AQUA
ANNUAL QUEENSTOWN
UPDATE IN ANAESTHESIA

AQUA 2014

Annual Queenstown Update in Anaesthesia

Programme and Abstracts

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AQUA
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Welcome to Queenstown

Dear Colleagues,

Welcome to Queenstown and another exciting AQUA conference.

This year our scientific programme features keynote speaker Associate Professor Paul Forrest, Director of Cardiothoracic Surgery and Perfusion at the Royal Prince Alfred Hospital in Sydney. Paul has an interest in thoracic anaesthesia and the management of patients with respiratory disease. He will also share with us the perils of anaesthesia in the sitting position and describe the challenges of providing testimony as an expert witness.

We are delighted to welcome Dr Nick Woodall, from Norfolk & Norwich University, co-lead investigator of the NAP4 audit. Nick, who is currently practicing at Auckland City Hospital will share with us the key lessons from this important study.

As usual, our keynote speaker is ably supported by a strong group of New Zealand anaesthetists. We have presentations on emergency laparotomy, regional anaesthesia, and a fresh look at crisis management. In addition, there are a broad range of subspecialty updates from neuroanaesthesia and paediatrics to obstetrics.

The AQUA 2014 social programme will feature dinner at the Skyline Restaurant. Delegates will enjoy a glass of champagne during the Gondola ride and fine dining with the best view in Queenstown. The famous AQUA BBQ will be held on Saturday at Coronet Peak, and will be followed by Test Match rugby, as the All Blacks take on the Wallabies in the second Bledisloe cup match.

This year we have been busy building a new website which offers a new look and many new features. Abstracts for current and past meetings can be found under the resources tab. Next year the registration process will be streamlined for easier use.

A special thanks to Martin Misur for his superb effort in setting up and running the AQUA website for the first five years of this meeting.

Thanks also to our sponsors who have supported the meeting generously and allowed us to maintain a high quality programme.

Neil MacLennan
AQUA Co-convenor

Social Programme

THURSDAY, 21 AUGUST 2014

17:00 – 19:00

Registration & Welcome Function
Millennium Hotel, Queenstown

FRIDAY, 22 AUGUST 2014

18:00 onwards

Conference Dinner
Skyline Gondola, Queenstown

SATURDAY, 23 AUGUST 2014

18:00 onwards

AQUA BBQ Function
Coronet Peak, Queenstown

International Faculty

Professor Paul Forrest

Royal Prince Alfred Hospital, Sydney

Born in Hamilton, raised in Huntly. Otago University for med school. Head of Cardiothoracic Anaesthesia and Perfusion at RPAH, Clinical Associate Professor Sydney University Medical School. Part I examiner. Clinical interests include anaesthesia for thoracic surgery and the preoperative assessment of patients with respiratory disease.

He has served as an expert witness in medico-legal cases.

New Zealand Faculty

Dr Catherine Sayer	Specialist Anaesthetist, Auckland City Hospital
Dr Dick Ongley	Specialist Anaesthetist, Auckland City Hospital
Dr Veronica Gin	Specialist Anaesthetist, Auckland City Hospital
Dr Tim Skinner	Specialist Anaesthetist, Auckland City Hospital
Dr James Cameron	Specialist Anaesthetist, Hutt Hospital
Dr Cam Buchanan	Specialist Anaesthetist, Waikato Hospital
Dr Nick Woodall	Consultant Anaesthetist Norfolk & Norwich University NHS Foundation Trust, Norwich, UK.
Dr Emma Patrick	Department of Anaesthesia, Base Hospital, New Plymouth
Dr Nigel Robertson	Specialist Anaesthetist, Auckland City Hospital
Dr Sharon Rhodes	Specialist Anaesthetist, Auckland City Hospital
Dr Doug Campbell	Specialist Anaesthetist, Auckland City Hospital

Scientific Programme

FRIDAY, 22 AUGUST 2014

Session 1

0800 - 0840	**Anaesthesia for the patient with respiratory disease**	*Paul Forrest*
0840 - 0905	**Emergency laparotomy; achieving better patient outcomes**	*Cath Sayer*
0905 - 0930	**#NOF patient: killing me softly with my song...**	*Dick Ongley*
0930 - 0955	**An update on crisis management**	*Veronica Gin*

Session 2

1025 - 1050	**ENT update**	*Tim Skinner*
1050 - 1115	**Regional anaesthesia update**	*James Cameron*
1115 - 1140	**Selected vignettes from paediatric anaesthesia**	*Cam Buchanan*

SATURDAY, 23 AUGUST 2014

Session 3

0800 - 0830	**Airway update: Lessons from NAP4 audit**	*Nick Woodall*
0830 - 0855	**Bleeding is out, your own blood is in**	*Emma Patrick*
0855 - 0920	**Update on neuroanaesthesia**	*Nigel Robertson*
0920 - 0945	**Obstetric anaesthesia update**	*Sharon Rhodes*

Session 4

1015 - 1055	**Changing practice with large trials**	*Doug Campbell*
1055 - 1140	**Casting the first stone: the trials and tribulations of an expert witness**	*Paul Forrest*
1140 - 1145	**Closing comments**	

Anaesthesia for patients with respiratory disease

A/Prof Paul Forrest
Department of Anaesthetics, RPAH

Unsurprisingly, pre-existing respiratory disease is a significant risk factor for postoperative pulmonary complications (PPCs). However, because there are also other important risk factors involved, it is necessary to take a broader clinical view of PPCs in order to understand how they can be assessed and minimised, not only in patients with pre-existing respiratory disease, but in all of our patients.

What are PPCs and their complications?

There are no standardised definitions of PPCs, which include a variety of conditions such as pneumonia, aspiration pneumonitis, respiratory failure, reintubation (within 48 hours), prolonged ventilation, bronchospasm, pleural effusion and pneumothorax.

PPCs occur in about 2.5% of cases following major non-cardiac surgery and have a similar mortality (~ 25%).[1] They not only prolong hospital admissions, but are much more expensive to manage than other common major complications (including cardiac, infective and thromboembolic).[2]

Preoperative assessment / investigations for PPCs

Assessing risk of PPCs

The major risk factors for PPCs are well defined, based on very large studies.
In a US Veterans study of over 300,000 patients,[3] the most important predictor of postoperative respiratory failure was the type of surgery, with an odds-ratio (OR) of 11 for abdominal aortic surgery, 3.5 for upper abdominal and peripheral vascular surgery, and 1.9 for any emergency procedures. The major patient–related risk factors were age > 70 (OR 2.6), ASA grade (III: OR 2.9; IV or V: OR 4.9), history of COPD (OR 1.8) and congestive cardiac failure (OR 2.9).

Surprisingly, while obesity increases the risk of other perioperative complications, it is not a significant risk factor for PPCs.[4]

Although several studies have shown that obstructive sleep apnoea (OSA- diagnosed by polysomnography or questionnaire) has been associated with a higher rate of postoperative complications in some studies, it has not been shown to increase the rate of adverse events or unplanned hospital admissions in patients undergoing day surgical procedures.[5] While recent practice guidelines recommend that the severity of OSA should be taken into account in the assessment of perioperative risk (along with the invasiveness of surgery and the requirement for postoperative opioids),[6] this recommendation is not supported by the available literature. In a prospective study of patients undergoing bariatric surgery who routinely received non-invasive ventilation postoperatively, severity of OSA was not associated with increased risk of PPCs.[7] The clinical value of routine screening for the presence and severity of OSA therefore remains unproven.

Recently, severe pulmonary hypertension has been recognised as a significant risk factor for postoperative respiratory failure (~25%), heart failure and death.[8]

Accurate methods to predict the risk of PPCs are useful to facilitate informed patient consent. However, these methods may be less useful in guiding perioperative clinical management, because of the low sensitivity of the tests available and because strategies that have been proven to reduce PPCs should be used in all patients, regardless of risk.

A number of scoring systems have been developed to predict the risk of PPCs. For example, in a recent study of 34,000 patients, the risk of reintubation was examined using an 11-point score that comprised ASA grade (III or IV= 3 points), emergency surgery (3 points), high-risk surgery (2 points), congestive cardiac failure (2 points) and COPD (1 point). The incidence of reintubation in patients with a score of 0 was 0.1%, vs. 5.9% if the score was 7-11.[9] However, because of the low rate of PPCs that may be predicted, this and other scoring systems are too insensitive to guide clinical decision-making in individual patients. Nevertheless, they are important research tools for investigating strategies to decrease PPCs.

Preoperative respiratory investigations

Poor predictive value is also a limitation of routine preoperative screening investigations. For example, spirometry is not recommended for routine screening for risk of PPCs.[4] This is because it has shown to be no better than clinical assessment

by history and examination in predicting the risk of PPCs. Unlike patients undergoing lung resections, there is also no lower limit of FEV_1 that reliably precludes non-thoracic surgery. Similarly, the use of routine preoperative chest X-rays in patients less than 70 years old is not indicated to predict PPCs in the absence of other risk factors. This is because routine preoperative CXRs mostly detect pre-existing chronic condition and have not been shown to significantly alter perioperative management or to improve outcome.[4,10] Cardiopulmonary exercise testing may provide a more quantitative means of assessing "fitness for surgery." In a trial currently underway in London, it is being assessed as a means of stratifying patient risk following colorectal surgery.

Preoperative strategies to decrease PPCs

Smoking cessation

Whether smoking cessation reduces PPCs remains unanswered.[8] This is because cough and sputum production may increase during the first month or two after smoking cessation.

Preoperative steroids

While well-controlled asthma and COPD are not major risk factors for PPCs, poorly controlled patients benefit from preoperative steroids and bronchodilators. In a study of patients with reversible, but poorly controlled reactive airways disease (FEV1<70% predicted and who were not already on chronic bronchodilator therapy), there was a high incidence of bronchospasm post-intubation in patients that received salbutamol alone, either preoperatively for 5 days (7/9 patients) or 10 minutes before induction (8/10 patients). This occurred despite improvements in their spirometry after salbutamol therapy. However, in patients who received methylprednisolone (40 mg) for 5 days preoperatively as well as salbutamol, the incidence of bronchospasm post-intubation was significantly decreased (1 / 10 patients, $p<0.001$).[11] Several studies have also shown that a short course of high-dose steroids preoperatively does not increase the risk of surgical complications.

Intraoperative strategies to decrease PPCs

"Protective" lung ventilation strategies (high PEEP / low tidal volume / low plateau pressure) have been shown to decrease mortality from acute respiratory distress syndrome in the landmark ARDSNet study.[12] There have subsequently been several recent studies on protective ventilation strategies during anaesthesia. Low levels of PEEP promote atelectasis during anaesthesia and in a large retrospective study, were associated with increased mortality and prolonged hospitalisation.[13] Two prospective trials have shown that protective ventilation strategies using moderate (but not high) levels of PEEP decrease PPCs in at-risk patients undergoing abdominal surgery. Ventilation with moderate PEEP (6-8 cmH_2O) and low tidal volumes (6-8 ml/kg + recruitment manoeuvres) reduced PPCs by about 50% when compared with "conventional" ventilation (no PEEP, VT 10—12 ml/kg, no recruitment manoeuvres).[14] However, ventilation with high PEEP (12 cmH_2O, VT =8ml/kg) did not decrease the incidence of PPCs when compared with low PEEP (0-2cmH_2O, VT 8ml/kg).[15] The high-PEEP group also required more vasopressors for hypotension intraoperatively.

In patients with reactive airways disease undergoing general anaesthesia, intraoperative bronchospasm may be detected by failure of expiratory flow to return to baseline. This sign can also guide the response to therapies; such as bronchodilators and prolongation of expiration (by decreasing respiratory rate and I:E ratio).

Although there is consensus opinion that substituting neuraxial or regional anaesthesia for general anaesthesia decrease PPCs, there is little supportive data. There is evidence to support the use of short vs. long -acting muscle relaxants and for laparoscopic vs. open surgery.[8]

For patients undergoing general anaesthesia, the use of an LMA instead of endotracheal intubation decreases the risk of laryngeal spasm post-extubation, although its effect on other PPCs is probably minor.[16] The use of volatile anaesthetics is theoretically attractive because of their bronchodilating properties. However, there is no data that their use decreases PPCs compared with TIVA.

The use of opiate-sparing techniques (such as multi-modal analgesia, local and regional anaesthesia) may limit PPCs due to respiratory depression. Several meta-analyses have shown that thoracic epidural analgesia reduces respiratory complications and duration of ventilation in high- risk patients undergoing major surgery,[17,18] although the magnitude of these benefits is reduced in more recent studies.[19]

Postoperative strategies to decrease PPCs

Following abdominal surgery, the selective use of nasogastric tubes in patients with abdominal distension or symptoms of nausea or vomiting decreases PPCs. However, nasogastric tubes also increase the risk of aspiration and have been shown to actually increase PPCs when used routinely.[20]

The most effective proven strategies to reduce PPCs are lung expansion techniques. These include incentive spirometry, breathing exercises and CPAP. These techniques probably all have similar efficacy, reducing PPCs by about one third. However, CPAP is particularly useful for patients who are unable to perform deep breathing exercises.[21]

Summary

Respiratory disease is one of several risk factors for PPCs. Other important risk factors include patient age and the type, site and acuity of surgery. Patients with respiratory disease should generally not be denied major surgery. However, elective patients with poorly controlled reactive airways disease should be treated with a course of high-dose steroids preoperatively.

There are only a few strategies that have been proven to reduce the incidence of PPCs. These include protective lung ventilation with moderate levels of PEEP, postoperative lung expansion techniques and the selective use of nasogatric tubes. Other strategies that may be effective include avoidance of general anaesthesia and the use of opiate-sparing analgesic techniques (such as regional anaesthesia). These strategies should be used in all patients at increased risk of PPCs, even in the absence of respiratory disease.

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Emergency Laparotomy: Achieving better patient outcomes

Catherine Sayer
Auckland City Hospital

Emergency laparotomy may be defined as non-elective, non-trauma related, open (+/- laparoscopic) procedures on the GI tract (excluding appendicectomy, cholecystectomy). It is a common procedure, with approximately 150-200 cases per year at Auckland City Hospital. All anaesthetists who participate in acute work will come across these cases frequently. This is one of the highest risk procedures that we do, with a mortality risk of approximately 15% in all-comers and 24% in over 80s[1]. Despite the high risk there are few clear guidelines regarding management, in stark comparison to other high risk areas such as the cardiac patient for non-cardiac surgery.

This presentation will look at quality improvement projects for this group of patients in other countries, risk assessment to aid management, and suggested pathways of care, including goal directed therapy. It will also look at retrospective data from Auckland City Hospital and discuss how we can better capture data for New Zealand as a whole which we may then use to improve care.

QA projects in other countries

In the UK there is an ongoing National Emergency Laparotomy Audit which is an anaesthesia led initiative being carried out by the National Institute of Academic Anaesthesia's Health Services Research Centre on behalf of the Royal College of Anaesthetist's[2]. It originated from the Emergency Laparotomy Network which recognised that there were wide variations in management and outcomes within the UK[1]. The scale of this project is impressive; all 191 NHS hospitals which carry out acute work are involved, and the audit is planned to run for 3 years in total. The standards of care to be audited are outlined in the organisational report[3] and include:

- The timely review by a senior surgeon following admission
- A formal assessment of risk of death
- A pathway of defined peri-operative care
- The prompt administration of antibiotics
- The ready availability of diagnostic investigations
- Prompt access to an operating theatre
- Surgery performed under the direct care of a consultant surgeon and consultant anaesthetist
- The admission of high-risk patients to a critical care unit following surgery

In the US, the American College of Surgeons runs the National Surgical Quality Improvement Programme which has a broader focus but also aims to collect data to drive improvements in the quality of care[4].

