the possibility of strangulation which has been mentioned on the report had been considered.

Following discussion with the consultant on call, the patient was scheduled for surgery early next day, which was nearly 20 hours after admission to the Emergency Department, and four days following the onset of symptoms.

Initially, a laparoscopic approach was instituted. This was converted into an open approach to access the femoral hernia. On finding ischaemic bowel, it was decided to proceed with a low midline laparotomy. The patient had a bowel resection and repair of the femoral hernia. Intra-operatively and in the immediate post-operative period, there was a cardiac event. The patient had a myocardial infarction and was transferred to the Intensive Care Unit.

The patient was languishing in the post-operative period and it was a stormy course.

He eventually died of multiple organ failure, 19 days after the presentation to Emergency.

Good Points

The record keeping was immaculate, especially the nursing side. It was easy to navigate through the records, and investigations were readily accessible. There was a constant input from the surgical and anaesthetic teams, and the family were kept informed throughout.

Clinical Lessons

The only concern was the initial delay. An elderly male with a three-day history of not opening bowels, with low abdominal pain, vomiting, and a CT scan supporting incarcerated hernia with possible strangulation should have been taken into theatre the same evening.

The First Line Assessor raised possible concerns of pre-operative management and choice and time of operation. It is difficult to comment from the periphery, and hindsight is a wonderful tool.

The only other suggestion would be that, possibly the surgical time could have been shortened. This would have been possible if the decision had been taken to go for an open approach straight away, with a low approach for the femoral hernia and then extend it into a laparotomy on finding the ischaemic bowel. It looked from the notes that initially there was a laparoscopic approach, which was then converted into an open hernia repair which progressed onto a midline laparotomy and bowel resection.

Assessor's Opinion

A different approach would have drastically cut down the operative time and possibly avoided the cardiac event. This is my only suggestion, but overall, I cannot fault the management, excellent record keeping, and the care imparted to the patient.

STRANGULATED GROIN HERNIAS IN THE ELDERLY

CLINICAL REVIEW
BY DR DAVID BLOMBERG,
GENERAL SURGEON - COLORECTAL

Summary for Cases 4 & 5
Two patients aged in their seventies were admitted to the same base hospital, in the same year, with strangulated groin hernias, which were reported as tender red groin lumps.

- Both patients had significant comorbidities, and both attended the same General Practitioner where ambulance transfer was arranged
- One patient was taken to the local hospital where a fluid pack was applied and transfer to the base hospital was arranged for the following day
- Both patients were admitted to an Acute Surgical Unit

Case 4
The transferred patient was assessed, and it was thought safe to defer surgery until after the weekend.

The surgeon who took over the following day was informed of the deterioration of the patient, and surgery was arranged. The surgery involved a sigmoid resection.

The patient was unwell post-operatively, and despite Intensive Care Unit management, died four days later.

Case 5
The second patient had a four-day history of abdominal pain with vomiting. Diagnosis of an incarcerated inguinal hernia was made initially on CT on the day of admission.

Surgery was arranged for the following day at which time the diagnosis was altered to strangulated femoral hernia.

A laparoscopy was performed, and diagnosis confirmed. A low approach was performed then to repair hernia.

The bowel was ischaemic, so after a period of observation, it was elected to perform small bowel resection, through a small midline incision. The stapled anastomosis was noted to be bleeding and therefore delivered and oversewn. The procedure commenced about 24 hours after admission, and was completed at 21:00 hours.

The patient had a NSTEMI and was unstable post-operatively, going into AF. Ongoing problems continued over the nine days post-operatively, a decision was made to palliate. The patient died four days later.

Clinical Lessons

With both cases, it would seem delay to surgery was an issue. These patients were frail and elderly, and perhaps therefore they were not attended to earlier. The other issue may have been the Acute Surgical Unit setting with problems of handover.

Recommendation
Elderly frail patients with strangulated groin hernias should be operated on early, unless a decision to palliate is made on admission.

CASE EXAMPLE 6

Plastic & Otolaryngology Head and Neck Surgery

Case Summary

- *A 71-year-old patient was admitted for a wide local excision of the soft palate and lateral pharyngeal wall, selective neck dissection, mandibulectomy and left forearm free flap reconstruction for an oropharyngeal squamous cell carcinoma (SCC).*
- *History of pituitary microadenoma, and chemotherapy / radiotherapy for oropharyngeal SCC, eight months prior to admission.*
- *Co-morbidities listed as COPD and Smoker of 40 years.*
- *Total admission time was 72 days.*

Surgeon's description of course to death

Patient underwent resection, neck dissection and free flap reconstruction following Intensive Care Unit stay. Post-operative complications – bleed and flap failure - neck fistula and haematoma.

Post-op Day 25: Operation for large oro-cutaneous fistula using pectoralis major salvage flap. Urgent return to theatre for haematoma. Returned to the Intensive Care Unit.

Approximately 4 weeks later the patient suffered an unwitnessed fall with facial fractures, head injury and aspiration pneumonia.

Two weeks later the patient became febrile 37.9^{o}C. Suction stoma. Restart antibiotics. Required oxygen by mask.

Five days later the patient had decreased responsiveness, passing away on post-op day 72.

Peer Report

Addressing the first line assessor's question

Was the patient discussed at an MDT? Clinical course to death was limited - were there any areas of deficiencies of care?

A 71-year-old male admitted for salvage surgery with major Head & Neck persistence / recurrence in oropharyngeal cavity; having failed chemo-radiotherapy for same tumour seven months prior.

Ten days prior to surgery at the Head & Neck MDT pre-operative case discussion, the patient was overwhelmed, asking "will I make it?".

PAC Assessment - JMO admission done.

- Asthma, moderate - Seretide.
- COPD, 50 m maximum tolerance "now only few steps - deconditioned", SpO_2 97%.
- Preliminary discussion of peri-operative period and risks.
- Anaesthetic review - risks discussed. Approximate 8-10% weight loss pre-operatively.

Diagnosis at death: Aspiration pneumonia fractured maxilla, dysphagia, falls, hyponatraemia, SCC oral / oropharynx.
Death Certificate: Sepsis, aspiration pneumonia, SCC tonsil, tracheostomy, neck fistula.

Clinical course

Day of Admission to Post-op Day 24:

- Planned operation for recurrent / persistent squamous cell carcinoma (SCC).
- PEG - open gastrostomy with surgical tracheostomy.
- Right selective neck dissection ii-iv.
- Right wide local excision of oral / oropharyngeal SCC - soft palate, uvula, retromolar trigone, base of tongue / glossotonsillar sulcus / floor of mouth / submandibular gland (SMG), marginal mandibulaectomy. Left radical forearm free-flap (RFFF) reconstruction.
- Post-operative cephazolin / metronidazole.
- Histology results: 35 mm poorly differentiated SCC p16INK4A positive.
- Extensive perineural invasion (PNI); 5 margins very close (<2 mm). A-H frozen sections all negative.

Post-op Day 25 to Post-op Day 72:

- Operation for large oro-cutaneous fistula using pectoralis major salvage flap.
- Nursing concerns raised at 18:50. Reviewed and dismissed.
- 20:45 post-op Code Blue: dropping sats O_2 and blood pressure. Neck swelling.
- Urgent return to theatre for haematoma.
- Code Blue: hypovolaemic, hypotensive.
- Patient admitted to the Intensive Care Unit post-op. Hb 50 g/L; INR 1.8. Serratia septicaemia: ciprofloxacin started, Tazocin ceased. Aramine (metaraminol) commenced to support blood pressure.

Clinical Lessons

- Aggressive tumour pathology - resistant to Chemo / Radiation Therapy.
- Self-selected resistance due to aggressive tumour genetics.
- This affects the patient's recovery / survival, particularly tissue healing and resilience of patient.

In this case, the teams involved in the patient's care included: ENT Head & Neck, Plastics, Nursing, Speech Therapy, Dietitians, Endocrine, Infectious Diseases, Geriatrics. It is important that careful coordination is implemented when multiple teams are involved, particularly those ancillary services involved in day-to-day care and having the luxury of being able to observe more of the day hours and patient function.

Areas of Good Practice

- Good note documentation by all teams.
- Good coordination and liaison between medical teams.
- Appropriate and timely operative intervention.

Areas for Consideration

- Early signs of neck haematoma / hypovolaemia seem to have been missed suggestive of a complicated course.
- Prevention of falls is always a significant factor in long stay admissions with complicated, frail and confused patients.
- Ancillary care - It is important to take note of observations of those teams involved in the day-to-day care of the patient.

Tracheostomy – Post-op day 37:

- Decannulation proceeded despite failing capping with desaturations.
- Copious mentions of excessive tracheal stoma secretions; on occasions mucopurulent with difficulty clearing secretions to mouth.
- Reinsertion of tracheostomy tube - no consideration mentioned in the notes until the end stages of care.

Assessor's Opinion

Consideration of re-cannulation could have been considered as an adjunct to respiratory management (mainly toileting of airway, but also airway protection) given ongoing copious secretions from stoma, poor respiratory function, and ongoing evidence of aspiration / pneumonia.

