PACSA 2012 – Ross's very rough notes

16th Annual Paediatric Anaesthetic Congress of South Africa

Emoya Wildlife Estate, Bloemfontein

Please recognise that these notes are taken contemporaneously during the sessions and are supplementary to the (excellent) congress abstract book. This can be downloaded from http://www.wildmedic.co.za or http://www.pacsa2012.co.za

This document is not peer reviewed and may contain errors.

Day 1 - Friday 2 November 2012

Anaesthetic Neurotoxicity in Children – Randolph Flick – Mayo Clinic

- Ikonomidou et al, Science 283:70, 1999.
- Wilder paper is the most widely cited paper in the field in the last decade.
- Millions of children are exposed to anaesthesia each year
- Concern for developmental apoptosis
- Synaptogenic period – 3rd trimester to 4 years
- GABA and NMDA agents
- Jevtovic-Todorovic et al
- Surgical stimulation is not protective (recent work)
- Is any of this clinically significant in children? Difficult to study prospectively!
- Research now focussing on nonhuman primates. Same findings in monkeys as in rats; both pathological and behavioural
- Observational studies in children – all retrospective, all significantly flawed.
- Association not causation!
- Twin study – "No evidence of a Causal Relationship" – no difference in unexposed twin.
- Hernia study – 2-fold higher frequency of development or behaviour. No control for patients who had other procedures.
- DiMaggio C study 2 – looks like a dose-response effect
- Hanson (Netherlands) – no difference in large national cohort (2500 hernia repairs vs. 5% sample of population). No control for patients who had other procedures; not all patients had a general anaesthetic.
- Five published Mayo studies – all from an old cohort (1976-1982)
- Wilder study (Anaesthesiology 110:796, 2009): 1 exposure, no difference. Increasing exposures show increasing risk of learning disability
- Are kids whose moms had an epidural smarter? -> Robust testing shows the answer is NO. Unsure where the confounders crept in
- Co-morbidities cause learning disabilities; illness exposes kids to doctors who may then diagnose previously unrecognised LDs

- Co-morbidity, however, does not seem to be the driver for the LDs associated with anaesthesia/surgery
- Pattern carried over in speech and ADHD disabilities; not in emotional learning abilities.
- Worthwhile reading – Flick & Warner, "A user's guide to interpreting observational studies of pediatric anesthetic neurotoxicity"
- Low hazard ratios (<3) are likely caused by confounders…but the scope of the problem if there is a true causation is huge.
- What do we tell parents? Very little evidence; we are doing research; no reason to be concerned based on what we do know.

Perioperative analgesia for the neonate and premature infant – Rebecca Grey – Red Cross War Memorial Children's Hospital, Cape Town

- Why are we nervous? Altered body composition, immature metabolism, technical challenges, questions regarding neuronal damage, off-label drug use.
- Off-label: common in paediatrics. Must have evidence to support choice of drug and dose, preferably in the international literature and guidelines
- Safety: Choose appropriate dose and placement of child (ICU/ward)
- Compassion
- Fulfil basic needs (feeding, temperature, sources of discomfort)
- Multimodal approach to analgesia
- Non-pharmacological: non-nutritional sucking; 2% glucose; swaddling; swaying; massage
- Regional: Neuraxial, truncal, specific nerve blocks. Advantages – less respiratory complications, good analgesia. Problems – risk of catastrophic neurological injury or toxicity
- Truncal blocks may be safer; catheter placement makes them very useful. US guidance makes these blocks much more effective.
- In a resource-limited setting, regional anaesthesia is EXTREMELY useful. Beware – areas that aren't covered by the block. Add simple analgesics.
- Systemic analgesia – stepwise and tailored.
- Simple (paracetamol etc.) -> Opiates -> opiate-sparing agents (a2/ketamine/gabapentin)
- Only oral NSAIDS available in this age group (rectal doses too high)
- Opiates: TITRATION! Prem/neonate needs at least a HCU setting
- Oral (valeron), intramuscular (not recommended); IV (morphine infusion)
- Beware of withdrawal
- Ketamine – 0.25-0.5mg.kg. Higher doses associated with apnoea
- Clonidine – 1mcg/kg PO 8 hourly
- Gabapentin – 2mg/kg TDS (up to 70mg/kg/day!)