Risk assessment

Risk assessment may be used to aid decision making regarding;

- The most appropriate surgical procedure
- Possibility of non-operative management
- Level of monitoring required
- Patient placement post-op
- Consent discussions with the patient and their family

Risk Scoring

There are a number of risk scores which may be used to predict surgical risk. In the UK, POSSUM and P POSSUM are widely used[5,6] and are available in an easy to use web based calculator[7]. These scores are used as part of the data collection for NELA to define a 'high risk' patient (>5% hospital mortality).

NSQIP has developed a multi procedure web based risk calculator based on data collected between 2009 and 2012[8]. This predicts mortality and morbidity in 8 specific fields, including discharge to nursing or rehab facility, and has a results page including graphical illustrations to facilitate communication of risk prediction to the patient[9].

Individual institutional risk calculators have also been developed which may be more relevant to the practising anaesthetist.

A documented risk score may also help to focus attention on the highest risk patients so that they receive appropriate senior input.

Ageing and Frailty

There is little doubt that with increasing age, perioperative risk also increases. However, we are all aware of the concept of 'physiological age' compared with chronological age, and this is not fully captured in available risk scoring. In recent years there has been increasing interest in the concept of frailty in care of the elderly circles.

Multiple definitions are available but Fried's definition, otherwise known as the Cardiovascular Health Study Index is most widely accepted. This uses the following parameters:-

- Weight loss (≥5 percent of body weight in last year)
- Exhaustion (positive response to questions regarding effort required for activity);
- Weakness (decreased grip strength)
- Slow walking speed (gait speed) (>6 to 7 seconds to walk 15 feet)
- Decreased physical activity (Kcals spent per week: males expending <383 Kcals and females <270 Kcal).

Frailty is considered predictive of adverse health outcomes in the general population[10]. More recently there has been increasing interest in frailty as a prognostic indicator in the surgical literature and the evidence base to support frailty as a predictor of postoperative complications continues to grow[11,12] . This evidence is mainly focused on elective procedures currently but it would seem reasonable to extrapolate to acute procedures. The REASON study[13] would lend support to this theory with its finding that hypoalbuminaemia, which is included in some frailty scores, is associated with increased mortality.

Pathways for management

Standardised pathways are likely to improve overall care. Pathways need to be institution specific to take account of local resources, expertise and practice. An example from Nottingham University Hospitals is available on the internet[14] This includes:-

- Initial risk assessment – history, examination, investigations. Risk scoring and delineating high risk patients
- Recognise and treat sepsis
- Explicit timelines for high risk vs low risk patients
- If predicted mortality >10% Consultant anaesthetist and Surgeon involvement mandatory
- Consider cell salvage
- Make a postoperative plan
- Involve critical care
- Consider antifungal therapy
- Use goal directed therapy (this is controversial, see below)
- Anticipate coagulopathy
- Avoid prolonged surgery in elderly
- Consider NGT/NJT
- Postop risk scoring
- Any laparotomy patient operated on out-of-hours who does not go to critical care should be cared for on a level 1 unit or extended recovery
- Proforma for documentation with prompts for each step

Fluid management and goal directed therapy

In recent years there has been a move towards restrictive fluid management practices for elective GI surgery. Although widely accepted, the evidence is mixed and the RELIEF trial, led by Paul Myles[15] is underway to examine this issue. (If any other centres are interested in being involved they would be welcomed, please contact Tim Short, tims@adhb.govt.nz).

Cardiac output monitoring and goal directed therapy have been adopted with enthusiasm in some centres, most notably in the UK, in elective patients. Evidence for this is mixed and it remains controversial. There is very little literature about goal directed therapy in emergency laparotomy although theoretically it is attractive in this group of patients. Unfortunately an ideal monitor is yet to emerge.

In terms of type of fluid used, in our institution there has been a resurgence in 4% Albumin use because of the controversy around starches, and Plasmalyte is used in preference to N/Saline, at least in the theatre environment.

Auckland City Hospital data

2 years worth of data for 828 patients coded as having had an emergency laparotomy (using the NELA exclusion criteria) was retrospectively analysed. It is likely that this data is 'dirty' and includes a number of patients who do not truly fit the criteria. Our data show similar patterns to the UK data, with 30 day mortality of 8% in all comers and 19% in patients >80. The primary surgeon was a consultant in 50% and the primary anaesthetist was a consultant in 33%. 21% of patients were admitted to the Department of Critical Care/HDU.

Whilst interesting, these data cannot be used to draw conclusions regarding care as without examining the medical records of the individual patients it is not possible to verify the details.

I plan to undertake a prospective audit of emergency laparotomies performed at ACH to better understand our care pathways and management of this high risk group of patients. In the long run I believe that it would be valuable to set up a NZ-wide audit to collect more data and to encourage collaboration between institutions. I would welcome interest from specialists in other centres who would like to be involved with this. Please contact me at **csayer@adhb.govt.nz**.

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Fractured NOF Patient: Killing me softly with my song...

Dick Ongley
Auckland City Hospital

The elderly patient with a fractured neck of femur (NOF) is a challenging patient for most anaesthetists. Frequently we seek to answer questions such as;

1) Can I optimise this patient before theatre?

2) Will delay of surgery to medically optimise actually lead to benefit?

3) What is the best anaesthetic technique for this individual?

4) Does my practice really have a significant impact on the outcome?

Hip fracture is diagnosed when there is a fracture occurring in the area between the edge of the femoral head and 5cm below the lesser trochanter. Hip fractures are traditionally divided into two main groups based on their position relative to the capsule of the hip joint. Those above the insertion of the capsule may be termed intra-capsular, subcapital, or femoral neck fractures; these are mostly treated with hemiarthoplasty or hip joint replacement. A more conservative approach may be trialed if the patient is under 55 years of age. Those fractures of the hip below the capsule are termed extracapsular. Extracapsular fractures are further divided into trochanteric and sub-trochanteric, which are treated surgically with plate and screw or nail fixation.

In Australasia, patients with fragility fractures of the hip currently have a mortality of 10% at one month and 33% at one year.[1] It is estimated that Australia and New Zealand spend around $600 million and $100 million per year respectively on these patients.[1] Although the rate of hip fracture in the elderly population is decreasing, we know that with an aging population the absolute number of hip fractures we need to treat will only continue to increase.[2,3]

The Australian and New Zealand Guideli ne for Hip Fracture Care is a 160 page document still in the public consultation phase as of October 2013.[1] It is based on the NICE clinical guideline while taking into account regional differences in practice and target population.[1,4] The "ultimate goal" of the document "is to ensure that every hip fracture patient is given the maximum chance of making a meaningful recovery from a significant injury".[1] An additional aim of this guideline is to standardise care where currently there exists marked variation in time to theatre and 30 day mortality between hospitals surveyed in New South Wales.[1]

The following factors[1] have previously been identified in the UK via the National Hip Fracture Database (NHFD) as vital to the delivery of quality care for the NOF patient:

- Surgery within 36 hours
- Shared care by surgeon and geriatrician
- Care protocol agreed by geriatrician, surgeon, and anaesthetist
- Assessment by geriatrician within 72 hours
- Pre- and post-operative abbreviated mental test score assessment
- Geriatrician-led multi-disciplinary rehabilitation
- Secondary prevention of falls
- Bone health assessment

Such factors have been used to create incentivised health care provision in the UK[1]. Although this may be worth adopting to allow audit and comparison in Australasian hospitals, caution is advised given the current poor quality of the evidence. For example, regarding the timing of surgery the NICE guidelines use ten studies with 193,793 patients, which are all classified as "very low" to "low quality" studies[1]. However, they do suggest a trend towards a statistically significant decrease in mortality, pressure ulcers, return to independent living and complication rates if surgery is performed in less than 48 hours.

The Australasian guidelines list the main goals of surgery as a) the alleviation of pain and b) the maximisation of functional outcome, which may or may not be part of a palliative intervention. The document is divided into the following areas:

a) Diagnosis and preoperative care

b) Perioperative care

c) Operative interventions

d) Postoperative mobilisation strategies

e) Models of care

f) Patient and care perspectives

The multidisciplinary expert panel sought to examine the evidence underpinning current practice and make recommendation toward best practice as evidence based, consensus based, or practice point. It is unfortunate that many of the studies currently used to guide practice are in fact of low quality and highlight the need for future research as previously mentioned. Take for example the issue of surgeon seniority for the elderly fractured neck of femur fracture. The expert panel highlights the fact that "age and experience do not guarantee performance and outcome". "The limited literature available suggests that technically more demanding hip fractures have higher rates of re-operation when undertaken by unsupervised junior surgeons."[1]

Under the heading of "Diagnosis and peroperative care" anaesthetists are vital in the provision of analgesia/pain services and guiding the identification and optimisation of correctable comorbidities, which delay surgery such as anaemia, anticoagulation, and heart failure. In the area of "Perioperative care" anaesthetists are advised to continue to offer regional and or general anaesthesia according to patient co-morbidity. Neither the NICE guideline nor the Australasian counterpart is able to define the optimal anaesthetic for this group of patients. Emphasis is placed on involvement of the patient and family where anaesthetic options are available with the need to define the limits of care/resuscitation.

Although, regional anaesthesia has been hypothesized to reduce postoperative mortality, there are no studies that convincingly demonstrate this.[5] There are two recent studies worthy of mention on this subject. In 2013, Chia et al. identified general anaesthesia as an independent risk factor for one-year mortality via retrospective analysis of 185 patients presenting with fractured neck of femur to an Australian metropolitan teaching hospital[2]. The authors noted that of the 54% of patients who received general anaesthesia they were more likely to have pre-operative hypoxia, abnormal pre-operative vital signs and require pre-operative medical intervention. This led the authors to suggest that general anaesthesia is administered to those who are "more unwell in the pre-operative period".[2] The second study by Patorno et al, 2014, looked at in hospital all-cause mortality of approximately 73 000 patients with hip fracture across a wide range of hospitals in the United States using a research database. In multivariate analyses there was no significant difference in mortality between regional anaesthesia, general anaesthesia, or combined anaesthesia.[5]

The NICE and Australasian guidelines can be used to develop NOF care pathways.[1,3] Many hospitals have or are actively developing such pathways, which are intended to expedite the patient's passage to theatre, reduce complications and coordinate care on the ward where multiple disciplines are involved. One such pathway from the Austin Hospital in Victoria will be presented as an example.[6]

All anaesthetists will be familiar with the repeated fasting that NOF patients are often subject to. Repeated fasting while reducing nutritional reserve and contributing to cognitive insult is extremely upsetting to the patient, family, carers, and staff. The Austin NOF pathway combats this problem through the use of a "fasting clock". The clock is commenced from the time the patient is scheduled for theatre, 9 hours thereafter the nurse rings the orthopaedic registrar to confirm the theatre plan is still in place, and at 12 hours the patient is fed. Delirium is a common problem for NOF patients and significantly increases hospital mortality. The Austin NOF pathway has incorporated the NICE clinical guideline on delirium[7] to try and reduce delirium via the following measures: assess cognition on admission, consider regional analgesia, monitor cognition and intervene early if changes detected, and consider preventative strategies such as early mobilisation, glasses, hearing aids, and hydration.[6]

Anaesthetic doctors have a vital role to play in the provision of quality care for the NOF patient. There are now international and local guidelines that should be used to guide practice and assist in the development of NOF care pathways. The current literature does not support the premise that regional anaesthesia has a lower mortality than general anaesthesia. Anaesthetists can continue to improve outcomes for NOF patients through ongoing audit process and there is still much research to be undertaken in this field.

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Crisis Management – A fresh look

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Abstract

In modern day medicine, there is increasing emphasis on the delivery of quality healthcare by multidisciplinary teams. During operating room crises, our teams need to deliver potentially life saving care by optimally implementing standard techniques of diagnosis and treatments. Maintaining situational awareness over our environment, equipment and team, under stress and time pressure in a dynamic and complex environment remains difficult[1]. Effective teamwork underpins successful crisis management; including team leadership, mutual performance, backup behavior, adaptability and team orientation[2]. Mutual trust, closed-loop communications and shared mental models underpin these.

Despite our increased understanding of delivering evidence based medicine, human factors and teamwork, there are still going issues in delivering optimal crisis management. It is well documented in the literature that communication failures and poor team culture contribute significantly to medical errors and compromises to patient safety and outcomes[3-5].

Therefore, there is a movement to pro-actively prevent crisis events from occurring and to introduce organisational systems that allow teams to perform optimally. There is emphasis on delivering education to build teamwork and to identify latent threats or hazards in our processes and systems that can compromise patient care. Changes in our organizations' culture and teamwork though protocols & procedures, such as checklists, briefings and debriefings may also prove beneficial.

Education – team training and the use of simulation

The aim of team training through simulation is to enhance patient safety through avoiding direct exposure of patient to harm. Simulation serves 4 general purposes:- education (knowledge and skill acquisition), assessment, research, and health system integration (organizational processes and structure)[6]. Team training has shown to significantly improve clinical care processes and lead to improved patient outcomes[7]. However, access by entire operating room teams may be prohibitive in certain workplaces. The transference of learning into the workplace through in-situ simulation may overcome these barriers. In-situ simulation increases fidelity (both physical and functional) and it has the potential to drive individual, team and organizational learning[8]. A great benefit, not necessarily able to be tested through exercises in the simulation centers, is identification of latent threats in the clinical environment.

However, limitations of in-situ simulations, include:-

- Simulations need to fit the needs of an area
- Requires expert simulation staff & equipment
- Resource intensive - time, location, cost
- Need to allow time for briefing and debriefing
- Quality improvement measures need to be accounted for after the scenario
  - Individual learning of skills
  - Changes in organizational process and structure

Organisational: Supporting teamwork through protocols, procedures and culture change

Checklists:

Emergency manuals have been available many years, but generally regarded as reference resources. There has been renewed interest to modify them such that they can be used during a critical event by the operating room team as a cognitive aid to remember essential steps of crisis management and as a communication tool.

Crisis checklists therefore are typically a list of action items arranged in a systematic manner. The checklists help identify the presence/absence of essential steps to ensure all are considered or completed, or can act as verification after completion of a task[9]. Therefore it can aid refractory situation recovery. The use is not only restricted crisis events, but can be used in pre-crisis preparation/education and post-crisis debriefing/event review[10] (see Figure 1).

Recently, developed checklists were validated through a high fidelity simulator setting by 17 operating teams in 106 simulated surgical-crises[11]. A reduction of 75% in the failure to adhere to lifesaving processes was less common when checklists were available (see table 1). Every team performed better with checklists. There was high acceptability of the checklist use as reported by 97% of participants who would want checklist used on them if they were the patient.