CLINICAL MANAGEMENT FOR PROLONGED ADMISSIONS

CLINICAL REVIEW
BY DR SZE MING LOH,
GERIATRICIAN & CLINICAL LECTURER

- The patient had undergone four sessions of chemotherapy eight months prior for tonsillar squamous cell carcinoma and had lost weight during the preceding year.
- There had been a marked reduction in exercise tolerance in the lead-up to surgery and the patient reported to the Preadmission Clinic anaesthetist that he was mobilising only 3 to 4 steps at a time.
- The patient lived with his wife and son at home and had been independent prior to the diagnosis of cancer.
- Medical history beyond that was limited to chronic obstructive pulmonary disease, hypertension and hypercholesterolemia.
- Total admission time was 72 days.

Clinical Course

The patient was classed as ASA grade 2 by the anaesthetist and was consented for tracheostomy and percutaneous endoscopic gastrostomy.

The anaesthetist documented a preliminary discussion regarding the peri-operative period and risks, and the patient was booked for an Intensive Care bed post-operatively.

Upon arrival to Intensive Care Unit, the patient was hypotensive with a systolic BP of 55 mmHg and required 2-units of packed cells and metaraminol boluses. He was commenced on gastrostomy feeds and his flap was assessed to be perfusing well. The patient was discharged to the ward on day 4 of his admission.

On the fifth day of admission, the patient was diagnosed with atelectasis.

Four days later the patient was commenced on intravenous piperacillin-tazobactam for suspected pneumonia. Chest physiotherapy was initiated by the surgical team, but mobility training was limited by his non-weight bearing status in his left upper limb.

However, by the end of the second week, the patient was mobilising 80 metres.

On day 17, the patient developed diarrhoea and was hypothermic. He had gained 1.4 kg since the commencement of gastrostomy feeds, but albumin remained sub-optimal at 23 g/L.

On day 23, the tracheostomy was capped, and the patient was subsequently decannulated. However, the following day the treating team reported two non-healing wounds in the right neck and suspected the possibility of fistulas.

The patient is advised of these findings and undergoes debridement of the right neck fistula and a pectoralis major muscle flap. The pharyngeal fistula is closed and a pedicled pectoralis major muscle flap harvested and inserted over the fistula and neck. The skin flaps are closed partially.

Upon returning to the ward from theatre the patient's blood pressure is 70/58 mmHg with a pulse of 112 bpm. The patient was hypoglycaemic with a blood glucose level of 1.7 mmol/L. 50% glucose and hydrocortisone is administered alongside fluid resuscitation by the medical registrar, but staff struggle to achieve a systolic blood pressure above 90 mmHg and a "code blue" is activated two hours later at 21:00.

The right chest donor site wound is discovered to be actively haemorrhaging by the surgical registrar and the patient is promptly taken back to theatre. Initial haemoglobin in theatre is 50 g/L and INR is 1.8. The patient received 4-units packed red blood cells and 1-unit of fresh frozen plasma. A pulsatile arterial bleeder at the lateral border of pectoralis minor is ligated and haemostasis achieved.

The patient required metaraminol infusion for three days post-operatively. *Serratia marsescens* is found in the blood cultures and the piperacillin-tazobactam, which had been ongoing since the initial diagnosis of pneumonia is continued, eventually transitioning to ciprofloxicin. The tracheostomy was re-inserted, and a chest binder applied.

The patient is discharged from Intensive Care Unit after a 5-day admission and 29 days into his hospital admission. The tracheostomy remained stable for the following week and the patient was decannulated.

The following day a PACE call was initiated for increased respiratory rate and difficulty breathing. Hyponatremia was diagnosed with sodium eventually reaching a nadir of 121 mg/L. Urine sodium was raised, and urine osmolality was normal. A provisional diagnosis of SIADH was made and the case was discussed with the medical registrar on call who recommended fluid restriction.

It is within the context of hyponatremia on day 53 of admission that the patient suffers an unwitnessed fall with head strike, and is found by nursing staff on the bathroom floor. No seizure activity was witnessed, and a CT head confirmed several comminuted facial and paranasal fractures, a sphenoid sinus haematoma and a left frontal subdural hygroma. A chest x-ray revealed left lower lobe collapse and effusion. CRP was raised at 165 mg/L.

Neurology are consulted and the patient commenced on intravenous Keppra. No epileptiform activity is found on EEG. A Geriatrician review concludes that delirium is attributable to the fall, hyponatremia, subdural hygroma and pneumonia. An Opthalmology review found no evidence of entrapment subsequent to the fall and facial injuries.

The Geriatrician requests consideration for continuous feeding over bolus feeding through the PEG tube out of concern for aspiration. The patient is able to mobilise 100 metres but copious secretions persist, both upon coughing as well as from the stoma.

On day 66, the patient is found to be tachypneic, tachycardic and short of breath. He starts to desaturate. Right basal crepitations are found on auscultation and the patient becomes febrile in the afternoon. Antibiotics and chest physio are commenced.

Intensive Care was consulted, and they advised in the context of the patient's cachexia, weak cough and swallow that prognosis looks poor. A discussion is held with the family who agree that the patient's comfort should be the focus of management from that point.

Over the following four days chest physiotherapy is continued, more with a view to assist with patient comfort. The patient becomes drowsy and febrile. Intravenous fluids and antibiotics are ceased. The patient passed away on Day 72.

Clinical Lessons

- This patient was likely frail despite being relatively young and having limited co-morbidities. The decline in mobility and weight loss are telling in hindsight. Frailty is being increasingly recognised as an integral part of pre-operative assessment and there are several frailty indices which might have delineated the patient's risk of post-operative complications. Given the patient's poor outcome, the process of risk assessment or the documentation of this process could have been stronger in hindsight, particularly in the context of aggressive malignancy. Surgical risk calculators are now validated and may have had relevance in this case, not least of which as an adjunct to advising the patient on the post-operative risks and possible outcomes of complex surgery.

- The patient, upon return to the ward post-operatively, was hypotensive and it is not clear if the neck haematoma was overlooked by the medical registrar. It would be worthwhile for Surgical teams to evaluate if the medical and nursing staff who will likely review patients in a post-operative setting have had training in surgical complications or if they have ready access to the Surgical teams to escalate concerns. Peri-operative care requires coordination and training across disciplines.

- Medical record keeping was consistent and diligent. It is worth noting that, by the time of death, eleven medical teams had been involved in the patient's care. Communication between teams seems to have been largely through the correspondence of the notes. By way of example, there is no direct conversation documented between the Neurology and Geriatric teams to negotiate the Keppra dose, which had justification for both continuation and discontinuation. This is a common problem in post-operative care, and one wonders if this compromises some of the decisions made. Similarly, the delay in commencement in in-reach rehabilitation onto the surgical ward may have been borne out of confusion in referral pathways, and more direct communication between teams may have been useful. Similarly, the emergent signs of delirium are more apparent on perusal of the nursing and allied health staff notes and it is likely that the delirium would have been declared earlier if these observations had been given greater weight.

- There were early signs that this patient would have a complicated course. It is worth noting that we could not find documentation of the treating ENT consultant reviewing the patient or setting an agenda throughout the first month of the admission, even in the context the team was led by the senior ENT registrar. The significant discussions between medical staff and family at points of crisis appear to have been ably led by the senior registrar. It is entirely possible that discussions around the patient's deterioration were comprehensive, but it is not explicitly documented what likelihoods were presented to the family, particularly after the initial unplanned return to surgery.

Conclusion

It is commendable that the Surgical teams co-ordinated a family conference subsequent to the second episode of pneumonia, but it is unclear if the potential challenges in discharge planning as outlined by the geriatrician were addressed directly in the conference.

There is no doubt that an assessment of the patient's Advanced Care Directives with the family would have been challenging, but the family distress upon reviewing of the patient's resuscitation status at the point of crisis could have been lessened had there been timely comprehensive discussion beforehand.

Pneumonia is an increasingly recognised complication of older post-operative patients with significant implications for post-operative mortality and should be looked for in the context of unexplained hyponatremia. The risk here was clearly high in the context of the discovered fistulas and the patient's frailty.

It is likely that the patient was delirious at the time of the fall, given nursing staff consistently documented confusion for the two days leading up to the head-strike. Given the lack of other pathology on CT and the prolonged prodrome of hyponatremia, it also likely the delirium was precipitated by the hyponatremia and pneumonia in combination, though what solitary contribution the patient's physical frailty at this late stage of admission had is up to conjecture.

The recognition of delirium in its early stages is crucial to initiate ward falls prevention strategies given the devastating sequalae for frail post-operative patients. The fall in this case prefaces the eventual deterioration and expiration of the patient. Post-operative delirium rates can be as high as 40% in high-risk surgical settings, and the re-operation significantly escalates this risk. Delirium increases post-operative complication rates and post-operative mortality, can double length of stay and double the risk of nursing home placement. It should be a complication seen as part of a surgical team's skillset and the outsourcing of delirium identification and management can lead to significant delays and failures in patient management.

This patient suffered multiple post-operative complications including a flap fistula, recurrent aspiration pneumonia, hyponatremia, delirium and falls during a prolonged admission over 72 days. He ultimately expired despite being assessed as ASA 2 (*Appendix 3*) with limited co-morbidities.

Recommendation

This case highlights the challenges for surgical teams managing sequential post-operative complications, and the need for close multi-team coordination.