Fluid management in the paediatric patient – Karmen Kemp – Red Cross War Memorial Children's Hospital, Cape Town

- Paediatric brain has higher intracellular sodium concentration and is much more sensitive to changes in tonicity
- Safety guidelines should be widely propagated; hypotonic solutions should be removed from perioperative wards
- High incidence of suspicion and alertness.
- Glucose – traditionally 5% was used in very hypotonic solutions. Patients regularly became hyperglycaemic. Should be reserved for patients at high risk of hypoglycaemia. Beware of patients with extensive regional blocks – no surgical stress, so they become hypoglycaemic. Beware TPN pumps – decrease rate based on regular insulin checks (can run at 2/3 of original rate)
- Cf. notes for fluid composition of neonates and renal maturation.
- Maintenance about 3ml/kg/hr on day one, increasing to 6ml/kg/hr over the first few days.
- Low threshold for using colloids like SHS in neonates
- Regular electrolyte, haemoglobin and glucose checks if giving large volumes
- Which colloid? Albumin very expensive. Data exists for the safe use of 3rd generation starches in children; caution in those at very high risk of coagulopathy. (Sumpelmann et al, Paediatric Anaesthesia; Liet et al, Pediatr Crit Care Med 2003). None of these studies used doses more than 20ml/kg however, and cardiac patients were excluded.
- SHS is approximately 20x more expensive than Voluven in SA State Sector
- Haas et al – TEGs – MA decreased in gelatin, MA and a-Angle decreased in HES
- Fluid shift: Impossible to measure, makes estimation of fluid requirements very difficult. We can't see what is going on at the level of the endothelial glycocalyx! Mechanical stress, endotoxin, ischaemia reperfusion injury, inflammation, glycocalyx destruction by fluid overload.
- Practice *conservative, demand driven* fluid administration
- See "The concept of the glycocalyx" by Brettner, Chappell and Jacob
- Fluid -> ANP release -> cGMP -> glycocalyx breakdown
- The future looks like it will feature a lot more of the word "Glycocalyx"…
- Further reading –
    - Cote Ch. 8 "Fluid management" in A Practice of Anesthesia for Infants and Children.
    - Bailey 2010 – Perioperative crystalloid and colloid management in children: Where are we and how did we get there?

Peri-operative Ventilation of Neonates – Maria Reyneke, University of the Orange Free State, Bloemfontein

- Why are they so vulnerable? Impaired gas exchange, high metabolic rate, shunt physiology, poor lung mechanics
- Effects of anaesthesia – post-op apnoea, periodic breathing, reduced FRC, VQ mismatch, worsened Vt:Vd, worsened compliance and more resistance, more prone to laryngospasm