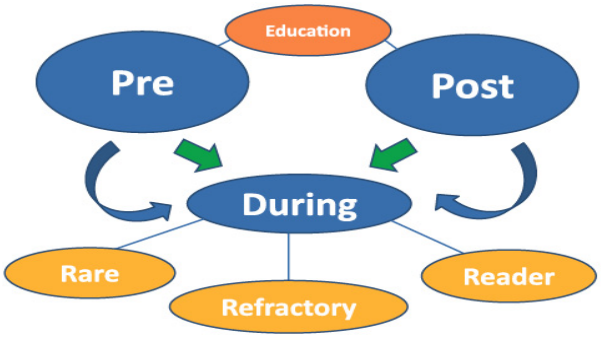

Figure 1. Clinical uses of emergency manuals. The double arrows from "Pre" and "Post" to "During" emphasize that both content and format familiarity are increased when emergency manuals are utilized for educational review. During a crisis, specific categories of events may be appropriate for emergency manual consultation in particular ways.

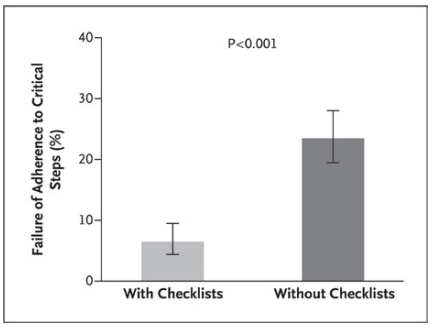

Table 1. Association between Use or Nonuse of Operating-Room Crisis Checklists and Failure to Adhere to Critical Steps in Management. The use of checklists during operating-room crises resulted in nearly a 75% reduction in failure to adhere to critical steps in management.

A reader, who reads out-loud the essential critical steps can aid adherence to critical steps. When tested in a simulator based, the use of a reader ensured that all critical actions were performed in comparison to simulated events in comparison to the absence of a reader[12].

Benefits of crisis checklists [9,10]:

- Error reduction
- Aid memory recall, standardisation, best practice adherence
- Promote effective teamwork & communication
- Shared mental model & Closed-loop communication
- Potentially reduce morbidity and mortality

Barriers to adoption in the operating room [9,10]:

- Operationally
  - Difficult to standardise certain processes
  - Disruption to workflow
  - Checklist fatigue
  - Implementation issues – creation, familiarization, use
  - Introduction of errors by choosing the wrong checklist
- Culturally
  - Limits autonomy and admission of "weakness"
  - Limited evidence on effects on teamwork
  - Limited evaluation against patient outcome

Briefing and debriefing:

Briefing and debriefings are verbal exchanges to help creating a shared mental-model. It intends to build teamwork, improve communication and reduce errors. During briefings, all patients are discussed before the list starts with the entire team to identify potential problems, preventable harm and allow pre-planning for events. Debriefings assess what went well, challenges and potential improvements[13].
The successful introduction of briefing and debriefings has been reported to reduce the number of non-routine events[14], wrong site surgeries[15], subjective benefits to teamwork and perceptions of safety culture. Another study also reports increased theatre efficiency and reduction in unexpected delays[16].

Similarly to checklists, successful implementation requires planning and education sessions before the techniques are integrated. Sustained and consistent use relies on strong leadership by clinical champions[13].

Conclusion:

Effective teamwork and communication are vital components to successful crisis management. The shift on emphasis currently in crisis management is on delivering better education and communication tools in order to build teamwork, promote more effective communication, and to identify latent threats and hazards in our processes and systems. Activities such as in-situ simulation and tools such as checklists, briefings and debriefings have been shown to have positive effects on the performance of teams, both functionally and culturally. However, none of these are easily implemented and require resources, local champions and leadership for their sustainability and success in the workplace.

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ENT update

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ENT anaesthesia is a routine part of most anaesthetists' work. Here I present aspects of my personal practice which may be less common and hopefully of some interest.

"The provision of a clear, free and unobstructed airway is the principle concern of all ENT procedures" in Miller, 2010

- Anaesthesia for FESS
- Controlled Hypotension
- Laryngeal Mask Airway in ENT
- Laryngeal Surgery
- High Frequency Jet Ventilation
- Laser Airway Surgery
- Anaesthesia for Free Flap Surgery

Anaesthesia for FESS

Excellent summary article by Alex Baker and Baker[1].

Although usually low risk, FESS can rarely result in serious morbidity. Good surgical field conditions may improve surgical technique and reduce risk. Although there are patient and surgical factors that will influence surgical field conditions, the anaesthetic can also influence surgical happiness.

Table 1

Indications for endoscopic sinus surgery.

Nasal Surgery
Chronic sinusitis refractory to medical treatment
Nasal polyposis
Recurrent sinusitis
Control of epistaxis
Sinus mucocoeles
Excision of selected tumours
Skull base surgery
Cerebrospinal fluid leak closure
Endoscopic pituitary surgery
Orbital surgery
Orbital decompression (e.g., Graves ophthalmopathy)
Dacryocystorhinostomy
Optic nerve decompression

Table 2

Complications of endoscopic sinus surgery.

Nasal
Haemorrhage
Synechiae
Anosmia
Intracranial
Haemorrhage
Cerebrospinal fluid leak potentially causing meningitis
Orbit
Nasolacrimal duct damage
Extraocular muscle injury
Intraorbital haemorrhage
Optic nerve damage
Pain

Table 3

Patient and surgical factors that contribute to bleeding and poor surgical conditions during sinus surgery.

Patient factors
Severity of sinus disease
Active infection/inflammation
Anticoagulation
Antiplatelet medications
Clotting disorders
Vascular tumours
Surgical factors
Extensive surgery
Duration of surgery
Revision of surgery

Assess: Usual anaesthetic assessment plus risk factors that would contra-indicate hypotension: CVS, cerebrovascular disease; severe respiratory disease; uncontrolled hypertension; reno-vascular disease. Airway assessment, including nasal obstruction from surgical pathology making BVM more difficult.

Discuss contraindications to hypotension with surgeon – they may change their plans if you feel it is unsafe to provide hypotension. Consider separate consent for deliberate hypotension – this is not what the general public expect from a normal anaesthetic and it may involve increased risk.

Surgical field bleeding depends on: Systolic BP, HR, capillary flow, venous pressure. You and the surgeon can influence all of these.

Arterial BP:
Smooth anaesthetic, no tachycardia, hypertension, no coughing on ETT.
Monitor depth of anaesthesia, NMB. Topicalise airway, consider using LMA, not ETT.

HR
Keep it low – see later

Capillary flow
Control CO2, so IPPV. Topical adrenaline, LA, cocaine applied by the surgeon (also reduces surgical stimulation)

Venous Pressure
Tilt head up, avoid tying ETT tightly round neck veins (!) Avoid coughing and straining. IPPV with low pressure strategy. Don't flood with IV fluid.

TIVA
There is reasonable evidence that remifentanil and avoidance of volatile improves surgical field conditions (at same BP). This only applies in patients with severe sinus disease. Less than severe, the surgeons cannot tell the difference when they are 'blinded'.

Remifentanil will, of course, help you keep your BP and HR under control.

Hypotensive agents
Using above strategy, I usually have no problem getting the BP to 20% less than resting awake BP. In the rare patient whose BP is not in this range, often because they develop a responsive tachycardia then a beta-blocker is my first choice (eg. Metoprolol, 1-2mg increments). Clonidine 50mcg increments is 2nd choice, but I find it delays recovery. I have only very rarely had to start a GTN infusion at low dose.

I much more frequently end up starting a Metaraminol infusion because reasonable doses of Propofol and remifentanil take the BP lower than I am happy with.

Monitoring
Routine monitoring in relatively healthy and BP down 20%. IABP if patient with risk factors and/or more than minor doses of deliberate hypotensive agents are required (e.g. GTN infusion). BIS if you're anxious about TIVA, but most patients get more than adequate Propofol/Remifentanil and don't have to have NMBA.

Hypotensive Anaesthesia

Does it work?

Does it cause Harm?
(What BP is "safe"?)

Should we get separate consent?

Deliberate hypotension dates from 1950's and was used to principally to reduce bleeding in increasingly complex surgery – "to make the impossible possible"[2]. There has always been an acknowledged risk associated with deliberate hypotension. Historical evidence included "The pooled series reviewed here suggest non-fatal complications in one in 39 cases and fatal complications in one in 167 cases." (Lindop, 1975)[3] and a series of 1802 ORL patients in whom 4 had symptoms of cerebral damage and 1 died, giving an incidence of severe cerebral complication of 1 in 450 (Pasch & Huk, 1986)[4].

Hypotensive anaesthesia became much less popular once trials showed worse outcome after neurosurgery[5]. Over the past two decades, the scope and complexity of endoscopic nasal surgery has expanded, equipment has improved (stealth CT -guided) and surgeons have increasingly required good surgical field conditions to achieve good surgical outcome.

Deliberate hypotension in the form of "Hypotensive Epidural Anaesthesia" (HEA) has been strongly advocated by one US group to reduce blood loss and improve outcome in lower limb joint replacement (Sharrock)[6]. Epidural-induced hypotension (MAP 45-55) in this group's data does not seem to adversely affect cardiac, renal or cerebrovascular outcome and does not affect cognitive function up to 4 months post-op (small numbers in trials, so rare badness not excluded). Deliberate TIVA-induced hypotension does not improve blood loss as much as HEA[7].

Blood loss per-se is not an issue in FESS. Transfusion is extremely rare. Surgical field conditions are the subjective view of the surgeon. Some studies have suggested that the blinded surgeon can tell the difference between TIVA and volatile-based anaesthesia[89] and is sensitive to MAP[10]. Other studies show no difference in surgical happiness dependent on anaesthetic technique[11]. A recent systematic review excluded many papers on the subject because of poor design or risk of bias. The remaining papers suggested that hypotensive anaesthesia does reduce blood loss in transfusion prone surgery, but the evidence for benefit in surgical field for FESS was "inconclusive" [12].

Beyond rare cerebral disasters, it has been suggested that deliberate hypotension may cause at least temporary cognitive decline. In a small study, there was no difference in detectable neurocognitive function at 24 hours between GTN induced hypotension (MAP 60-70) and normotension[13].

LMA for ENT

First described for use in nasal surgery in 1995[14]. Several papers have compared ETT with Reinforced LMA, some using fibreoptic bronchoscope[15] to assess airway soiling, some assessing extent of blood soiling of device[16]. Most also assess clinical outcome – ease of emergence, extubation, coughing and desaturation during recovery.

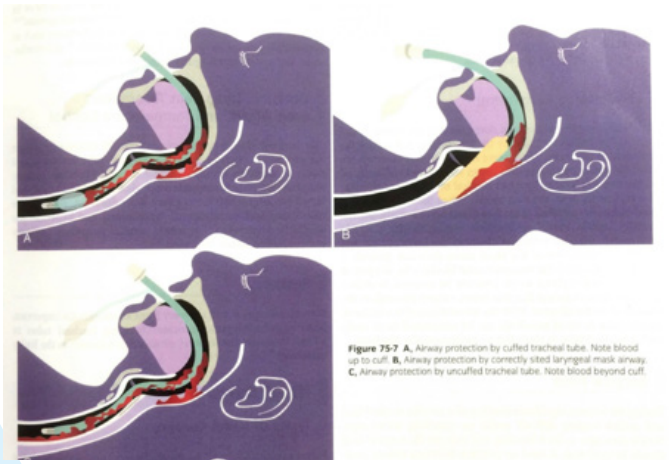


Figure 75-7 A, Airway protection by cuffed tracheal tube. Note blood up to cuff. B, Airway protection by correctly sited laryngeal mask airway. C, Airway protection by uncuffed tracheal tube. Note blood beyond cuff.

Surgical field conditions have been judged better with LMA for the first 15mins of surgery and required lower rates of remifentanil compared to an ETT after that[17].

LMA has repeatedly been shown to provide a satisfactory airway for tonsillectomy, with less bronchospasm, laryngospasm, bleeding and desaturation compared to the use of an ETT (most trials in kids)[18]

Most studies showed superior protection of the larynx from soiling with blood. One study suggested that the incidence of blood in the distal trachea was higher with an LMA[19]. Older studies have shown significantly better emergence with a LMA, but these studies used volatile/fentanyl based anaesthetics. No study yet has compared emergence characteristics of LMA vs ETT when Propofol/Remifentanil are used.

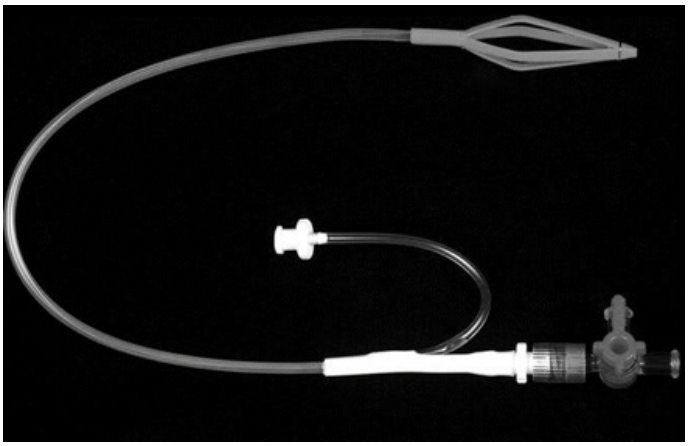
Proseal LMA has been used successfully for prolonged middle ear surgery[20].

If a LMA is contraindicated, then topicalisation of the airway may improve emergence/extubation.

Lignocaine spray to the larynx seems to reduce cough at extubation for up to 2 hours[21]. Additional effect may be gained by inflating the endotracheal cuff with alkalinised lignocaine, although the results in adults are inconsistent. One study using Rusch reinforced ETT showed prolonged suppression of adverse extubation phenomenon and measureable systemic lignocaine concentrations from intra-cuff lignocaine[22].

Anaesthesia for Laser Micro-laryngoscopy

The traditional approach of Laser-resistant ETT or supraglottic jet ventilation is not without risks. Sub-glottic catheter jet ventilation was first described in 1970's, but carries highest risk of barotrauma. Transtracheal jet ventilation has been described but is associated with the highest incidence of barotrauma resulting from airway outflow obstruction, most often laryngospasm[23].



Hunsaker described his Mon-jet tube in 1994. It is effectively laser safe (CO2, NdYAG, KTP)[24] and provides the optimum conduit for safe automated high frequency jet ventilation[25]. Barotrauma is minimised by monitoring airway pressure through the secondary lumen and setting the ventilator to pause if the pressure rises above a safe level.

The Hunsaker Mon-jet tube in conjunction with an automated jet ventilator, has been successfully used in most types of microlaryngeal surgery work, including in patients with severe co-morbidities, obesity and difficult airway access. Only 2% of patients required change to ETT.

High frequency jet ventilation HFJV is generally considered safer than other forms of supra or infra-glottic high pressure source ventilation (HPSV)[26]. HFJV provides good MV with adequate CO2 elimination[27] (typical starting settings: 150cpm, I:E, 0.5, driving pressure 1.5 – 2.0bar, 100% O2).

Laser airway surgery

Historically CO2 laser – line of sight via microscope and surgical laryngoscope. Now Nd-YAG used for subglottic and tracheal surgery since it can be directed down an optical fibre placed through the working channel of a fibrescope. KTP laser is also focused through an optic fibre but photo-ablates much more superficially, so can be used in the airway with local anaesthesia +/- sedation, potentially in an outpatient setting.

Laser Airway Fire

- 0.14% of CO2 laser operations.
- O2 (or N2O) + fuel (ETT) + ignition -> burn++ (and toxic fumes)
- Cuff deflation -> Incr O2 at operation site

Prevention: Protect ETT
Venturi/jet ventilate
Intermittent apnoea / spont vent.
Low FiO2
"No Volatile" - toxic products

ETT metalised foil tape – historical method
Integral laser resistant coating – Xomed Laser-Shield
Metal tube- 'Laser-flex': Mallinckrodt with 2 cuffs
'Fome-Cuf'
All are relatively resistant. None are licensed for use with Nd-YAG laser.