There is an acute necessity to reassess the patient's trajectory and goals of care at each point of crisis as the patient's prognosis may likely deteriorate over the course of a prolonged admission.

PROGRAM DATA

CHASM SNAPSHOT

88%

The percentage of surgical case forms submitted by surgeons for deaths occurring in the 2018 calendar year.

19.5%

The percentage of forms (n=331) submitted by surgeons and assessed as Terminal Care deaths occurring in 2018.

2,091

The number of request forms created from the deaths notified to CHASM by hospitals and practitioners during the 2018 calendar year.

1,071

The number of forms assessed for deaths occurring in 2018 and identified as having: ***no area of consideration or area of concern.***

NOTIFICATIONS FOR 2018 SURGICAL DEATHS

The structure and nature of the CHASM Program allows for a process of continuous improvement to occur with the death screening completed as part of hospital clinical governance systems. This means that there can be a wide variance in the timing of when a surgical death occurs, when it gets notified to CHASM, and when the surgeon submits their response.

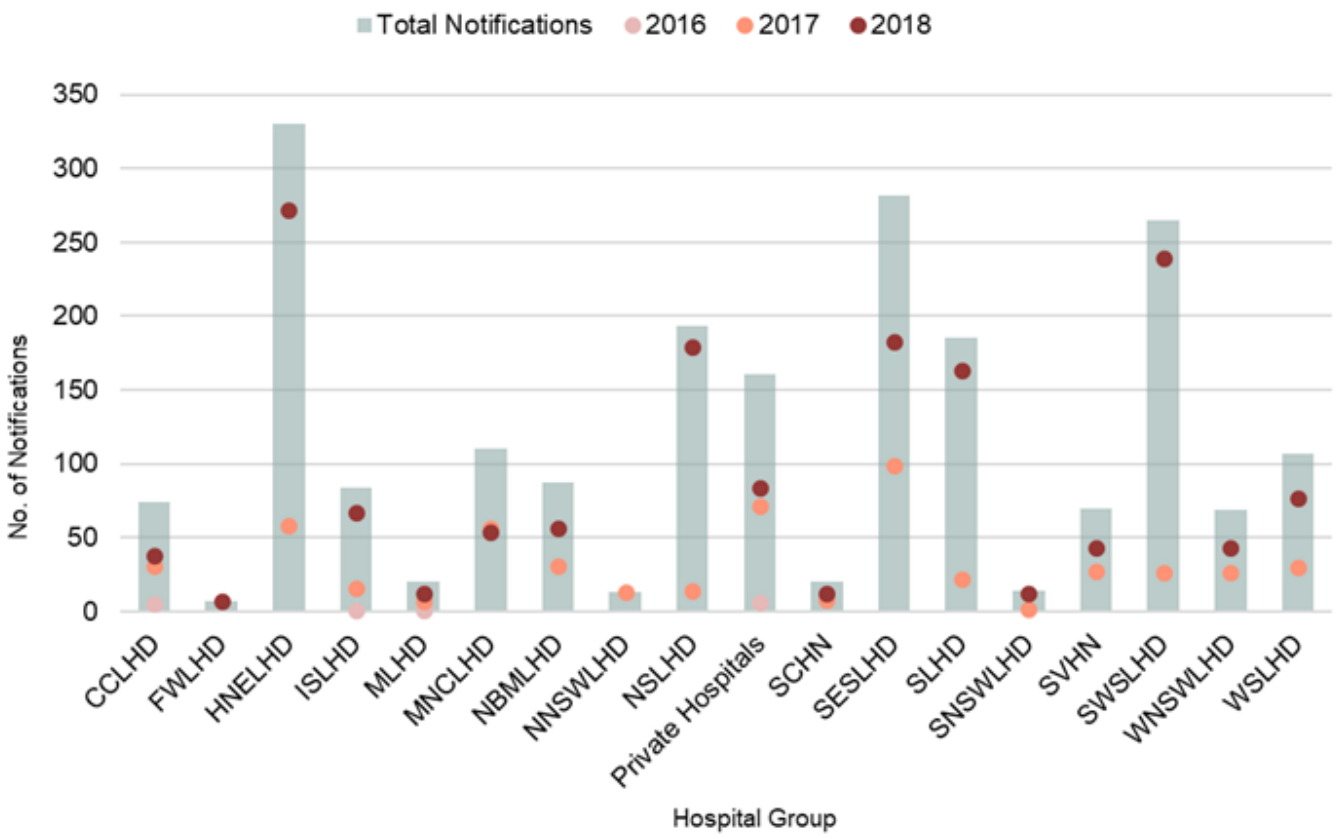
The most obvious variation is for deaths that occur towards the end of the calendar year, as they may not be notified until the following year, usually due to skeleton staffing arrangements. The timing of notifications and responses can also be affected by Root Cause Analysis (RCA) investigations and whether any Coronial matters are outstanding. Sometimes it is preferable to wait for these investigations to be concluded, rather than run parallel reviews. Delays can also be attributable to resourcing and other clinical issues which may impact the public health system.

The column chart on the next page (Figure 4) demonstrates these variances by identifying the year in which the death occurred for all notifications of surgical deaths submitted to CHASM in the 2018 calendar year. Although the figure for private hospitals is slightly under 8% of the total number of notifications, participation has increased over the following 18 months with the assistance of new technology. Additionally, only 13 deaths occurring in 2016 were notified to CHASM in 2018, with 74% of notifications being for deaths occurring in 2018.

It is important to note that these figures are not an indication of poor performance. Variances in surgical activity can occur in hospitals with trauma centres, specialised surgical fields and higher community populations. The key message here is for hospitals and surgeons to notify CHASM as soon as possible after a death occurs. This creates opportunities to share valuable clinical lessons about recent cases.

NOTIFICATIONS FOR 2018 SURGICAL DEATHS

Figure 4: The number of surgical deaths notified to CHASM (n=2,091) in the 2018 calendar year.
(Note: This includes deaths occurring 2016, 2017 and 2018)
*Data extracted on 3 November 2020



TOP 6 CATEGORIES OF DEFICIENCY OF CARE

Analysis on the coding for the 'Areas of Consideration', 'Areas of Concern' (ACONs) and Adverse Events, identified by assessors on closed cases for deaths occurring during the 2018 calendar year. It is important to note that a case can have multiple ACONs and these may not be related to the surgical management of the patient. For example; *Communication Failures*, can be related to poor or missing documentation and miscommunication, or poor communication between teams, which may occur more frequently during after-hours or on weekends.

These areas of clinical management have many contributors over the course of a patient's stay in hospital. It should be recognised that there may be a flow-effect for the patient when communication failures occur in a clinical setting. Although not all communication failures result in death, they may contribute to poor patient outcomes.

Assessment Problems are regularly discussed at CHASM Committee meetings. Concerns vary and may include such issues as the time the pre-admission assessment is conducted in contrast with the time of admission for surgery. Some patients have extended waiting list times and over the duration prior to admission they may acquire an additional medical illness or disease which may go undiagnosed before admission. Any new changes in the health or medical condition of a patient may impact their recovery time or affect the clinical decision making associated with their admission and subsequent surgery.

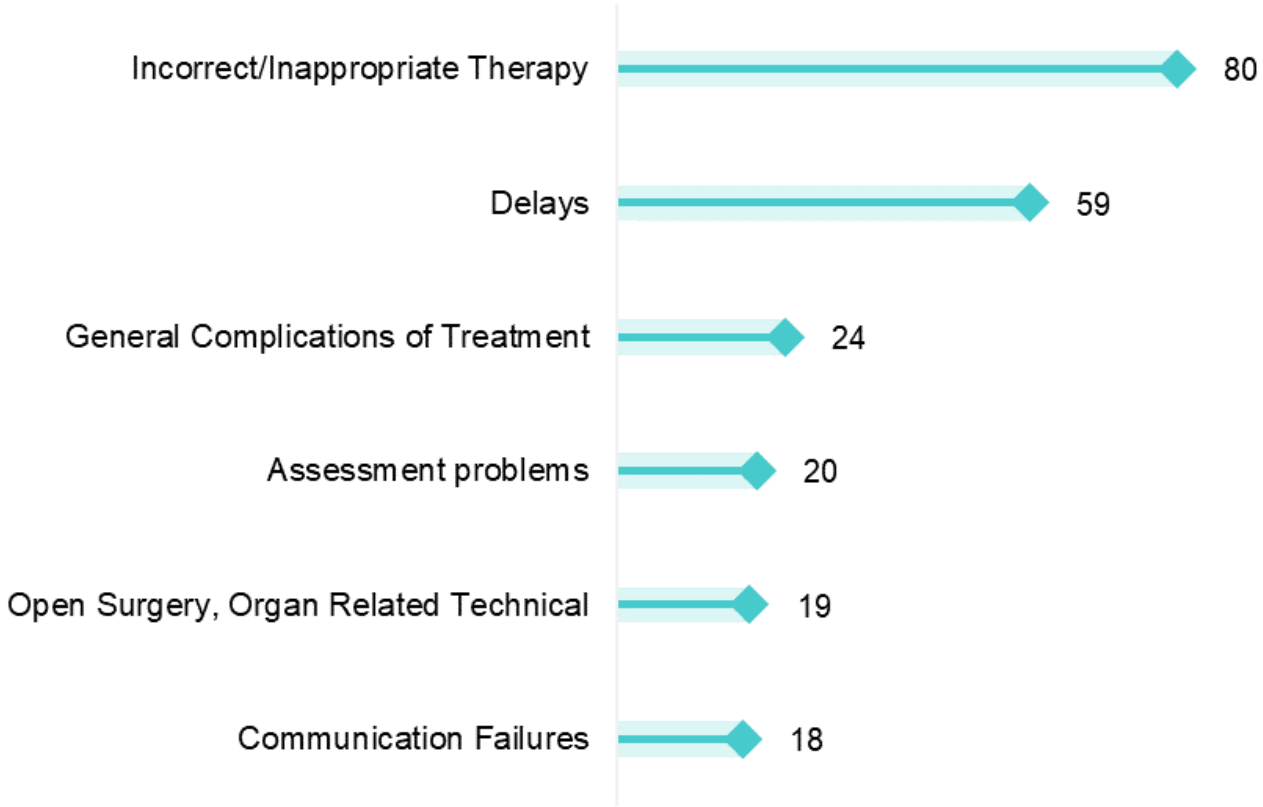
Assessment Problems may also occur when a patient is transferred from one hospital to another during an emergency or weekend admission, or may be associated with on-call rostering, or access to appropriate clinical resources. These emergency admissions and surgeries can place additional pressure on the people and systems involved.