- Ventiator-assosciated lung injury (VALI) has multiple causative mechanisms – volutrauma, barotrauma, atelectrauma, biotrauma (TRALI; oxygen toxicity -> fibrosis)
- How to prevent VALI:
    - Avoid hypoxia and hypercarbia – maintain oxygenation (Pmean and FiO2) and ventilation (Alveolar MV and frequency). Low volume, high frequency ventilation is usually less pathological to the lung
    - Lung-protective ventilation (Safe window between closing volume and lower inflection point on the volume-pressure curve)
    - Recruitment manoeuvres should take the pressure to the higher inflection point on the v-p curve
    - Adapt to specific pathophysiology and surgical requirements (eg. heterogeneous ventilation, higher or lower PEEP, lower respiratory rates and permissive hypercarbia)
    - Focus on lung mechanics
        - Monitor capnography and blood gasses frequently
        - Extreme caution with laparoscopy (IAP<6mmHg, VCV, be alert for ETT displacement into RMB)
        - Choose mode carefully – decide whether PCV or VCV will suit your patient's pathology better. Beware PCV when the IAP is changing frequently. Newer machines have much more sensitive control of VCV; newer modes (such as pressure-controlled volume-guaranteed ventilation) have distinct advantages.
- Decide…then monitor, monitor, monitor! SpO2, EtCO2, ABGs, CXRs, etc.
- Ventilator problems: Mnemonic DOPES (Displacement, Obstruction, Pneumothorax, Equipment failure, Splinting of the diaphragm) {S added by Ross}
- Extubation should be a team decision with surgeon, ICU, etc. Patient must be stable, normothermic, normal electrolytes, no inotropes, etc. Beware the known difficult airway. Prems must have prophylaxis against apnoea and be monitored (HCU!).
- Transport on vent support: Prevent accidental extubation; maintain temperature; take emergency equipment; sort out sedation and pain control; take t-piece/neopuff/neonatal BVMR. Extreme caution if <1500g
- Surgery in NICU:
    - Challenging, uncomfortable
    - Paralysis and high dose opiate
    - TIVA (no vaporiser)
    - Keep the lung open!
    - Consider HFOV
- HFOV
    - Transport almost impossible
    - Akin to open lung strategy with ling protection
    - Very small Vt at very high frequency
    - Trend towards reduced mortality and BPD (literature inconclusive)
    - Decouples oxygenation (controlled by FiO2 and Pmean) and ventilation (controlled by pressure difference and frequency)
    - Alveolar pressure just above the closing pressure

- Bias flow of warm humidified air at 20 litres/min at the frequency of oscillation (3-10Hz; 180-600/min!)
- Cycle volume = tidal volume delivered = amplitude
- Decreasing the frequency increases the amplitude, thus decreasing PaCO2
- Chest wiggle factor – clinically useful measure. Visible movement of the patient's chest while on the oscillator.
- "HFOV = CPAP with a wiggle"
- Practically:
    - Never disconnect the circle!
    - Sedation and analgesia important
    - Inhalational anaesthesia is not possible – use TIVA
    - Consider the intravascular volume carefully
    - Increase bias flow to 40l/min if suctioning has to be performed
    - Tolerate hypercarbia if there is no contraindication

Oesophageal Atresia & Tracheoesophageal Fistula –Priorities in Resource-Limited Environments – Andrew Levin, University of Stellenbosch & Tygerberg Academic Hospital, Cape Town

- Lots of anatomical variants (Sub-type 3b has 20 sub-subtypes)
- Embryology probably of little importance to the busy clinician
- Incidence between 1:1500 and 1:4500 – TBH sees about 8 a year
- VATER and VACTERL association – cardiac anomalies are the very big problem
- Many other associated congenital abnormalities (CHARGE, etc)
- Presentation – antenatal (polyhydramnios; enzyme tests), at birth (scaphoid, gasless abdomen), frothing, feeding problems, coughing, cyanosis, etc
- Routine echo and renal ultrasound should be a standard of care
- Prognosis depends on anomaly, genetic background, and cardiac morbidity
- Initial management – upright position, replogle tube on suction, antibiotics, urgent surgery
- Surgical approach – excision and anastomosis over a *very well fixed* NGT
- Interposition if the defect is very long
- Thoracotomy on the opposite side to the aortic arch -> extrapleural dissection -> azygous divided -> Division of trachea and oesophagus -> Repair -> Closure
- Have blood in theatre
- Thoracoscopy is becoming a reality
- Surgical complications – anastomotic leak, anastomotic stricture, recurrent fistula)
- Anaesthetic management:
    - Difficult ventilation (on induction 7%, during maintenance 15%)
    - Positive pressure support is needed if the lungs are compromised
    - Gentle bagging will usually ventilate the lungs
    - Stomach inflation will aggravate ventilation problems
    - During thoracotomy, IPPV is essential
    - Lots of shunt during thoracotomy