High Pressure Source Ventilation (HPSV)
- Supra-glottic jet ventilation or Infra-glottic catheter (Hunsaker Mon-jet)
- need high cost high frequency ventilator
- need IV anaesthetic
- need relatively compliant lungs
risk barotrauma, pneumothorax, crepitus, gastric distension.

Apnoea or Spont Vent
Via surgical laryngoscope
+/- O2 catheter or O2 insufflation

Treat Airway Fires: Surgeon reports.
Stop ventilation / disconnect
Extinguish flames – Drench area with saline
Remove burning material into bucket of water
100% O2 via face mask
Continue anaesthetic -> direct laryngoscopy, rigid bronchoscopy +/- fibreoptic to assess damage.
? re-intubate, prolonged IPPV.

Free flap surgery

Pre-op assessment: Multiple potential co-morbidities. Older smokers. 9% incidence of post-operative systemic medical complications. Meticulous pre-operative preparation would include optimisation of medical conditions, evaluation by nutritionists and physiotherapists and pre-operative preparation and selection of the appropriate surgical procedure[28].

Blood Pressure Control: From physiological first principles, both hypotension and use of vasopressors could adversely affect flap flow. There is some evidence in animal models that vasopressors can cause vasoconstriction in the microcirculation of the flap. In clinical studies use of vasopressors does not seem to affect early flap failure.
Dobutamine in high doses has been shown to increase flap flow when measured by in-situ ultrasonic flow meters. This, however, also resulted in what would probably be clinically unacceptable increases in CI and HR in a potentially vulnerable patient group. Noradrenaline has also been shown to increase CI and free flap blood flow.
"In practice the basis of intra and post-operative management is the maintenance of normothermia, normo- or mild hypervolaemia, low blood viscosity and reduction of systemic sympathetic stimulation[29].

Fluid Therapy: Excessive crystalloid infusion has been associated with poor flap outcome, possibly due to increased flap oedema and increased risk of thrombosis[30]. Most anaesthetists aim for +ve balance 0-2L for the case.
Transfusion trigger should be low, as viscosity, and therefore flap flow, improve with a lower haemoglobin. All patients should be kept normothermic.

Post-operative Care: Despite the length of most operations there is no specific need for post-operative ventilation. HDU may be required for monitoring and maintenance of BP and for monitoring of flap perfusion.

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LMA for ENT

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Regional Anaesthesia Update - Simple Steps to a Safer Block

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This talk is aimed at both regional enthusiasts and occasional-ists alike. The main aim is to outline the evidence on enhancing safety in regional anaesthesia, primarily in the avoidance of neurologic complications, as well as local anaesthetic systemic toxicity. I will discuss a number of techniques that may help reduce these risks, according to our current knowledge.

It was established in the 1970's by Dag Selander that intraneural injection caused both functional and histological adverse outcomes[1]. It was generally assumed that intraneural injection was the cause of post-operative complications, and that assumption carried through the landmark-guided and nerve stimulator phases.

In 2006 Paul Bigeleisen published a paper in which he described intentional intraneural injection for his axillary blocks in 26 patients[2]. The majority described paraesthesia or dyaesthesia, and in about 50%, the symptoms increased during injection. He followed them up at 6 months and none of the patients had any permanent neurological deficit. This study (despite some methodological limitations), suggests that intraneural injection does not invariably lead to neurologic injury.

This may be explained by the structure of a nerve. An intraneural injection may be intra-fascicular or extra-fascicular. It is suggested that the high pressure required to inject within the poorly compliant perineurium (i.e. an intrafascicular injection) may herald the increased likelihood of nerve damage.

This was explored by Hadzic et al in 2004[3], where they used a microscope to position a needle either intra- or extrafascicularly in surgically exposed canine sciatic nerves. They found the extrafascicular injections routinely had a low injection pressure (<4 psi), a normal functional recovery and normal histology. The intrafascicular injections fell into two groups: those that had a low injection pressure and essentially behaved like extrafascicular injections; a those that had a high injection pressure (>25 psi), which showed severe neurological injury clinically and histological evidence of injury. This suggested that the high injection pressure did indeed predict poor outcome.

The same group repeated their experiments in 2007[4] and showed the same outcome, although with a lower incidence of high pressure injection in the intrafascicular group (40% vs 60% in 2004).

Another study from Duke University in 2010 used ultrasound to locate femoral and brachial plexus nerves in pigs, impaled and injected the nerves using a short-beveled needle[5]. Dye tests later revealed that none of the injections were intrafascicular despite all being intraneural. Two injections recorded an injection pressure of greater than 25psi, showing that there is a false positive rate for high pressure injections indicating intrafascicular injection. The fact that there were no intrafascicular injections probably relates to the short beveled needle, a theory backed up by experiments showing that a short beveled needle is likely to push the fascicles away as it traverses a nerve, whereas a long beveled needle is more likely to penetrate the fascicle[6].

However, if a short beveled needle does enter a fascicle it is more likely to cause more severe damage[7].

A study by Chan et al[8] showed that low pressure intraneural injection in pigs did not cause any functional adverse outcome, however histological signs of inflammation were detected.

This animal evidence suggests that the monitoring of injection pressure, or the limitation of injection pressure below a safe threshold may reduce the incidence of poor neurological outcome after peripheral nerve blockade.

One cheap, easily taught and reproduced method to limit injection pressure is the Compressed Air Injection Technique[9]. 10mL of air is introduced above the fluid in the syringe (I use a 30mL syringe using 20mL of fluid and 10mL of air), the syringe is inverted to have the air at the top, the air is compressed to 5mL to initiate the flow of fluid. This follows Boyle's Law, in which pressure x volume is constant. The volume is halved so the pressure is doubled, to 2 x ATM. The net pressure felt at the needle is 1xATM (as the pressure in the needle is already at atmospheric pressure) which is 760mmHg or 14.7 psi, much less than the 25 psi thought to cause damage as part of an intrafascicular injection. This will also slow the injectate rate down, which will reduce the maximum concentration of the local anaesthetic[10]. A recent letter suggested the initial injection of the test solution be carried out using this technique[11].

The initial solution I inject is a non-local anaesthetic solution. This is for several reasons: it ensures the correct location of the needle tip prior to using the local anaesthetic, thus avoiding any wastage of local anaesthetic. The use of a test solution also allows hydrodissection to be performed, again without incorrectly placed local anaesthetic. Saline has been shown not to cause any functional or histologic damage when injected intrafascicularly[12]. It also gives a margin of safety in case of intravascular injection. Having said that, a relatively large dose, ie 60mg of ropivacaine consistently produces symptoms of mild CNS toxicity in young healthy volunteers, in unpremeditated patients as well as those who have received midazolam[13]. This means a large volume ie 12mL of 0.5% ropivacaine can be injected with only mild CNS symptoms, although that dose may be a lot lower in elderly or frail patients[14].

The initial test solution that I prefer is 5% dextrose. This allows nerve stimulation to be performed after the solution has been injected. The reason for this is that 5% dextrose is a non-conducting solution, so the current density is maintained at the tip of the insulated needle[15]. Saline and local anaesthetics conduct the current so the current density is greatly reduced, and is not enough to stimulate the nerve, even though the needle might be right next to the nerve.

Nerve stimulation is still a potentially useful tool for detecting intraneural injection. Chan et al showed that a low minimum stimulating current (MSC) was not a great predictor of intraneural placement in pigs[16]. A twitch with an intraneural injection was obtained with an MSC of 0.2mA or less in less than a third of cases, and greater than 0.5mA in 50% of cases.

A study by Tsai et al[17] showed that as the needle approached a nerve the lowest current that could elicit a twitch was 0.24mA, however inside the nerve the twitch could be elicited by a current as low as 0.08mA, but in one out of eight cases, the MSC was greater than 0.8mA.

A study by Bigeleisen[18] in humans demonstrated that an MSC of 0.2mA is only achieved with an intraneural injection in the brachial plexus. This study, however, has been the topic of debate given that he is describing an intra-plexus injection, rather than an intraneural injection[19,20].

Thus, as another tool in the prevention of neurologic injury, a nerve stimulator can be used with a current set for 0.2mA. A lack of twitch has no value (you could be intraneural with no twitch), but a twitch at that current can only be coming from an intraneural needle tip position.

Another potential use for the nerve stimulator is the measurement of impedance that is produced by some devices, such as the Stimuplex HNS 12 from B-Braun. Tsui et al[21] was able to show that the interior of a nerve has a higher impedance than tissue outside of the nerve due to a difference in water and fat components. No absolute numbers have been shown and there was a high variability in the numbers produced, so a relative increase may indicate intraneural needle placement, but further investigation is required.

Ideal placement of local anaesthetic in the correct plane under ultrasound is key to both a safe and effective block. In a single nerve, subepineural injection can be identified by nerve swelling, and as little as 1ml has been able to be detected in animal studies[22]. In humans, as well as being able to visualise the needle within the substance of the nerve, an increase in the nerve diameter, separation of the fascicles and a 'halo' appearance are all suggestive of a subepineural needle position. The issue becomes less clear with a double nerve i.e. the sciatic nerve and multiple nerves as contained within the sheath of the brachial plexus. In the case of the sciatic nerve, a paraneural sheath, which surrounds the epineurium of both the common peroneal and tibial nerves has been identified[23]. Injection into this space, instead of the subepimysial space appears to have improved spread and block dynamics. With regards to the brachial plexus, the prevertebral fascia or the axillary sheath can be breached to enter the area containing the extraneural connective tissue. Injection here will cause an expansion of the whole complex under the fascia, whereas the individual nerves will remain the same size[20]. This does not necessarily imply an intraneural injection, although several authors interpret this as one[18,24].

Of course simply using the ultrasound does not exclude an intraneural injury. A recent study comparing different methods of injecting around the sciatic nerve showed an unintended subepineural injection in 8% of patients[25].

However, if you combine these techniques, using 5% dextrose as the initial test solution to allow low current nerve stimulation prior to a pressure limited injection, in the correct plane under ultrasound, ensuring that no individual nerve swelling is visualised, you have taken several steps to make the block as safe as possible, according to our current understanding.

Please note there are other safety issues that have not been discussed including asleep vs awake patients, intravascular markers such as adrenaline and safe doses of local anaesthetics.

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Selected Vignettes from Paediatric Anaesthesia

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What's changed in paediatric anaesthesia recently? Not a lot really! What follows are a few anecdotes derived from the literature and used by me clinically.

Cuffed ETT's

The use of cuffed ETTs in Paediatric Anaesthesia is now common place within Australasia and supported by safety data (1). Monitoring of cuff pressure seems wise but is not universally accepted as a standard of care. SPANZA member's use of ETT cuff monitoring is currently being surveyed by von Ungem-Stemberg et al as an area of controversy within Paediatric Anaesthesia.

Intermittent gauge monitoring of ETT cuff pressure appears common with an aim of keeping pressure < 30cm/H2O. Cuff pressure would be expected to increase with time as a consequence of temperature and the use of N2O. Kato et al (2) showed that ETT cuff pressure changes when the head is moved from the neutral position and is usually up (68%). Pressure may rise by more than 20cm/H2O in some cases (7%) and children less than 8 years appear susceptible. A validated continuous electronic monitoring device used by authors will be demonstrated as an alternative to a gauge.

CVL fixation

Tunnelled internal jugular central venous lines are now our preferred continuous venous access device (CVAD) at Waikato Hospital for children. Malbezin et al (3) paper of over 20 years' experience illustrated 4920 IJV tunnelled lines with a 99.5% success rate.There was a 1.3% complication rate of which 0.6% were venous malposition, 0.5% were failure to cannulate (a learning curve) and 13 life threatening complications. How IJV lines are tunnelled at Waikato will be demonstrated using Cook PICC and Arrow PICC Seldinger Conversion sets. I recommend a review article by Gibson et al titled "Misplaced central venous catheters: applied anatomy and practical management" (4) for all. When selecting the "system", choose the line you want to place first, then select the sheath that will be used in the neck and finally, consider how you will tunnel (Ian Smith RCH).

Airway management for the solo anaesthetist

A dilemma for the solo Anaesthetist following a gaseous induction in a child is, "do I hand the airway over to a non-Anaesthetist and risk loss of the airway while I seek IV access or do I ask another theatre staff member to obtain IV access that may be difficult"?

Another option is to secure the airway with a LMA or ETT and then seek IV access yourself. Intubation may be achieved with deep inhalational anaesthesia using IM suxamethonium as backup. In a RCT by Verghese et al (5) a technique using nasal remifentanyl 4 mcg/Kg demonstrated acceptable intubating conditions in 91.7% at 3 minutes. My experience with this technique will be outlined.

Reducing day of surgery cancellation

Cancellation on the day of surgery impacts on theatre efficiency and is socially disruptive for the child and family. Von Ungem-Stemberg et al (6) in a one year prospective cohort study defined which children were at risk of perioperative respiratory events and the duration of risk. We adapted these findings in a preoperative telephone questionnaire with the purpose of reducing the day of surgery cancellation. This questionnaire, process and results will be presented.

Anaesthetic management for endoscopy

Endoscopy is a frequent intervention requiring Anaesthesia support in children. Usually this is General Anaesthesia where the children's airways are managed with an ETT or LMA. An alternative approach is using sedation and my current regimes are "Remifol" and "Ketafol" (7) .

"Remifol" (personal communication Charles Berde to Brian Anderson)

- > 10 years add 50mcg Remifentanyl(1ml) + 19ml Propofol 1%
  - Starting 175mcg/Kg/min (40 Kg = 42mls/hr)
- < 10 years add 100mcg Remifenanyl(2ml) + 18 ml Propofol1%
  - Starting at 150mcg/Kg/min (20Kg = 18mls/Hr)

For "Ketafol" both drugs are context sensitive and the chosen ratio of Propofol:Ketamine depends upon the analgesic requirement and the impact of duration of procedure on wake up times. I use 10:1 Propofol:Ketamine for Endoscopy. Following Propofol 2.5mg/Kg induction, calculate mls/hour of Ketafol on Propofol dose of 15mg/Kg for 15 minutes, then 13mg/Kg for 15-30 minutes, then 11mg/Kg 30-60 minutes and 10mg/Kg thereafter (8). Always titrate to effect!

The power point presentation is available on request from AQUA.