Analysis of the ACON data showed that of the 1,322 closed cases assessed by surgeons, only 19% (n=251) of cases had an area of consideration, concern or an adverse event identified. From this, 32% of cases were assessed with issues under the category of *Incorrect/Inappropriate Therapy* and 23.5% under the category of *Delays*. These outcomes suggest that despite the majority of CHASM cases being emergency admissions or patients requiring emergency surgery, most of the poor patient outcomes are not due to deficiencies in surgical care.

The bar chart on the next page (Figure 5) breaks down the six highest frequency counts of ACONs for 2018 deaths.

TOP 6 CATEGORIES OF DEFICIENCY OF CARE

Figure 5: Top 6 identified areas of consideration or concern, and adverse events, for surgical deaths occurring in the 2018 calendar year.
(Note: This is a frequency count as a case may have more than one ACON)
**Data extracted on 3 November 2020 for assessments completed up to 16 October 2020.*



CODING SYSTEM: READ CODES

Nationally, the Audits of Surgical Mortality have adopted the same coding system to classify diagnosis and operative procedures. However, there are slight variations and additions in some states and territories that have been adopted over the course of the program. These codes were developed by Dr James Read, first released in 1986, and comprised of a four character code structure [7].

When cases are reviewed, events or factors that are thought to be sub-optimal and may be improved upon are recorded as 'Areas of Concern' or 'Areas for Consideration' (ACONs) by the assessor. The ACON codes were devised by the Scottish Audit of Surgical Mortality (SASM) and structured similarly to Read codes [8]. This coding system has remained constant throughout the CHASM Program.

Sub-classifications of the 'Top 6' ACONs identified for 2018 include, but are not limited to:

INCORRECT / INAPPROPRIATE THERAPY INCLUDES:

- Decision to operate
- Better to have done different operation or procedure, or performed more limited surgery
- Unsatisfactory medical management; or care provided

DELAYS INCLUDES:

- Delay to surgery or re-operation; or earlier operation desirable
- Delay in diagnosis
- Delay in transfer to surgical unit, ICU, or tertiary hospital

GENERAL COMPLICATIONS OF TREATMENT INCLUDES:

- Aspiration pneumonia
- Septicaemia; or graft infection
- Renal Failure

OPEN SURGERY, ORGAN-RELATED TECHNICAL INCLUDES:

- Vascular complication of open surgery
- Intra-operative bleeding during, or post-operative bleeding after, surgery
- Anastomotic leak following surgery

COMMUNICATION FAILURES INCLUDES:

- Poor communication (unspecified)
- Poor communication between physician and surgeon
- Poor documentation

ASSESSMENT PROBLEMS INCLUDES:

- Pre-operative, or post-operative, assessment inadequate
- Failure to recognise severity of illness
- Failure to investigate, or assess, patient fully

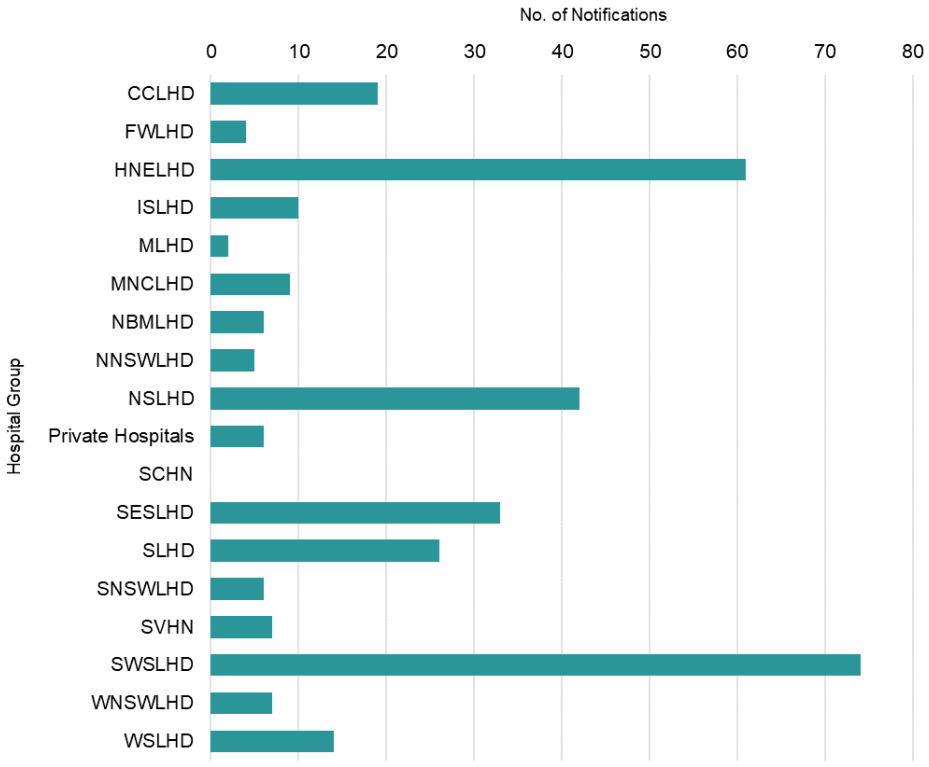
TERMINAL CARE BY ADMITTING SPECIALTY

The CHASM Committee appreciates that the structure of the Surgical Case Form is not appropriate for cases where terminal care was planned for a patient either prior to, or on, admission. In these instances, surgeons are requested to describe the terminal condition of the patient and confirm whether an operation was performed on the patient.

In general, patients that are considered as terminal care will have advanced malignancy, be involved in a major trauma situation, or are considered irretrievable due to injuries, illness, or events, such as massive haemorrhage. The bar chart below (Figure 6) shows that a higher number of terminal care cases are reported in Local Health Districts and Specialty Health Networks with Major Trauma Centres and Regional Trauma Centres [9].

- In NSW Health, the seven Adult Major Trauma Centres are located at: John Hunter Hospital, Liverpool Hospital, Royal North Shore Hospital, Royal Prince Alfred Hospital, St George Hospital, St Vincent's Hospital and Westmead Hospital.
- Paediatric Major Trauma Centres are located at: John Hunter Children's Hospital, Sydney Children's Hospital and The Children's Hospital at Westmead.
- There are also 10 designated Regional Trauma Centres in NSW located at: Coffs Harbour Base Hospital, Gosford Hospital, Lismore Base Hospital, Nepean Hospital, Orange Health Service, Port Macquarie Base Hospital, Tamworth Rural Referral Hospital, The Tweed Hospital, Wagga Wagga Base Hospital and The Wollongong Hospital.