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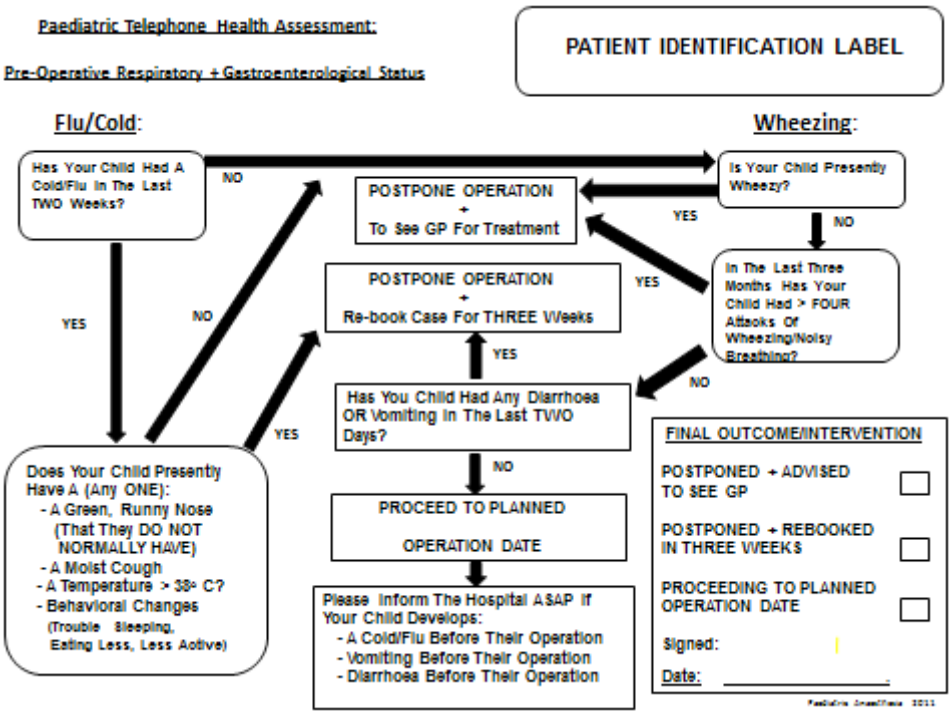

Major complications of airway management in the UK The Fourth National Audit Project.

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Introduction

The Fourth National Audit Project (NAP4) collected data on airway management techniques in use throughout the UK, and case reports of adverse incidents (inclusion criteria **table 1**) occurring in the Emergency Department, ICU or during anaesthesia over one year (1,2,3,4).

Inclusion Criteria
An airway problem resulting in;

1/ Death
2/ Brain damage
3/ Emergency surgical airway (ESA)
4/ Unanticipated ICU admission

Table 1

Major Airway Complications during Anaesthesia Reported in the UK

Death	1:180,000
Death or Brain damagE	1:151,000
ESA	1:50,000
Any major complication	1:22,000

Table 2

Airway complications during anaesthesia

The project received 184 reports in total; 133 came from anaesthesia which included 16 deaths, 3 patients with persistent neurological deficit and 58 attempted surgical airways. The outcomes recorded from the ICU and ED tended to be more adverse. The point incidence of complications during anaesthesia is shown in **table 2**. It is unlikely that every case meeting the inclusion criteria was actually reported to the project and the incidence of one death from an airway problem per 180,000 general anaesthetics represents an underestimate. On average 2.9 anaesthetists were involved in each event reported, therefore, the risk of an anaesthetist encountering a complication meeting each inclusion criterion is 3 times higher than expected for a patient.

Findings and recommendations

The main benefits of this project come from the systematic and detailed analysis of the individual reports. In one-third of cases the care provided was considered to be poor, but in one-fifth, care was considered to be good and in the majority of cases there were elements of both good and poor care.

Airway management strategy

An airway management strategy requires a logical sequence of plans or techniques aimed at; maintaining oxygenation, preventing aspiration and avoiding airway trauma. In some cases there was little anticipation of the possibility of failure, some anaesthetists followed plans which were poorly suited to the patient's clinical problem and in others plans failed where equipment or personnel were not available when needed.

Airway assessment

The cornerstone of airway management is assessment which was often poorly performed or not recorded. It is important to identify those patients who are incompatible with standard airway management algorithms and poor performance was evident in this area. Airway difficulty is increased by problems with; 1) mask ventilation, 2) LMA insertion, 3) tracheal intubation, 4) direct tracheal access. In addition, an assessment of the aspiration risk and of a patient's ability to co-operate is also required to develop the safest strategy.

Aspiration

This was the commonest cause of death reported to NAP4 and the assessment of aspiration risk was found to be poor.

In some patients at very high risk of regurgitation and aspiration, routine precautions such as gastric drainage, rapid sequence induction, or tracheal intubation were omitted. Some patients with intestinal obstruction were managed with no precaution against aspiration. In patients at lesser risk, steps to reduce aspiration by pharmacological means or by the use of a 2nd generation supra-glottic airway (SAD) were not taken. Trauma and opiate medication may lead to gastric stasis and regurgitation. Where this was not considered or it was ignored, aspiration occurred.

Supra-glottic airway devices

Deaths were reported where SADs were used inappropriately, for example in morbidly obese patients in the lithotomy position, or in patients at high risk of aspiration. SADs were employed to avoid tracheal intubation in some patients with an anticipated difficult airway with no obvious backup plan when the device was displaced. SADs may act as a useful conduit for tracheal intubation which was most successful using a fibrescope and an Aintree catheter. If this technique had been used in some patients instead of prolonged ventilation via SAD cases of aspiration, fatal airway obstruction and surgical airways might have been avoided.

Known or anticipated difficult airways

Awake intubation and awake tracheostomy were under-utilised; several patients with obvious potential difficulty might have been protected by the use of awake intubation rather than general anaesthesia. In others, where awake fibreoptic intubation (AFOI) was attempted the airway became obstructed; notably sedation led to complications with AFOI. Awake intubation may fail, its safety relies upon the fact that spontaneous ventilation is maintained and the option of regrouping or abandonment is available. A plan in the event of failure should be decided and communicated at the outset. Over-sedation can result in airway obstruction or central apnoea, placing the patient in a perilous position, at an even greater risk than if general anaesthesia had been induced after thorough pre-oxygenation. Complicated sedation techniques or difficult patients are best managed by a 2nd anaesthetist with sole responsibility for maintaining oxygenation and sedation. Unnecessary selection of the nasal route led to failures of awake intubation, as in these patients either the tracheal tube would not pass through the nose, or excessive bleeding led to airway compromise. All departments of anaesthesia should ensure patients have access to skilled awake intubation if needed and provision should be made to support anaesthetists who need assistance in providing this standard of care.

Regional anaesthesia could have prevented some serious complications which developed under general anaesthesia, however, loco-regional anaesthesia needs to be carefully conducted. Several patients with an anticipated difficult airway ran into problems when it was necessary to convert loco-regional anaesthesia to general anaesthesia. Intraoperative conversion to GA is higher risk than gaining control of the airway before starting surgery. For regional anaesthesia in patients with a known difficult airway a clear plan for block failure should be formulated and communicated with the whole theatre team. The quality of the block must be confirmed before starting and a competent surgeon capable of performing the surgery in the time available is needed.

Supra-glottic airway devices were used as an alternative to tracheal intubation in some patients with anticipated or unexpectedly difficult airways. Deaths occurred in such patients where a device became displaced or obstructed and rescue techniques failed.

Abnormal BMI

Patients with high or low BMI were disproportionately represented in NAP4 reports. Patients of normal habitus who were not underweight or obese accounted for relatively few reports. Obese and morbidly obese patients were respectively reported to NAP4 twice and four times as often as would be expected from their prevalence in the UK national population. The options for airway rescue need to be carefully evaluated. Where rescue techniques are assessed as difficult or problematic, awake intubation or regional anaesthesia should be considered. Morbidly obese patients require more time for assessment and adequate discussion of the options for anaesthesia. Planning for operations, including minor surgery, must recognise the additional time and resources needed to safely assess and to anaesthetise the morbidly obese patient.

Head and neck surgery

Patients with head & neck pathology frequently developed airway obstruction and carried the highest risk of CICV. Pre-assessment was considered to be poor as was planning and communication about this group and this applied at both induction and to the recovery period leading to adverse outcomes. Airway tumours, particularly those producing airway obstruction, should be assessed with airway radiological investigations and supplemented by nasendoscopy and a team approach taken if necessary with prior group discussion. Awake tracheostomy was apparently under-utilised but could have prevented some serious complications, particularly in those patients with severe airway obstruction and stridor.

Emergence and recovery

Approximately one-quarter of complications occurred at the end of anaesthesia. All cases resulted in airway obstruction with operations in or around the airway, particularly involving bleeding commonly featured in this group. Anticipation of problems was poor which was most surprising when difficulty had already been encountered at induction. Some patients were well managed by controlled extubation in the operating room followed by a period of observation prior to transfer to PACU but better communication of problems to recovery staff could have improved care. In those patients with a difficult airway who are unsuited to routine rescue techniques, post-operative instructions on what to look for, a plan of management, equipment needed and location of skilled personnel should be communicated to recovery or ICU staff.

Post obstructive pulmonary oedema occurred in 13 (10%) anaesthesia cases reported to NAP4 and this was associated with one death. A number of these cases could have been prevented by the use of a bite block or 2nd generation SAD to prevent airway occlusion by a patient biting down on an artificial airway.

Airway trauma

Repeated attempts at tracheal intubation led to the development of CICV. Several cases of failed tracheal intubation followed a recent difficult but successful tracheal intubation where swelling may have complicated their management. Previous difficulty by a trainee was ignored by seniors who then ran into problems themselves. Airway trauma at induction, if followed by a period of extreme Trendelenburg, led to cases of postoperative airway obstruction necessitating intubation or tracheostomy. High pressure oxygenation via an airway exchange catheter resulted in bilateral pneumothoraces. One tracheal tear and a case of severe airway haemorrhage were attributed the blind use of a bougie.

Capnography

Capnography was used in all anaesthesia cases but several deaths followed when an absence of detectable CO_2 was erroneously attributed to cardiac arrest, this delayed recognition of tracheal tube obstruction or oesophageal intubation. An absence of detectable CO_2 indicates non-ventilation of the lungs due to tracheal tube misplacement or total airway obstruction.

Emergency surgical airway

NAP4 reviewed 80 cases involving an emergency surgical airway, 58 during anaesthesia. Needle crico-thyroidotomy was favoured by anaesthetists of which 60% failed with fine bore techniques having the highest failure rate. The opportunities for failure are multiple, including misplacement, device malfunction and misuse. Surgical tracheostomy or crico-thyroidotomy carried the highest success rate. Insertion of a supra-glottic airway or administration of a muscle relaxant might have enabled pulmonary ventilation in some patients and these should always precede an emergency surgical airway in the management of CICV.

ICU and ED reports

Of the 184 reports 36 came from ICU and 15 from emergency departments (ED). Using appropriate denominator data for the ED (5) and ICU (6) airway management interventions were respectively 36 times and 56 times more likely to result in major complications than during anaesthesia.

ICU

Displaced tracheostomy tubes and to a lesser extent displaced tracheal tubes were the greatest cause of morbidity and mortality in ICU patients. In the cases reported, planning for the management of airway problems was poor, most notably in those patients who were admitted for the management of prior airway problems and in those patients on the ICU in whom airway management problems had already occurred. All patients dependent on an artificial airway should have a re-intubation plan with the appropriate equipment immediately available.

Continuous capnography in the ICU would have facilitated the earlier detection of some airway events or recognition of failed rescue attempts. The absence of capnography contributed to 70% of ICU related deaths.

Emergency department

Inexperienced practitioners, unfamiliar or absent equipment and poor access to skilled help were considered to be factors contributing to complications. In the Emergency Department oesophageal intubations were missed due to failure to use capnography.

Conclusion

Airway management in the UK could be safer. The problems reported in the UK may occur in other countries, even in those with better training, equipment, or skills and complacency is a serious threat to safer airway management. Throughout their careers most anaesthetists and in particular those who work in ICU or emergency medicine, can have a real expectation to be involved in multiple airway events of the type collected by the NAP4 project.

More Information

The full 220 page report can be freely downloaded from the Royal College of Anaesthetist's web-site at the address provided in reference 3.

Powerpoint presentations made for the release of the NAP4 report can be viewed or downloaded from (https://rayzume.com/NIAA/article.php?newsid=515) accessed 29/07/2014.

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Transfusion Update: Bleeding is out, your own blood is in

Emma Patrick

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The last 4 years have seen a paradigm shift in our approach to managing bleeding and transfusion practice. This brief presentation will aim to look at some of the changes in blood product management and our challenges for the future.

Australasia is at the forefront of a worldwide move towards blood conservation strategies that has seen a steady decline in the use of packed red cells by 8.9% between 2010 and 2012. There appears to be no slowing of this trend in 2014. Research continues to demonstrate that conservative red cell transfusion strategies in the majority of anaemic post-operative patients does not appear to affect outcome in terms of morbidity, recovery or quality of life (So-Osman et al 2012 Blood Transfusion 11:289-95). There are always exceptions to the rule and those with critical and acute ischaemic cardiac states should perhaps be considered for a higher transfusion threshold. Recent publications have looked at transfusion thresholds and outcomes in GI bleeding and again support a conservative policy (2)

Massive transfusion protocols

Massive transfusion protocols (MTP's) have become widespread in their clinical application in the last 4 years. The initial studies by Holcomb examining outcomes from US trauma centres supported early initiation of red cells and coagulation products in severe trauma. Military studies from Iraq and Afghanistan further supported the concept that a 1:1:1 "balanced" transfusion practice in major haemorrhaging trauma appeared to confer a survival benefit.

New evidence suggests there is potential for harm from over transfusion. We need to avoid missing early cues to tailor product selection to target specific coagulation defects. MTPs must be used in association with clinical judgment for the best outcome. The rise of point of care coagulation testing is of great value in this process however it remains in the domain of mostly tertiary centre's so we cannot discard the standard coagulation testing available to the majority of hospitals.

WE still await a true RCT indicating the benefits of 1:1:1 therapy, but the PROMMTT study (13) did show patients with a better than 1:2 ratio of products had a 3-4 times less likelihood of dying than if the ratio less dominated with plasma compared to red cells. The forthcoming publication of the PROPPR study looked prospectively at the different outcomes in fixed ratio options for MTPs. The results could define better what we put in the boxes in future hospital MT protocols.

Fibrinogen appears to have a critical role in the management of massive haemorrhage with the target fibrinogen higher than previously suggested. It appears especially important in the context of massive obstetric haemorrhage.

If fibrinogen is the most important clotting product to support in exsanguination, and we can provide a ready source of it in cryoprecipitate, or fibrinogen concentrate, the question then becomes why not just use that initially to manage the patient until surgical control can be obtained. As fibrinogen concentrate is stable at room temperature, and does not require ABO typing, it offers a different management pathway for massive bleeding. Its' dosing can be controlled by traditional coagulation testing (the Von Clauss fibrinogen level) or integrated into TEG or ROTEM (the functional fibrinogen, FF TEG, or FIBTEM). There is the potential for goal directed therapy using POC devices as a real alternative to the empirical treatment with a MTP providing fixed ratios. Initial studies are encouraging (14), but currently fibrinogen concentrate is not manufactured in Australasia, and the cost of the products is high. Cryoprecipitate in New Zealand is obtained for plasmapheresis from high fibrinogen level donors and provides a high quality source of fibrinogen to use in massive bleeding. One single donor plasmapheresis unit contains up to 1.6G of fibrinogen.

Acute trauma coagulopathy

This appears to have a role in the evolution of acute hypofibrinolysis, leading to early death in severe trauma. A combination of tissue injury and shock appears to drive an endogenous process involving activation of Protein C that promotes early coagulopathy (7). Fewer than 25% of trauma patients will present with ATC and of those, the expected mortality is in the order of 50%. Therefore early detection of coagulopathy, targeted treatment with blood products, early tranexamic acid and careful yet aggressive management of acidosis, thermoregulation and continuing blood loss should be targeted at this cohort of patients.

Tranexamic Acid

Crash 2, MATTERs and MATTERs II study and the forthcoming WOMAN Trial and CRASH 3 provide new information on the role of TXA. Initially designed over 50 years ago for the treatment of post-partum haemorrhage, we have come full circle with tranexamic acid. It has become integrated into routine joint replacement surgery, to reduce intra-operative and post-operative bleeding and is currently being examined for its role in managing post-partum haemorrhage and traumatic intracranial bleeding. Despite ongoing concerns regarding thrombotic events these have not born out in the literature. There is evidence that lower doses at 10mg/kg bolus are sufficient to decrease acute fibrinolysis, and at higher doses it is associated with seizure activity. It should be used at a lower dose and with caution in patients with significant renal failure.

Novel Oral Anti-Coagulants (NOACs)

These agents pose a significant challenge for the acute anaesthetist. Dabigatran is a direct thrombin inhibitor licensed for prevention of thrombotic events due to non-valvular atrial fibrillation. Rivaroxaban and apixaban are factor Xa inhibitors. They are licensed for use in the prevention and treatment of VTE after orthopaedic surgery. Currently neither of these drug classes require ongoing coagulation or therapeutic drug level monitoring according to the guidelines of use. In a small group of patients with AF and acute coronary syndromes we may see patients presenting on triple anti-thrombin therapy: aspirin, clopridrogel and dabigatran or warfarin.

The problems arise in that the group of patients most likely to be prescribed NOACs are precisely those more at risk of renal impairment, advancing age >75, intercurrent illness and polypharmacy leading to drug interactions (i.e aspirin). The benefit of reducing stroke must be weighed up against the risk of bleeding, without anti-dote or reversal available.

With the advent of prothrombinase complexes such as Prothrombinex and Beriplex and clear guidelines on warfarin reversal we have seen a marked drop in the consumption of FFP for acute bleeding in warfarinsed patients and an improvement in their management.

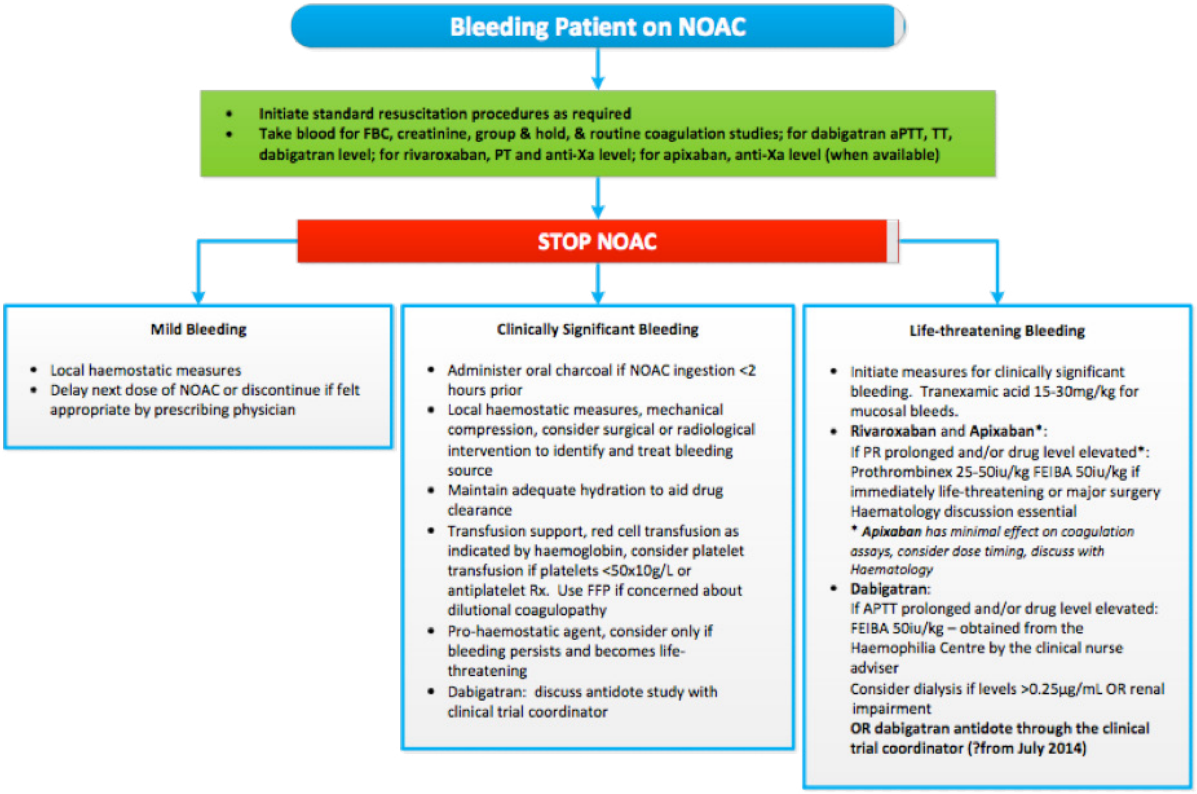
The challenge of managing bleeding patients, or patients requiring emergent surgery on NOACs remain. Monitoring of the residual effects of Dabigatran should include APPT, PR, and thrombin clotting time (TCT or TT). Some labs have the ability to provide a dabigatran level, and anaesthetists should use the APPT, TCT and dabigatran levels in assessing the bleeding potential of invasive procedures. The effect on coagulation factor correlated directly with dabigatran levels. An elevated APPT indicates dabigatran effect, with a linear relationship with dabigatran levels up to 200 ng/ml, and then a flattening of the curve occurs. However a normal APPT cannot assure an absence of dabigatran effect.

The thrombin time (TT) is an assay that assesses the activity of thrombin in plasma. The TT is sensitive to the effects of direct thrombin inhibitors, including dabigatran, and can be used to assess the presence of dabigatran in plasma. A linear relationship between the TT and serum dabigatran concentration has been observed. It is very much more sensitive to the presence of dabigatran and a normal TT (or TCT) indicates a lack of dabigatran effect.

A specific reversal agent is being developed. It is an Fab fraction that selectively competitively binds Dabigatran with a binding affinity many times greater then Thrombin. Reversal of the effects are near immediate. Phase 3 studies are currently ongoing with this agent, including in Australasian centres. The hope is a specific antidote for the reversal of Dabigatran may be available in the next five years. Orphan status has been obtained by the FDA for the accelerated regulatory approval of the drug.

Rivaroxaban has a shorter half-life than dabigatran, is less reliant on renal clearance and it can be monitored using a PT (INR) test, as it increases in a dose dependent manners. It appears that rivaroxaban may be more readily reversed using prothrombinex. A reversal agent is in development, a cyclodextran similar to suggamadex that should reverse the current market anti-Xa drugs.

It appears that transfusion of plasma and platelets is not effective unless for the management of haemorrhage, thrombocytopaenia or dilutional coagulopathy. While we wait for the magic bullet of a reversal agent, there may be some benefit in using 4 Factor prothrombinase complex (Prothrombinex -VF) , activated 4 factor prothrombinase (FEIBA) and activated FVIIa under haematology guidance as these would all be off label use. Activated charcoal can be given if the NOAC has been administered in the last 2 hours. Dialysis is effective at removing dabigatran (65% at 4 hours) . Maintaining a good diuresis is important for the renal excretion of these drugs. These complex cases must engage a multidisciplinary approach between anaesthetist, surgeon, haematologist and cardiologist to ensure the best possible patient outcome.



Resources:

NZ Blood Service Annual Haemovigilance Report 2012. Acknowledgement for graphical data for NZ blood product usage in presentation.

National Blood Authority: www.nba.gov.au

Excellent patient blood management guidelines available for critical care, critical bleeding , perioperative care and medical . Available as a free online resource for ipad and hard copies. Learning CME modules available. Obstetric and paediatric modules on their way.

Blood Safe elearning Australia: www.bloodsafelearning.org.au – useful app for management of Iron deficiency anaemia

HealthObs Ltd. Apps for current NZ guidelines for reversing warfarin and managing patients on dabigatran and Rivaroxiban

Transfusion evidence library. www.transfusionevidencelibrary.com. Comprehensive online database of systemic reviews and RCTs updated monthly. Membership required.

www.nataonline.com Review of recent research with synopsis and critiques of papers.
All aspects of transfusion discussed. Membership required for full access to resources.
Annual conference.

nata
Network for the Advancement of Patient Blood Management, Haemostasis and Thrombosis

www.canadianthrombosis.org For guidelines on NOAC reversal and summary of current evidence

http://www.escardio.org/communities/ehra/publications/novel-oral-anticoagulants-for-atrial-fibrillation/documents/ehra-noac-practical-execsumm-ehj-2013.pdf European guidelines on NOAC use in AF. Useful charts and management in renal failure.

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Neuroscience and Anaesthesia – Current and Future trends

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It is a fascinating time for neuroscience, with novel therapeutic techniques and good physiological and clinical research improving our understanding of the complexity of the human CNS.

Interventional stroke therapy (IST) has become a treatment standard in many centre's and yet controversy remains regarding clinical outcomes and the role of anaesthesia in managing stroke patients. Initial studies suggested inferior outcomes for stroke patients requiring general anaesthesia for clot retrieval in the neuroradiology suite compared to sedation only. Davis et al. (1), in a retrospective series, reported worse modified Rankin score at 3 months in GA patients (fig 1) but also reported significantly lower systolic blood pressures during treatment in the same group. This accorded with earlier work (Fig 2) from Leonardi-Bee (2) suggesting that optimal survival rates post-stroke correlated with a systolic BP of 140 -180mmHg. Further work is ongoing – RCT's on IST and anaesthesia vs. sedation for IST are in progress.

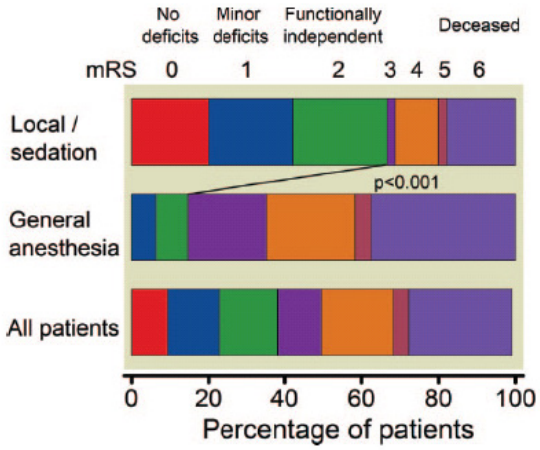

Fig. 1

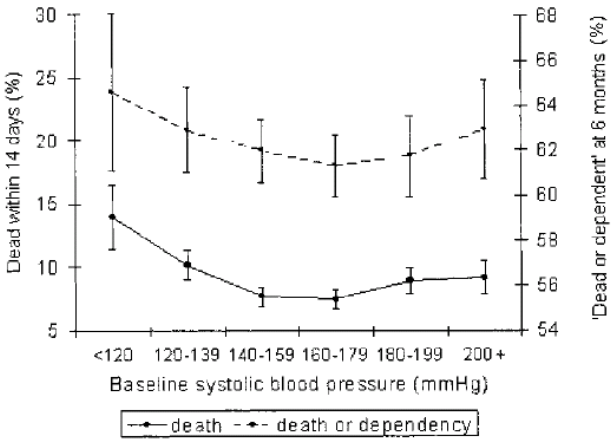

Fig. 2

Covert stroke after surgery and anaesthesia is now recognised as a potential cause of poor recovery, post-operative cognitive decline (POCD), depression, dementia and ongoing disability. The Framingham Heart Study (3) has estimated the covert stroke rate in the general population to be 12.3% (CI 10.9 – 13.8%), rising to nearly 40% after carotid stent procedures (4) and it is recognised that the covert stroke rate is many times higher than the published overt prerioperative stroke rate of 0.2 - 4.3%.

The NeuroVISION pilot study (n=70) found a 11.4% covert stroke rate post-surgery and the multi-centre prospective cohort study resulting from this finding is now underway. Patients >65 years having non-cardiac surgery will receive a diffusion weighted brain MRI between days 3 and 9 postoperatively. Primary outcomes are the impact of covert stroke on neurocognitive function at 1 year and a Montreal Cognitive Assessment Tool decrease of > 2 points.

Two related research topics have potential to alter our practice with regard to covert stroke. The first is a revision of the physiology of autoregulation of cerebral blood flow. Willie et al. (5) have produced a comprehensive review of the topic and the key messages from this review are that CBF autoregulation (CA) occurs over a much narrower range that was thought hitherto (Fig 3, new model on the right); there is important synergism and interdependence between CA and PaCO2 / PAO2 responsiveness; that the regulatory response is not solely at the micro-arterial level and that neurogenic control of CA is important. These are all important messages for anaesthetists.

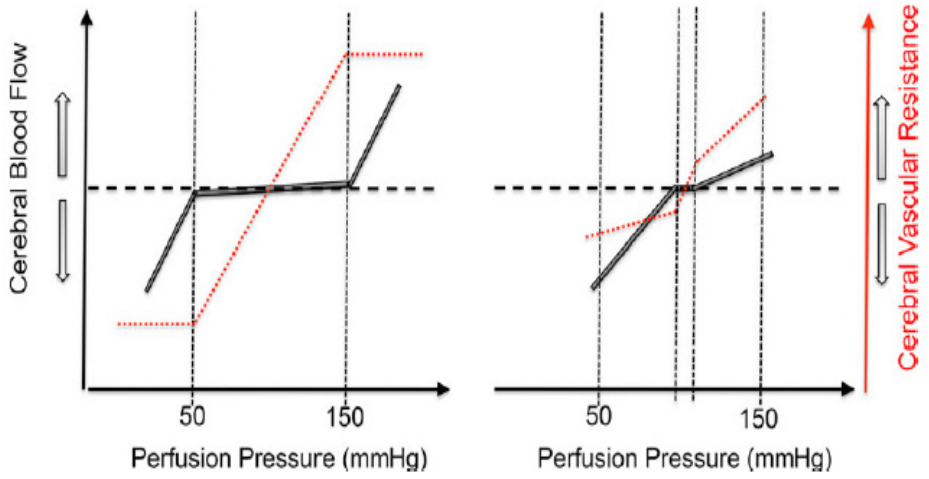

Fig. 3

Other work has backed up these assertions with clinical examples. Papers from Joshi et al. (6), Ono et al. (7) and Brady et al. (8) have demonstrated, using trans-cranial Doppler (TCD) and near infra-red spectroscopy (NIRS) techniques, that the lower limit for CA varies widely in patients undergoing cardiac surgery. Values for lower CA threshold ranged from MAP of 45mmHg to as high as 80-90 mmHg and indeed in some patients, there was no evidence of CA at any MAP value; that is their circulation was entirely pressure–passive. Figure 4 demonstrates a single patient trace with a lower CA threshold of 80mmHg MAP.