Figure 6: Deaths by Hospital Group occurring in 2018 (n=331) assessed as Terminal Care

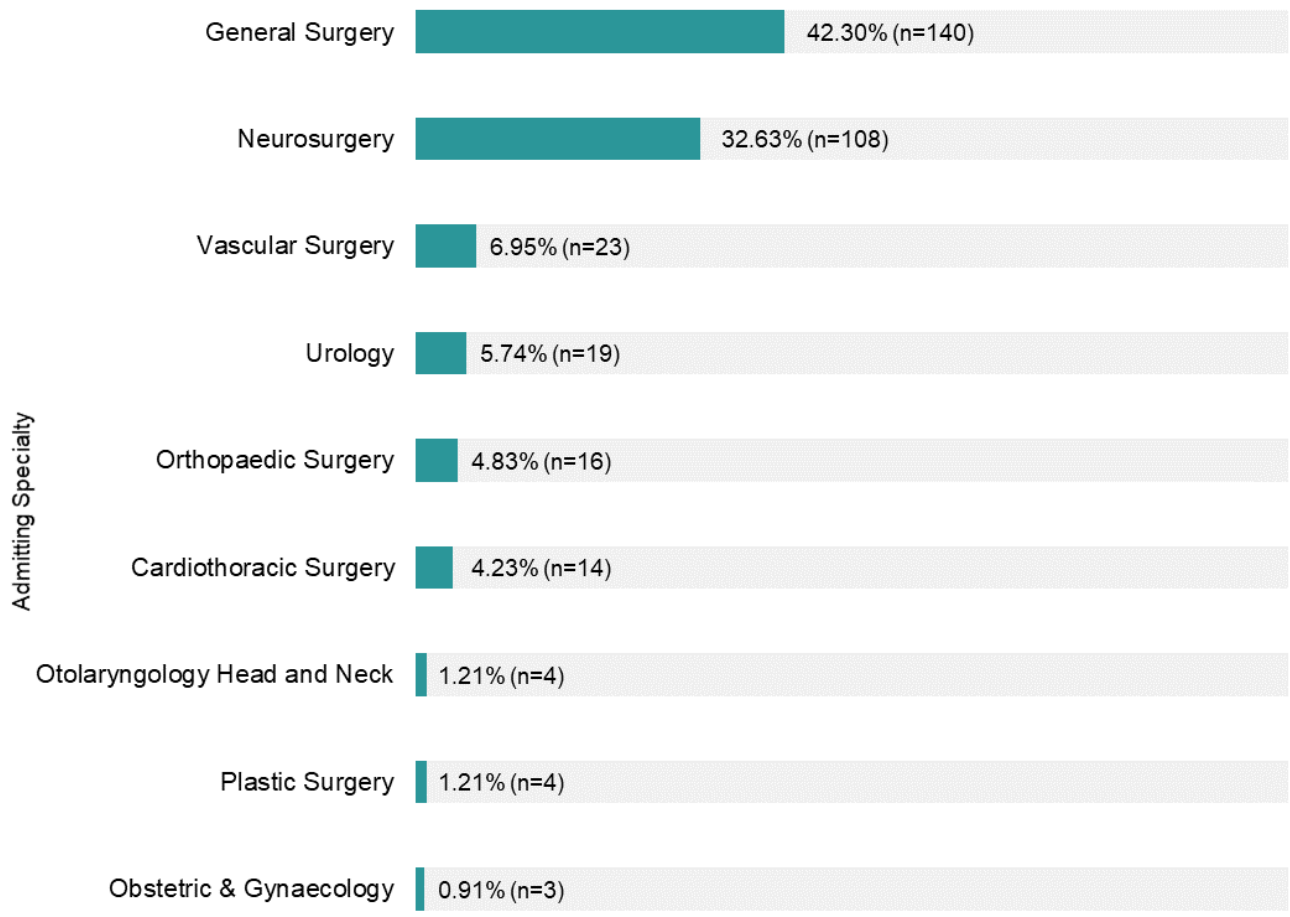


TERMINAL CARE BY ADMITTING SPECIALTY

Some surgical specialties are considered high risk, or may have a patient cohort that are older, or more complex. The data analysis for Figure 7, below, indicates a higher number of terminal care cases for neurosurgery and general surgery. When this data is interrogated further, it shows that of the neurosurgical case forms submitted (n=327) to CHASM, 33% are patients considered to be terminal upon admission. Whereas, general surgery case forms (n=683) indicate 20.5% are patients considered to be terminal upon admission.

When we consider the reasons associated with these outcomes the surgical activity and the complexity of the presenting patient need to be understood. Neurosurgical case forms only make up 19% of the total submissions to CHASM, however, General Surgery is 40%. While the volume of neurosurgical cases is less than general surgery, the ratio of patients assessed as terminal care is higher, suggesting a higher risk or complexity in this specialty.

Figure 7: Cases Notified in 2018 assessed as Terminal Care by Admitting Specialty



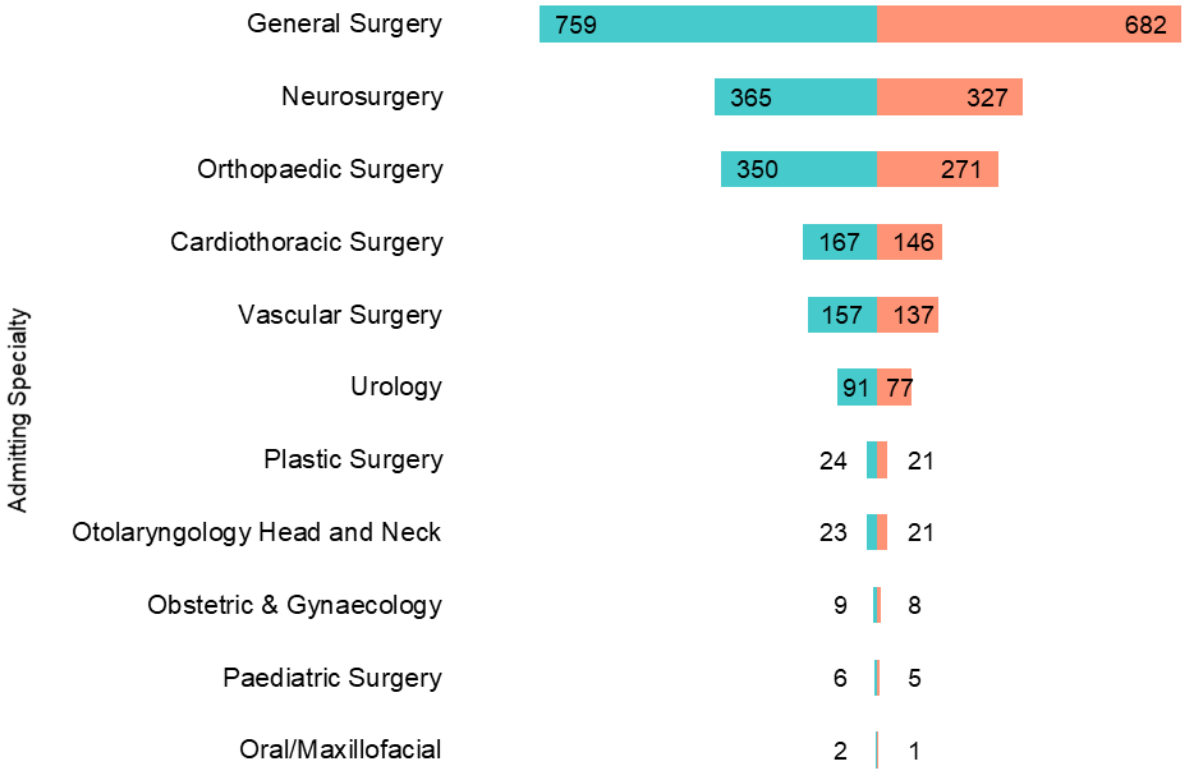
RESPONSE RATE BY SURGICAL SPECIALTY

As mentioned, there are a variety of factors that contribute to the responsiveness of surgeons participating in the CHASM Program. Now that the program has transitioned to an electronic platform, it is important that surgeons ensure the CHASM Office knows their current contact details, including a preferred email address. This enables fast and effective communication and the transfer of forms and case notes for completion and assessment.

The data displayed by surgical specialty in the diverging bar graph below (Figure 8) is for deaths occurring in the 2018 calendar year, and includes surgical case forms submitted up to and including 16 October 2020. Data analysis shows the average overall response rate of surgeons is 87%, with the majority of hospital groups registering above 84%.

This is an excellent result, particularly as it was a year of transition from paper to electronic processes with a steep learning curve for all involved. The willingness of surgeons to participate in user testing with the CHASM Office also helped to improve the functionality of the system and was a testament to the collaborative spirit of the Program.

Figure 8: Response Rates by Specialty for Deaths Occurring in 2018 (n=1,696)



RESPONSE RATE BY HOSPITAL GROUP

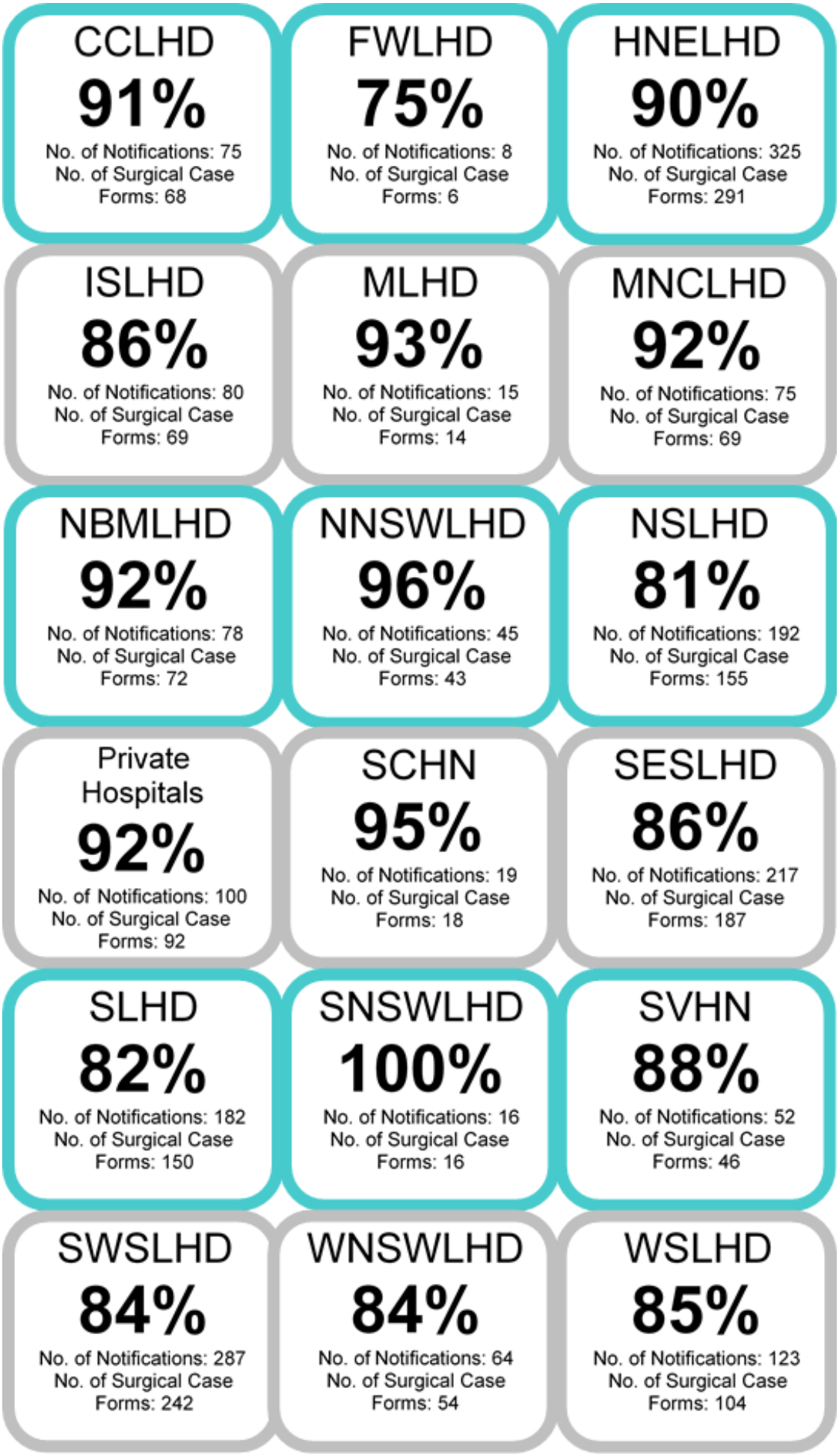
Public and private hospitals throughout New South Wales notify CHASM of surgical deaths that meet the criteria stated in the Committee's Terms of Reference. Notifications of death are usually reported on the third week of every month following a rigorous screening process conducted by Clinical Governance and/or Patient Safety teams. Submission is made via email with a password protected spreadsheet enclosed. The CHASM Office then completes the data entry into the BAS system and generates a request to the surgeon by email.

Figure 9, on the following page, groups deaths occurring in the 2018 calendar year by hospital group, and includes responses up to and including 16 October 2020. Data analysis shows the range of response rates is between 75% and 100%. These results demonstrate the strong reporting culture that is present across the state and the commitment that hospitals and surgeons have to the CHASM Program.

The 2018 data for CHASM is a reflection of notifications received from 15 Local Health Districts, 2 Specialty Health Networks, and 12 Private Hospitals. Response rates have not been calculated for performance management purposes. They are merely an indication of where improved communications may be required to achieve a proactive reporting culture for notifying surgical deaths to CHASM.

The CHASM Office is available to assist with reporting requirements for notifications and also to assist in the set-up and navigation of the Fellows' Interface for surgeons.

Figure 9: Response Rates by Hospital Group for Deaths Occurring in 2018 (n=1,696)



ADMISSION TYPE BY SURGICAL SPECIALTY

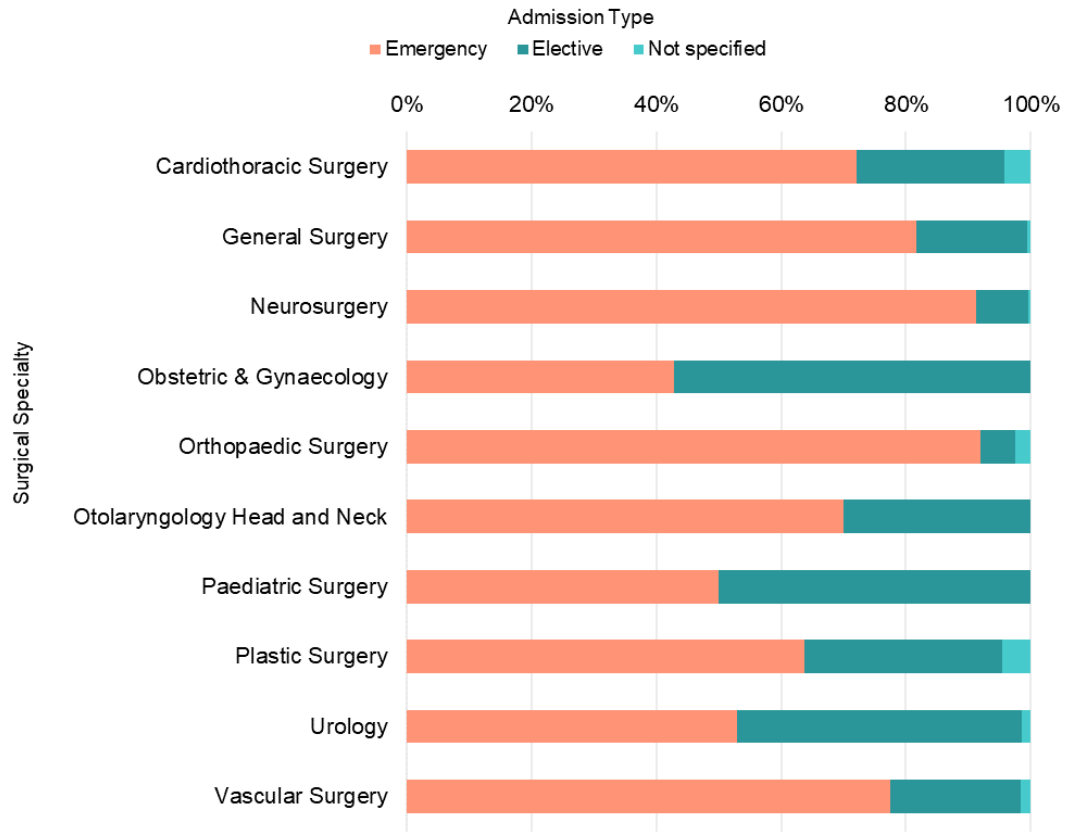
Surgical case forms submitted by surgeons (up to and including 3 November 2020) for deaths occurring in the 2018 calendar year indicates that approximately 82% of responses (n=1,515) were for patients requiring emergency admission or re-admission. In comparison, a review of the ASA physical status classification scores [Appendix 3], shows that patients assessed as ASA 'Emergency' classification account for approximately 27% of responses.

Note: *An ASA emergency classification is defined as existing when delay in treatment of the patient would lead to a significant increase in the threat to life or body part.*

These results may suggest that emergency admissions for surgical patients require a more in-depth assessment of the complexities associated with the patient's admission, rather than the need for urgent surgery. Further review of the ACON classification data for *Incorrect/Inappropriate Therapy*, may indicate the complexity associated with emergency admissions as the *Decision to Operate* sub-category has the highest representation (34%).

The stacked bar graph (Figure 10) below represents the admission type of the patient for each surgical specialty, for deaths occurring in 2018.