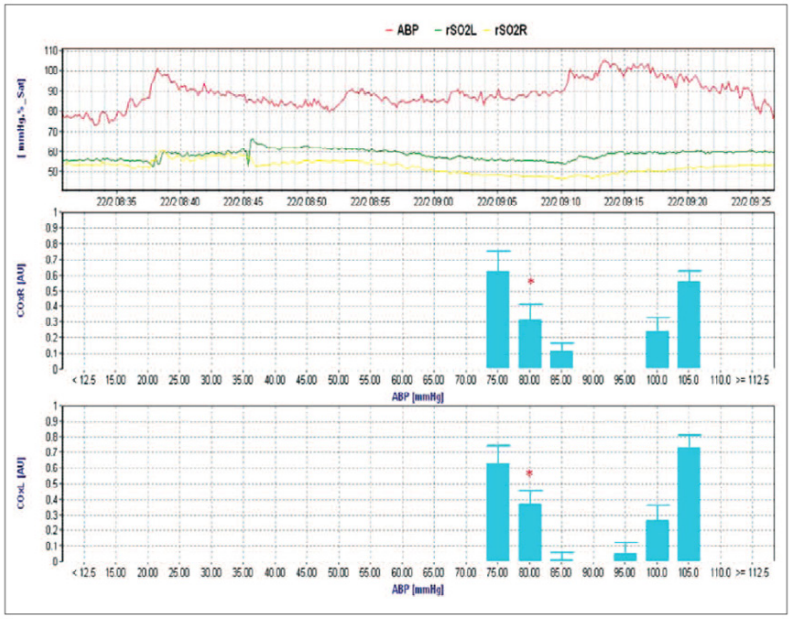

Fig. 4

A fascinating paper by Purkayastha et al. (9) looked at the association of impaired cerebrovascular haemodynamics and the development of white matter hyper-intensities that may represent covert stroke and found that changes in TCD pulsatility index may be a predictor of white matter damage, a potentially important tool for clinicians.

The second topic of interest is that of neuro-inflammation. It is now apparent that this process is a response to injury in the CNS, that it may be very long-lasting and that it may be a powerful cause of cognitive decline and dementia. The role and influence of glial cells, particularly M1 and M2 – type microglia (fig. 5) and astrocytes has been well elucidated in a review by Cherry et al. (10) and Johnson et al (11) have demonstrated that inflammation and white matter degeneration persist for many years after traumatic brain injury (TBI) in up to one third of patients, with striking histological evidence of corpus callosum volume loss (fig. 6 post TBI patients panels A,C,E, aged matched controls B,D,F).

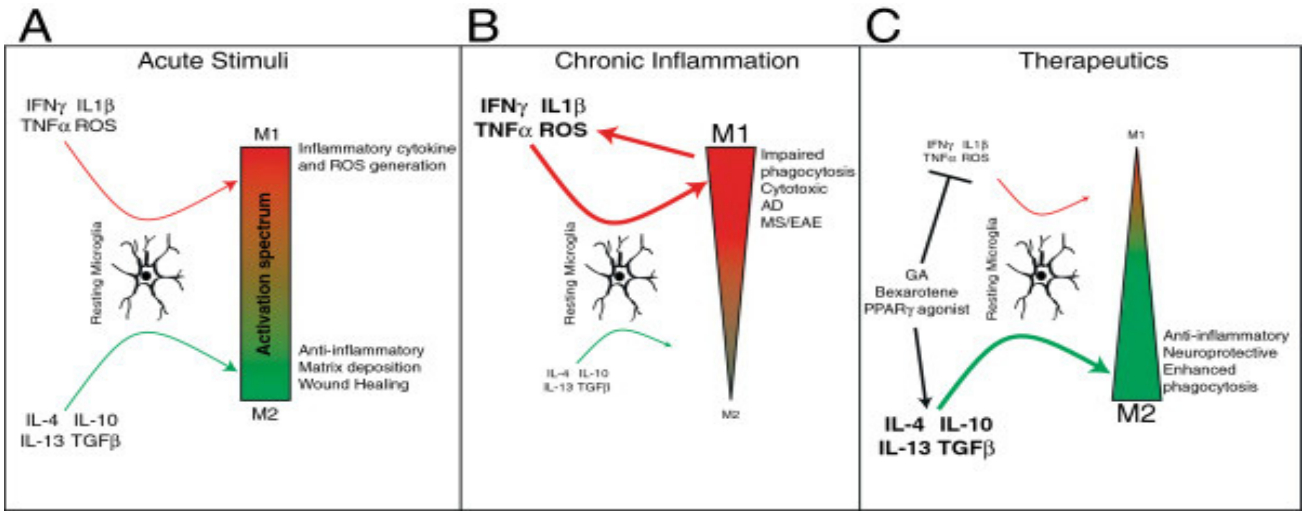

Fig. 5

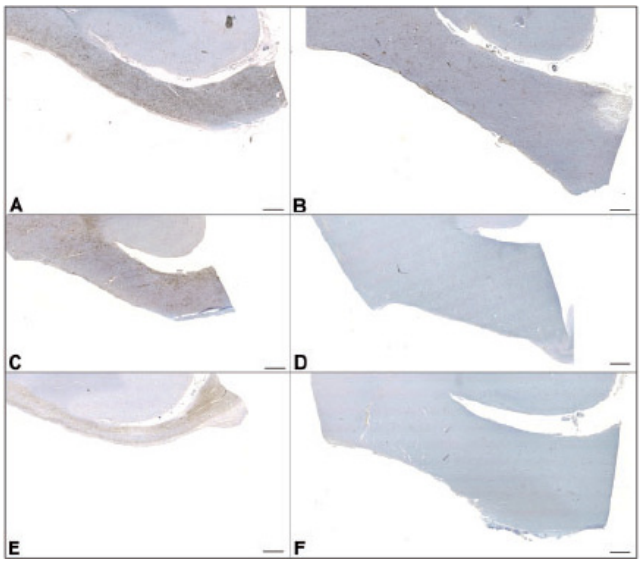

Fig. 6

Iliff et al. (12), in a fascinating paper, reviewed the evidence for a cerebral lymphatic system (the Glymphatic pathway, fig. 7) and its potential contribution to the blood brain barrier, recovery from (TBI) and development of chronic inflammation, cognitive dysfunction and dementia.

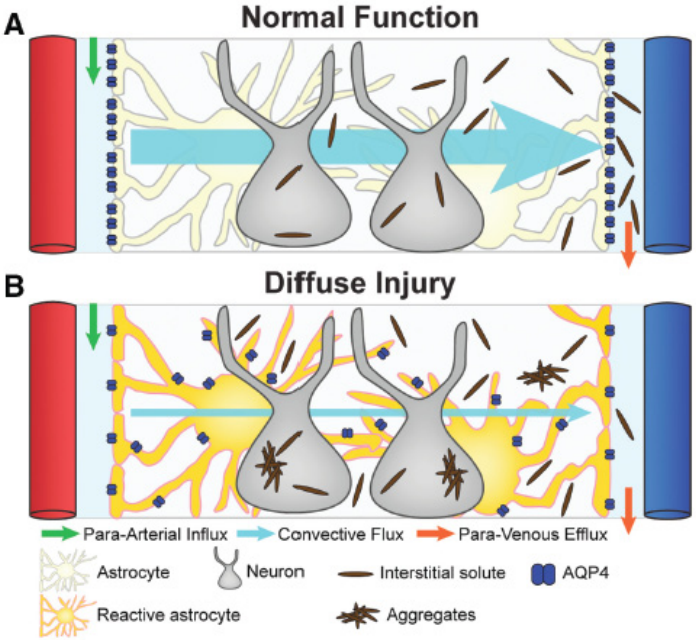

Fig. 7

Finally, anaesthetists are regularly exposed to significant levels of radiation in the neurointerventional suite (fig.8) and Anastasian at al. (13) have produced a nice review of these risks with compelling data.

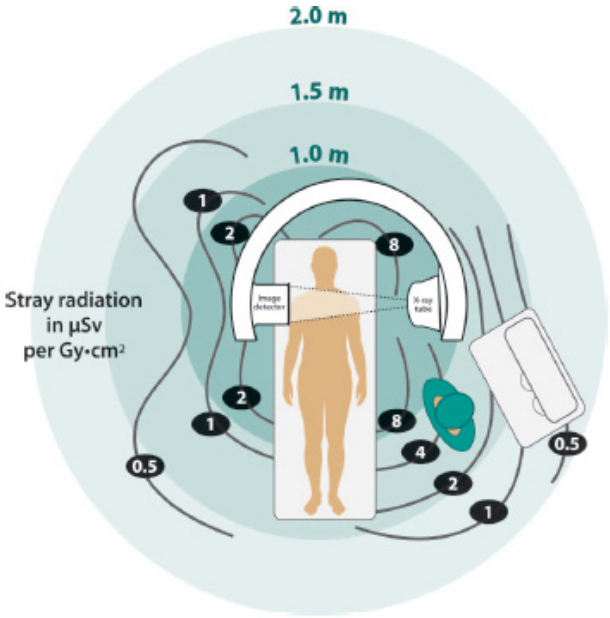

Fig. 8

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Update on Obstetric Anaesthesia

Sharon Rhodes
Auckland City Hospital

My presentation covers diverse current issues within obstetric anaesthesia.

- **Enhancing Recovery after Obstetric Surgery**

Well established for colorectal, gynaecological and urological surgery but can it be done after Caesarean Section?

- **Early Warning Scores in Obstetrics**

Recommendations of CMACH 2003-5; reiterated in CMACE 2006-8; NICE 2007
Currently no national MOEWS; a missed opportunity?

- **The Hypertensive Parturient**

A focus on Magnesium (not just for eclampsia/pre-eclampsia) and the dose of remifentanil to attenuate the hypertensive response to laryngoscopy and intubation.

- **The Haemorrhaging Parturient**

Postpartum haemorrhage and fibrinogen.

- **The Parturient with Headache**

The role of intrathecal catheters after accidental dural puncture, and, more controversially, prophylactic versus therapeutic blood patch.

- **Finally a few vignettes:**
  - Thiopentone -time to go?
  - Tailoring the Tilt
  - on Trial; Chlorhexidine; Remifentanil for labour analgesia
  - Technology: Echocardiography, Ultrasound scan and "the Reynolds Zone"

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Large trials – what have we learnt?

Doug Campbell
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Introduction

Large randomised controlled trials (RCTs) in anaesthesia and perioperative medicine are a relatively recent phenomenon. In comparison, large trials in cardiology have been around since the early 1990s. The practice of cardiovascular medicine is now guided by large trials and megatrials in a way that anaesthesia and perioperative medicine is not. Large randomised controlled trials are part of the future of anaesthesia and perioperative medicine. This talk will focus on some of the important lessons from recent clinical trials, concentrating less on the detail of individual trials and more on the general principles of what we have learnt. Moreover, I will outline many areas of uncertainty about current practice that demand RCTs and how each of us can engage and contribute to these projects.

Efficacy, effectiveness and safety

Well designed, highly controlled trials can demonstrate efficacy. Often the real-world application of the treatment is difficult and diminishes the effectiveness of the intervention. That is why many large trials are pragmatic and test real-world application of the treatment (1). Similarly, if you are going to assess the benefits you have to look for harms. Many small trials do not even report on harms so any subsequent meta-analysis will be flawed. Large trials are necessary to weigh up the risks and benefits. These principles will be highlighted by the IHAST-2 and POISE-1 trials (2, 3).

Fragility

The P value is one way to evaluate the findings of a RCT. Low event rates in the primary and secondary outcomes in anaesthesia trials means the statistical significance of a trial result hinges on small changes in numbers of outcomes (4). The B-Aware trial is an example of a fragile result whereby one more case of awareness in the treatment group would have made the result non-significant (5). The trials Fragility Index is 1. Trials with a fragility Index of 3 or less are considered fragile. Very few anaesthesia and perioperative medicine trials are not fragile. Fragility Index can be easily described in binomial outcomes or time to event. However the principle that one or two outlying results in a continuous outcome could change the statistical significance extends the fragility concept in this group also. Worked examples will be demonstrated during the talk.

Equipoise and clinician (un)certainty

The principle of clinical equipoise is the ethical basis on which patients can be allocated to both arms of the trial as there is genuine uncertainty as to which is better. The purpose of the trial is to answer this question. Before all of the trials described in the talk I had a clear sense that one arm of the trial was more likely to be superior. I was often wrong, indeed, my ability to predict trial results is no better than chance! The Expert Opinion study polled 500 ANZCA fellows in Australia and New Zealand to predict the results of the ENIGMA-2 trial (7). Nitrous oxide has been in use for over 160 years, is a fundamental part of our practice, its physiological and pharmacological properties are part of the exam syllabus and there is a recent large trial, ENIGMA-1, to base our prediction on. The results of this survey will be used to highlight the point that we should all be less certain about what we know.

Endpoints

Choosing the correct endpoint for the primary and secondary outcomes of a study is a key design decision. Unfortunately, anaesthesia and perioperative medicine are awash with inappropriate endpoints. Moreover, inconsistent definitions often mean comparisons cannot be made between very similar trials in the field. A recent review of intraoperative hypotension found 130 relevant articles with 140 separate definitions of intraoperative hypotension (8). Surrogate endpoints are frequently used where the relationship between the surrogate and a meaningful enpoint is often unknown or not fully elucidated (9). The extrapolation from trials with surrogate endpoints has sometimes been catastrophic. Other specialities are trying to define relevant and consistent outcomes and this process will start in our speciality soon (10).

Future trial design

Advantages of factorial, step wedge and cluster randomised crossover trials will be discussed and why these might be the future of research in our speciality. Examples of each will be supplied with descriptions of their advantages and disadvantages. Where a trial is a comparison of two usual practice interventions then waiver of consent may be ethical.

This streamlining can allow a quick, efficient and cost-effective trial to be undertaken. Database research is often cited as cost-effective and can generate huge N. They are usually not definitive in their results.

How and why should I participate?

Research should be a core component of an individuals practice alongside teaching, audit and management. However, research is difficult without assistance and money. Participating in ANZCA trials group trials is a way of collaborating, seeking mentorship and generating income. Research nurses or assistants should be an integral part of most departments. I will outline a suggested business plan for departments interested in developing their departmental infrastructure (11).

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Casting the first stone: Trials and tribulations of an expert witness

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"Judge not, that ye be not judged" ***Matthew 7:1***

"...let he who is without sin cast the first stone" ***John 8:7***

The familiar biblical injunctions against judging others must be set aside by expert witnesses involved in medical negligence cases. Unlike New Zealand, Australia does not have a "no fault" system for compensating patients who are injured by medical treatment. The only avenue for an injured patient to obtain compensation is through the civil courts, which is a slow, expensive and unreliable process. Only about half of cases continue to settlement, and of these only 6% are settled in court. About half of cases are settled for less than $10,000 and 6% for more than $500,000. Most claims are settled within three years of lodgement, although 10% take more than five years.[1]

Settlement is always the best outcome for both doctors and patients. For the doctor being sued, it avoids the stress and the disruption to their practice involved with appearing in court. For the plaintiff, it avoids the risk that they may not receive any compensation at all. Because the terms of settlement are confidential, expert witnesses usually do not learn the outcome of the cases that they have reported on.

What is an expert witness?

An expert may be defined as *"a person who has specialised knowledge based on the person's training, study or experience."* [2]

An expert witness in medical negligence cases may be commissioned to provide a report by legal firms representing either side of the dispute. However, in coronial inquests, they are commissioned by the court. Legal firms also commission expert witnesses to report on cases that have lead to a hospital enquiry into a doctor's performance, or have resulted from a complaint to another regulatory body.

Expert witnesses should be familiar with contemporary clinical practice. In some countries (such as the USA, but not Australia) retired doctors are not allowed to serve in this role.

Responsibilities of the expert witness

The core responsibilities of an expert witness are outlined in the "Expert Witness Code of Conduct."[3] These include an *"…overriding duty to assist the court impartially on matters relevant to the expert's area of expertise; to observe a paramount duty to the court and not to the person retaining the expert; not to act as an advocate for a party; to make a full disclosure of all matters relevant to his or her report and evidence.."* Expert witnesses are required to state in their reports that they have read and agree to comply with this code.