Figure 10: Admission Type by Specialty according to the Surgeon's response



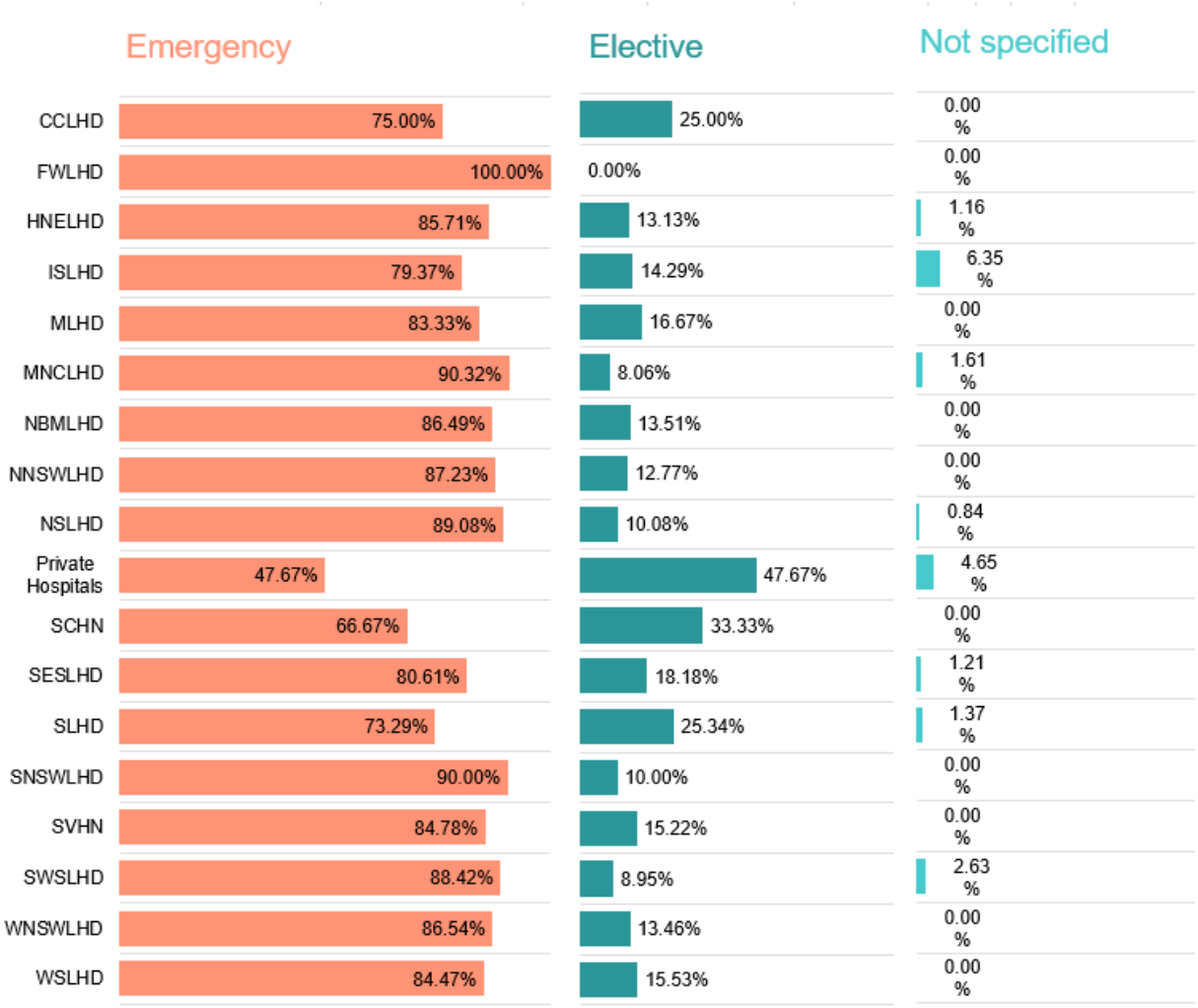
ADMISSION TYPE BY HOSPITAL GROUP

Further analysis on this data set identifies that elective surgery deaths (within 30 days of surgery) occurring in 2018 is only 17% of total responses (n=1,515).

The stacked bar graph (Figure 11) below indicates the ratio of responses for admission type, including 1.55% of non-specified responses. As expected, these outcomes indicate a higher level of emergency admissions for hospitals with Major Trauma Centres (MTCs) and Emergency Departments (EDs).

A review of the ACON data for the categories of *General Complications of Treatment* and *Assessment Problems* shows that aspiration pneumonia (35%) is the most common complication, and inadequate pre-operative assessment (41%) the most common assessment problem identified by assessors.

Figure 11: Admission Type by Hospital Group according to the Surgeon's response



ASA GRADE BY SURGICAL SPECIALTY

The purpose of the ASA Physical Status classification system is to assess and communicate a patient's pre-anesthesia medical co-morbidities. The classification system alone does not predict peri-operative risks, but when used with other factors, for example, type of surgery and frailty scale, studies have shown it to be a reliable independent predictor of medical complications and mortality post-operatively [10].

Data analysis on the information contained in surgical case forms submitted by surgeons for deaths occurring in the 2018 calendar year, identified 4 episodes of elective surgery deaths where the patient was classified with an ASA 1 score.

Further investigation of these cases reveals the following information:

- All deaths occurred in different tertiary hospitals
- All forms were completed by Consultant Surgeons
- Two patients were aged in their 80s
- Two patients had known diagnoses of cancer
- Two patients suffered post-operative injuries unrelated to their surgery
- Two patients had an unexpected return to theatre
- One patient had no known co-morbidities listed

Although the ASA Classification is a relatively simple assessment tool, it does rely on the experience of the medical practitioner to make the classification based on the patient information available at the time. The CHASM Committee considers that the two patients with cancer should be an ASA 2 or ASA 3 depending on the advancement of the disease. Further, most elderly patients would not be considered as an ASA 1 due to their age making them more susceptible to diseases like hypertension or osteoporosis.

The charts on the next page (Figure 12) indicate the ASA grade for each specialty and identify the 'Top 5' specialties by volume as: General Surgery; Orthopaedic Surgery; Neurosurgery; Cardiothoracic Surgery, and; Vascular Surgery.

ASA GRADE BY SURGICAL SPECIALTY

Figure 12: ASA Type by Surgical Specialty according to the Surgeon's response

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APPENDICES

APPENDIX 1: FIRST LINE ASSESSOR QUESTIONS

First-line Assessment Form

Study Number

1 **Was there enough information to come to a conclusion?** Yes ☐ No ☐

If NO, what information was lacking? .....

.....

.....

2 **Should this case progress to second-line assessment** (that is *case note review*)**?** Yes ☐ No ☐

If YES, which aspects of the case should be looked at in more detail? .....

.....

.....

3 **If no operation was performed:**

Should an operation have been performed? Yes ☐ No ☐ N/A ☐

If YES, what operation and why? .....

.....

.....

4 **Assessor's view (before any surgery) of overall risk of death**

Minimal ☐ Small ☐ Moderate ☐ Considerable ☐ Expected ☐

5 **Was this patient treated in a critical care unit during this admission?**

Yes ☐ (go to Q6) No ☐ continue

Should this patient have been provided critical care in:

Intensive Care Unit (ICU)? Yes ☐ No ☐ High Dependency Unit (HDU)? Yes ☐ No ☐

6 **Was the decision on the use of DVT prophylaxis appropriate?** Yes ☐ No ☐ don't know ☐

7 **Was fluid balance an issue in this case?** Yes ☐ No ☐ don't know ☐

8 **Do you consider management could have been improved in the following areas?**

Pre-operative management/ preparation	Yes ☐	No ☐	N/A ☐	Intra-operative/technical management of surgery	Yes ☐ No ☐ N/A ☐
Decision to operate at all	Yes ☐	No ☐	N/A ☐	Grade/experience of surgeon deciding	Yes ☐ No ☐ N/A ☐
Choice of operation	Yes ☐	No ☐	N/A ☐	Grade/experience of surgeon operating	Yes ☐ No ☐ N/A ☐
Timing of operation *(too late, too soon, wrong time of day)*	Yes ☐	No ☐	N/A ☐	Post operative care	Yes ☐ No ☐ N/A ☐

Note: *If areas for consideration, areas of concern, or adverse events have been identified, please list below in order of significance.*

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2.

FIRST LINE ASSESSOR QUESTIONS

First-line Assessment Form

Definitions: An *area for consideration* is where the clinician believes areas of care COULD have been IMPROVED or DIFFERENT, but recognises that it may be an area of debate.

An *area of concern* is where the clinician believes that areas of care SHOULD have been better.

An *adverse event* is an unintended injury caused by medical management rather than by disease process, which is sufficiently serious to lead to prolonged hospitalisation or to temporary or permanent impairment or disability of the patient at the time of discharge, or which contributes to or causes death.

9a Were there any *Areas for Consideration*, *Areas of Concern* or *Adverse Events* in the management of this patient? Yes ☐ No ☐

9b (please describe the most significant event) .....

.....

.....

.....

Area of:		Which:		Was the event preventable?		Associated with?	
Consideration	☐	Made no difference to outcome	☐	Definitely	☐	Audited Surgical team	☐
Concern	☐	May have contributed to death	☐	Probably	☐	Another Clinical team	☐
Adverse event	☐	Caused death of patient who would otherwise be expected to survive	☐	Probably not	☐	Hospital	☐
				Definitely not	☐	Other (please specify)	☐

.....

9c (please describe the second most significant event) .....

.....

.....

.....

Area of:		Which:		Was the event preventable?		Associated with?	
Consideration	☐	Made no difference to outcome	☐	Definitely	☐	Audited Surgical team	☐
Concern	☐	May have contributed to death	☐	Probably	☐	Another Clinical team	☐
Adverse event	☐	Caused death of patient who would otherwise be expected to survive	☐	Probably not	☐	Hospital	☐
				Definitely not	☐	Other (please specify)	☐

.....

9d (please describe the third most significant event) .....

.....

.....

.....

Area of:		Which:		Was the event preventable?		Associated with?	
Consideration	☐	Made no difference to outcome	☐	Definitely	☐	Audited Surgical team	☐
Concern	☐	May have contributed to death	☐	Probably	☐	Another Clinical team	☐
Adverse event	☐	Caused death of patient who would otherwise be expected to survive	☐	Probably not	☐	Hospital	☐
				Definitely not	☐	Other (please specify)	☐

.....

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3.

APPENDIX 2: SECOND LINE ASSESSOR GUIDELINES

SECOND LINE ASSESSMENT

CHASM
Collaborating Hospitals Audit of Surgical Mortality

Guidelines for Second Line Assessors

Following the outcomes of this research, Second Line Assessors should endeavour to review these key areas in their independent case note assessment:

- Appropriate and timely diagnostic and therapeutic measures
- Correct indication and timing of
  - Operations
  - Interventions
  - Intensive care
  - Resuscitation orders
  - Palliative care treatment orders
- Consideration and adherence to guidelines
- Monitoring of the treatment process
- Effective interdisciplinary co-operation
- Accurate documentation of patient management and patient records
- Correct assessment of working diagnosis and treatment effects

Research Outcomes: Peer Review

The goal of peer review is to add to your learning. It aims to identify challenges in clinical management so as to improve future treatments.[1,3]

Some of the challenges which may improvement treatment quality include:[2]

- Inadequate interdisciplinary co-operation
- Delayed transfer from ward to the intensive care unit
- Misdiagnosis of complications

Other areas of consideration for peer review, such as organisational shortcomings which affect surgical outcomes, may include:[1]

- Unclear responsibilities in emergency cases
- Structural / Infrastructure issues that impede access, transfers and diagnostics, which may lead to delays in treatment / care

The results of three studies conducted on peer review on the effect of hospital mortality rates suggest that:[1][2][3]
The combination of outcome measures with peer review can identify treatment processes that are deficient, and; implementing improvement protocols can help to lower mortality rates.

Further, detecting adverse events through retrospective patient record reviews is more effective than voluntary reporting systems.[1]

1. U. Nimptsch, T. Mansky, Quality Measurement combined with Peer Review improved German in-hospital mortality rates for four diseases; Health Affairs 32, No. 9 (2013): 1616-1623. DOI:10.1377/hithaff.2012.0925 September 2013 32:9 https://www.healthaffairs.org/doi/full/10.1377/hlthaff.2012.0925 Accessed 17 April 2019
2. W. Krahwinkel, E. Schuler, M. Liebetrau, A. Meier-Hellmann, J. Zacher, R. Kuhlen, For the HELIOS Medical Board and HELIOS Working Group on Peer Reviewing, The effect of peer review on mortality rates, International Journal for Quality in Health Care, Volume 28, Issue 5, 10 October 2016, Pages 594–600. DOI: 10.1093/intqhc/mzw072 https://academic.oup.com/intqhc/article/28/5/594/2499471 Accessed 17 April 2019
3. Chi-Wai Lui, Frances M. Boyle, Arkadiusz Peter Wysocki, Peter Baker, Alisha D'Souza, Sonya Faint, Therese Rey-Conde, John B. North. How participation in surgical mortality audit impacts surgical practice. BMC Surgery. 2017;17:42 DOI:10.1186/s12893-017-0240z: https://bmcsurg.biomedcentral.com/articles/10.1186/s12893-017-0240-z

SECOND LINE ASSESSOR GUIDELINES

Example report - Renal insufficiency in a patient with a severely ischaemic right foot

Background

This 83 year old man was admitted to hospital for further treatment of a severely ischaemic right foot. He had a nine month history of rest pain in the foot and had also developed septic arthritis in the right fourth toe some time before admission. He was an overweight man with a past history of diabetes and polymyalgia for which he was on steroids.

Sequence of Events

His admission blood sugars were of the order of 15.0 mmol/L and there was mild renal insufficiency with a CGFR of 45 mL/min and a creatinine of 0.18 mmol/L.

Initially angioplasty the day following admission was cancelled, as the patient was not adequately hydrated. On the second day after admission, he proceeded to angioplasty, though unfortunately the procedure was complicated by a tibio-peroneal artery dissection. Further anterior tibial subintimal angioplasty was attempted and a dorsalis pedis pulse was recorded at the end of the procedure though it faded quickly. The patient was then managed conservatively but on the second day post angioplasty developed diarrhoea, worsening renal function and became septic. There had been a suggestion of a UTI on admission.

Three days post angioplasty it was decided that the patient's leg required amputation and he underwent a below-knee amputation. According to the anaesthetic notes however, the patient was 'in extremis' on presentation to theatre. He managed to survive the procedure and was subsequently managed in ICU for a few days. He then went back to the ward where his condition deteriorated and he died fairly quickly from renal failure, cardiac insufficiency and sepsis.

Areas of Good Practice / Deficiencies of Care (if any)

While it is difficult to tell from the notes the critical nature of the limb and whether in fact muscle ischaemia was severe, I think it is unlikely, given this elderly man's co-morbidities as mentioned above, that an angioplasty alone would have salvaged his leg. Given the fact that he had pre-angioplasty mild renal insufficiency, one would have been more tempted to offer him primary toe or below-knee amputation as a first-line measure of treatment so as to get rid of one of the septic foci. The UTI may well have contributed to his ultimate demise with systemic sepsis.

Also from the notes it appears that despite a second angioplasty procedure achieving some benefit angiographically, the patient was still in severe foot pain and required morphine for this. In view of this, it became quite clear that revascularization was not going to be helpful and therefore I would have recommended earlier below-knee amputation.

Summary

The main issues arising from my assessment of this case are related to:

1. Proper hydration prior to any angioplasty procedure in a patient with renal insufficiency
2. When the angioplasty failed, further earlier amputation in all probability would have been beneficial.

Learning Points

I think this case highlights the importance of hydration before any radiology procedure involving contrast, especially in patients with pre-existing renal insufficiency. There did not appear to be communication between the vascular staff and the radiologists (who did the angioplasty) concerning this problem. Hence the radiologist quite rightly cancelled the first procedure until such time as hydration had been improved.

CHASM would like to extend its gratitude to the Queensland chapter of the Australian and New Zealand Audit of Surgical Mortality for sharing this case study as an example for Second Line Assessors in New South Wales.

APPENDIX 3: ASA CLASSIFICATION SYSTEM

American Society of Anesthesiologists™

ASA Physical Status Classification System

Committee of Oversight: Economics

(Approved by the ASA House of Delegates on October 15, 2014, and last amended on October 23, 2019)

The ASA Physical Status Classification System has been in use for over 60 years. The purpose of the system is to assess and communicate a patient's pre-anesthesia medical co-morbidities. The classification system alone does not predict the perioperative risks, but used with other factors (eg, type of surgery, frailty, level of deconditioning), it can be helpful in predicting perioperative risks.

The definitions and examples shown in the table below are guidelines for the clinician. To improve communication and assessments at a specific institution, anesthesiology departments may choose to develop institutional-specific examples to supplement the ASA-approved examples.

The examples in the table below address adult patients and are not necessarily applicable to pediatric or obstetric patients.

Assigning a Physical Status classification level is a clinical decision based on multiple factors. While the Physical Status classification may initially be determined at various times during the preoperative assessment of the patient, the final assignment of Physical Status classification is made on the day of anesthesia care by the anesthesiologist after evaluating the patient.

Current Definitions and ASA-Approved Examples

ASA PS Classification	Definition	Adult Examples, Including, but not Limited to:
ASA I	A normal healthy patient	Healthy, non-smoking, no or minimal alcohol use
ASA II	A patient with mild systemic disease	Mild diseases only without substantive functional limitations. Examples include (but not limited to): current smoker, social alcohol drinker, pregnancy, obesity (30<BMI<40), well-controlled DM/HTN, mild lung disease
ASA III	A patient with severe systemic disease	Substantive functional limitations; One or more moderate to severe diseases. Examples include (but not limited to): poorly controlled DM or HTN, COPD, morbid obesity (BMI ≥40), active hepatitis, alcohol dependence or abuse, implanted pacemaker, moderate reduction of ejection fraction, ESRD undergoing regularly scheduled dialysis, premature infant

ASA CLASSIFICATION SYSTEM

American Society of Anesthesiologists™

		PCA < 60 weeks, history (>3 months) of MI, CVA, TIA, or CAD/stents.
ASA IV	A patient with severe systemic disease that is a constant threat to life	Examples include (but not limited to): recent (<3 months) MI, CVA, TIA, or CAD/stents, ongoing cardiac ischemia or severe valve dysfunction, severe reduction of ejection fraction, sepsis, DIC, ARD or ESRD not undergoing regularly scheduled dialysis
ASA V	A moribund patient who is not expected to survive without the operation	Examples include (but not limited to): ruptured abdominal/thoracic aneurysm, massive trauma, intracranial bleed with mass effect, ischemic bowel in the face of significant cardiac pathology or multiple organ/system dysfunction
ASA VI	A declared brain-dead patient whose organs are being removed for donor purposes	
*The addition of "E" denotes Emergency surgery: (An emergency is defined as existing when delay in treatment of the patient would lead to a significant increase in the threat to life or body part)		

References

For more information on the ASA Physical Status Classification system and the use of examples, the following publications are helpful. Additionally, in the reference section of each of the articles, one can find additional publications on this topic.

1. Abouleish AE, Leib ML, Cohen NH. ASA provides examples to each ASA physical status class. *ASA Monitor* 2015; 79:38-9 http://monitor.pubs.asahq.org/article.aspx?articleid=2434536

2. Hurwitz EE, Simon M, Vinta SR, et al. Adding examples to the ASA-Physical Status classification improves correct assignments to patients. *Anesthesiology* 2017; 126:614-22

3. Mayhew D, Mendonca V, Murthy BVS. A review of ASA physical status – historical perspectives and modern developments. Anaesthesia 2019; 74:373-9