It is worth expanding on these core responsibilities, especially the requirement "to assist the court." The expert witness must avoid the temptation to act solely as an advocate for the party who is commissioning their services. The "hired gun" contributes to the polarisation of expert witnesses, which is apparently a bigger problem in medical negligence cases than in other forms of personal injury litigation.[4] I have seen some expert witness reports that could best be described as false and misleading, and worst as simply malicious.

By the same token, expert witnesses shouldn't allow professional loyalty or other factors to affect their judgement. Writing a report that unfairly minimises or justifies an act of negligence by a colleague may prevent a patient from winning a valid claim for compensation. It may also not even help the doctor being sued, as it may encourage his or her lawyers to take the case to court, rather than to negotiate a settlement.

Expert witnesses should only provide opinions that are directly related to their areas of expertise. They should either avoid providing opinions that are outside of their area of expertise or acknowledge when they are doing so.

Keys to writing a medico-legal report

Blessed with perfect hindsight, it is easy for an expert witness to criticise a doctor's actions that led to an adverse outcome. In the interests of fairness however, it is important to attempt to judge their actions based on the information that was available to them at the time, with reference to what was considered accepted practice at that time.

The question (in various forms) that you will repeatedly be asked by lawyers is: *"In relation to this action, do you consider that Dr. X acted in a manner that was widely accepted at that time by peer professional opinion as competent professional practice for an anaesthetist?"* When answering these questions, you need to explain in plain English the basis for your opinions and any medical terms or concepts in your report. You should explain whether your opinion is based on your interpretation of the patient's medical records, or on the Statement of Assumptions provided to you. The Statement of Assumptions includes a summary of the events in the medical records as well as statements from the doctor or the patient in relation to these events.

Writing a report frequently involves reference to the medical literature that was available at the time of the incident and a comment on whether it was widely known at the time. Relevant journal articles or clinical practice guidelines (such as institutional, national or College guidelines) should be appended to your report.

Other reasons for your opinions should also be explained (such as clinical experience, institutional practice etc.) and areas of clinical uncertainty or controversy should be acknowledged.

Appearing in court

From the preceding, expert witnesses do not have to appear in court to defend their reports very often. This is fortunate, as it can be very tedious and time consuming. You have little control over the nature and direction of questioning during cross-examination and legal discussions can become very bogged down in clinically irrelevant areas.

Appearing in court can also be very stressful, especially for coronial inquests. Coronial inquests are less adversarial than civil suits as they intended to establish the cause of death, rather than to apportion blame. However, this distinction may mean little to the grieving relatives of the patient and to the anaesthetist involved in their death, who share the courtroom.

Conclusion

The most interesting aspects of being an expert witness are the 'forensic' nature of the work involved and the challenge of writing a report that can withstand close scrutiny by the opposing medical and legal team. The least appealing aspects are not knowing the outcome of the majority of your cases (which are mediated prior to trial) and having to appear in court. It is also important work, because a doctor's actions cannot be judged fairly unless their peers are, when necessary, prepared to pick up a stone.

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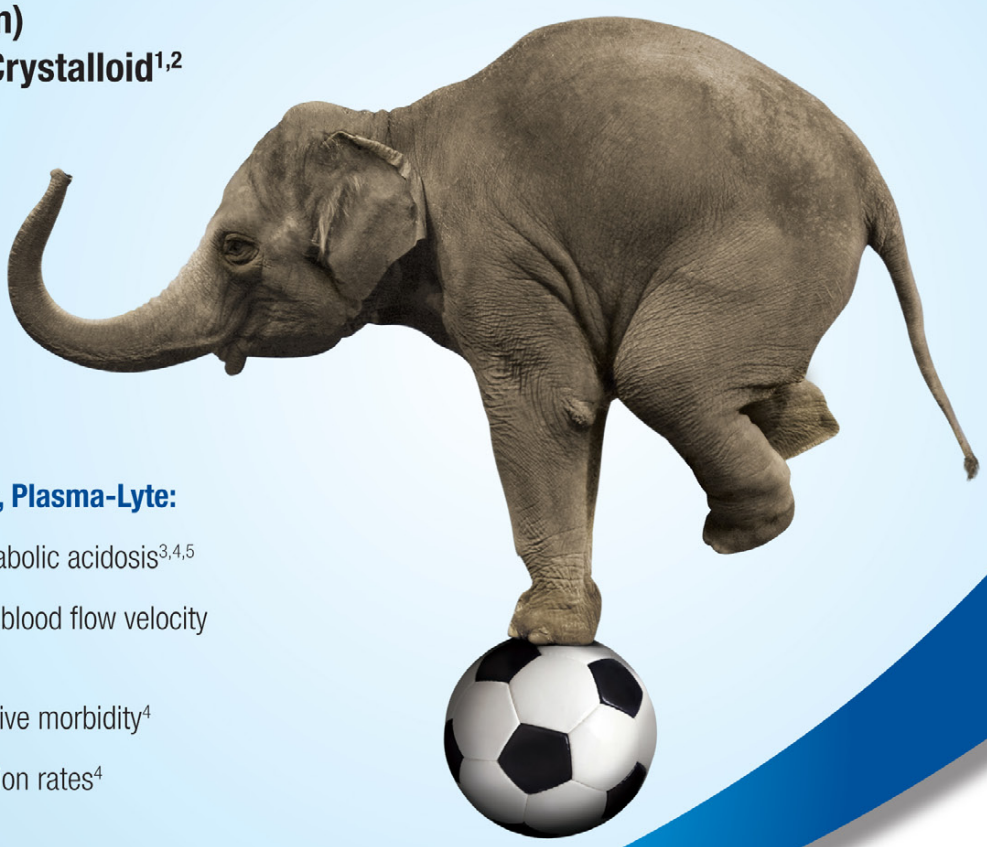

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REFERENCES: 1. Baxter Plasma-Lyte 148 Product Information **2.** Powell-Tuck J, Gosling P, Lobo DL, et al. British Consensus Guidelines on Intravenous Fluid Therapy for Adult Surgical Patients (GIFTASUP). March 2011. **3.** Chowdhury AH, et al. A Randomized, Controlled, Double-Blind Crossover Study on the Effects of 2-L Infusions of 0.9% Saline and Plasma-Lyte 148 on Renal Blood Flow Velocity and Renal Cortical Tissue Perfusion in Healthy Volunteers. Ann Surg. 2012; 00: 1-7. **4.** Shaw AD, et al. Major complications, mortality, and resource utilization after open abdominal surgery: 0.9% saline compared to Plasma-Lyte. Ann Surg. 2012 May; 255(5): 821-9. **5.** Hadimioglu N, et al. The Effect of Different Crystalloid Solutions on Acid-Base Balance and Early Kidney Function After Kidney Transplantation. Anesthesia & Analgesia. 2008 Jul; 107: 264-9.

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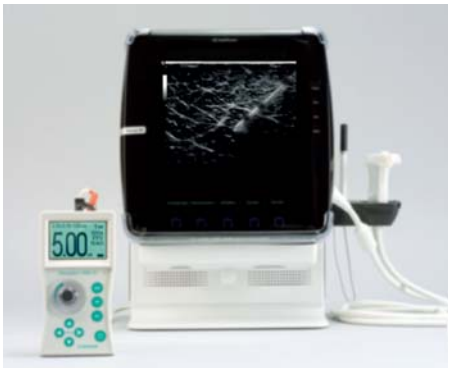

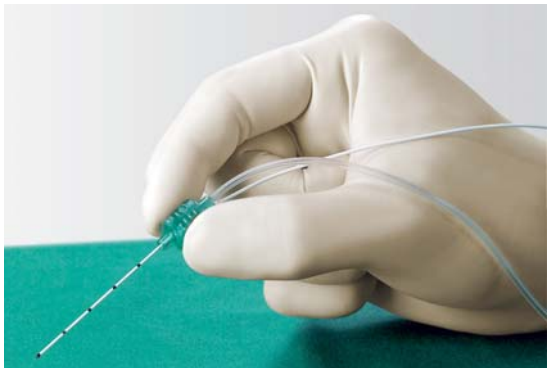

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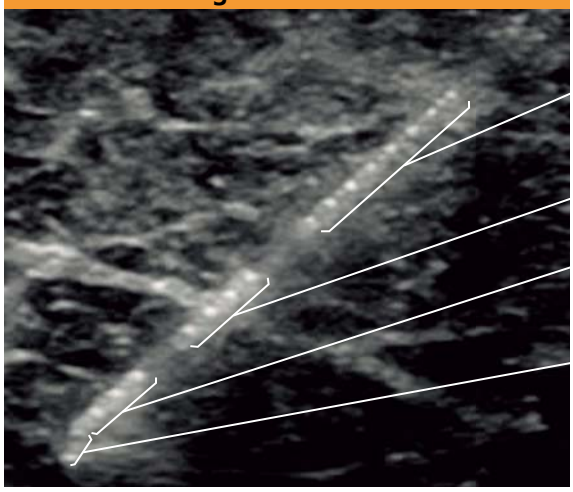

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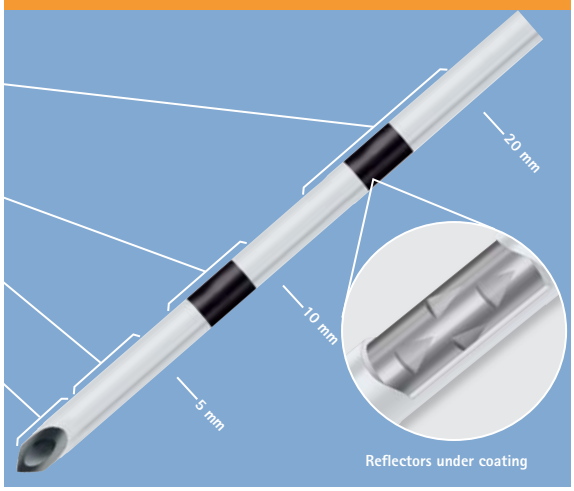

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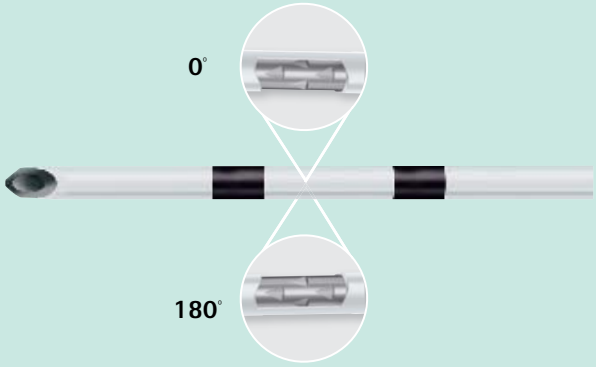

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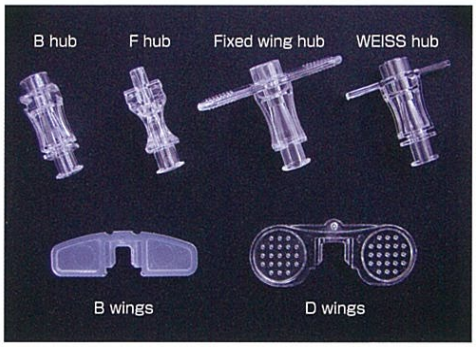
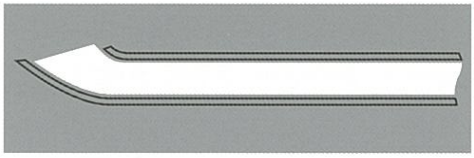
●Needle hubs in wide varieties
Diverse hubs are available in shapes and functions, together with variety of wings (fixed or detachable), to satisfy various purposes and favourites of doctors.

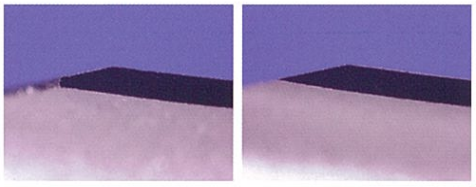


Options of needle hubs and wings

●Ideal formation of bevel facets
Bevels of stylet and needle are precisely ground to form an optimal angle, to achieve both moderate puncture resistance and minimal invasiveness.
The ideal clearance between stylet and needle prevents a risk of jamming by and transportation of tissues to other place.

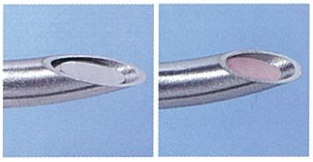


●Prevent damage to catheter
Specially treated inner edge of bevel heel enables a smooth catheter insertion, and protect catheter from cutting or nicking.

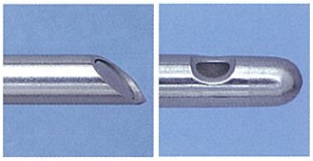


with anti-coring　　without anti-coring

Needle points

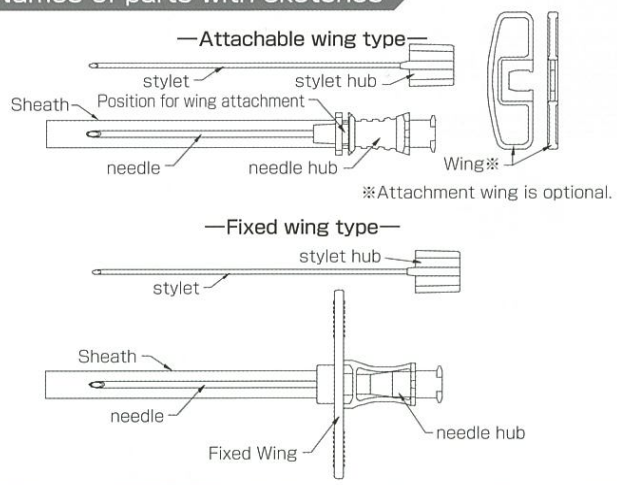


Huber point
Our needle has an ideal curveture supporting you to advance a catheter to your intended direction. Huber point with plastic-stylet, deliberating on safety, is also available.



Crawford and Lutz points
A super-short beveled point is ideal for caudal blocks (left). A round point is suitable for blunt insertion (right)

Names of parts with sketches



Standard sizes

Product : Disposable Tuohy Epidural Needles
Needle Point Type : Huber point

G:Gauge/ Color Code	size	Graduation
16G	90mm	Belt type
17G		
18G		
20G		
22G		

individually packed and 25 pcs/box
E.O.G.sterilized (shelf life 3years)

Manufacturer

UNISIS CORP. JAPAN

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Made in Japan

Representative

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Freephone 0800 333 444

Note : Product specifications are subject to change without prior notice due to product improvements, etc.

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- External monitor connection capability for education and observation

TITANIUM SINGLE-USE SYSTEM

- 4 single-use blades, virtually identical in form and function to Titanium reusable blades
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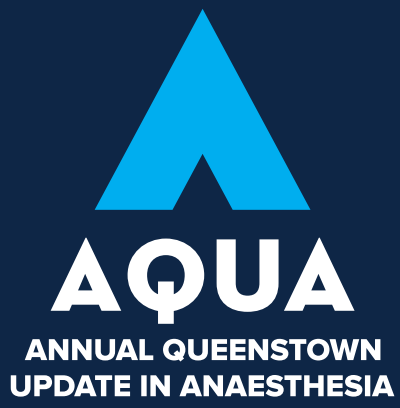

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