    - Moving the tube may help occlude the fistula – this clearly has problems if the fistula is at the level of the carina, which makes a trifurcation in which the fistula is indistinguishable from the main bronchi
    - USE BRONCHOSCOPY TO IDENTIFY THE FISTULA...*if* you have a bronchoscope suitable for neonates.
    - Use a cuffed endotracheal tube
    - Consider using a Fogarty catheter down the fistula to occlude it. This also facilitates location of the fistula by palpation. This prevents extensive dissection in the tracheoesophageal grove, preventing recurrent laryngeal nerve injury.
- If no flexible fiberoscope:
    - A urology cystoscope with a 30 degree lens can be used
    - Must be very careful – rigid, sharp device!
- Main priority is control of ventilation

Paediatric Massive Transfusion Protocols – Graeme Knottenbelt, Starship Hospital, Auckland

- Situation of crisis – physiology, leadership, systems all challenged
- J Trauma 2006 Malone et al – first comprehensive adult MTP
- Transfusion, June 2012 – first comprehensive paediatric MTP
- Dente J Trauma – MTP decreased mortality
- O'Keefe 2008 – MTP reduced costs
- Why should there be a benefit after MTP implementation? Crisis resource management, systems improvement, evidence based practice
- Focus on "Human Factors" – non-technical skills (eg. communications)
- Enticott JC – Review on decision support for massive transfusion
- Change from a reactive to a proactive system of blood provision
- What we know about massive transfusion
    - Acidosis
    - Hypothermia
    - Coagulopathy
    - Crystalloids avoided
    - 1:1:1 RBC:FFP:platelets
    - MTP essential
    - Complications of transfusions
- SHOT – Serious Hazards of Transfusion in Children (Ped Anaes 2011)
- What we're unsure about…
    - Fibrinogen (BJA review recently)
    - rFVIIa (Drug in search of evidence of benefit… Cochrane: Indications should be restricted to clinical trials)
    - Tranexamic acid (Cheap, available, minimal complications)
    - Goal-directed therapy using TEG/ROTEM – absence of evidence (so far)
    - Paediatric management (most information is taken from adult studies)

- See ADHP Paediatric Massive Transfusion Protocol; Royal Children's Hospital (Queensland) MTP; Princess Margaret Hospital (Perth) MTP; various UK protocols (Birmingham, Bristol); Seattle Children's Hospital; Boston Children's Hospital
- Create an MTP for your hospital!
    - Create
    - Institute
    - Audit
    - Research
    - Contribute to consensus
- "Whatever you do, always give 100%... unless you're donating blood."

Day 2 - Saturday 3 November

Congenital cardiac abnormalities for non-cardiac surgery – Pieter Kruger, Bloemfontein

See extensive notes in Congress book. Here selective take-home messages:

- Actual PaCO2 value is less important in PHT than pH – control the acidosis more strictly than controlling the PaCO2 per se
- Oxygen is probably the most specific pulmonary vasodilator that we have – use it in a crisis
- In CHF, clinical markers for failure are important. Beware the baby who sweats while he feeds!
- Chronic ischaemia stimulates myocardial dysfunction, hypertrophy and fibrosis; ability to compensate under anaesthesia/surgery is diminished. Polycythaemia is another common complication, which leads to thrombotic and haemostatic abnormalities. Clotting times often normal due to the polycythaemia, but once the blood becomes diluted during surgery, these patients bleed more. Iron deficiency is common, causes red cell dysmorphism, and thus reduces oxygen delivery.
- Dysrhythmias are common; beware prolonged QTs.
- Beware of the airway abnormalities associated with congenital cardiac defects – can be at any level in the airway, so don't forget the intrathoracic problems.
- Fortunately there is usually time to perform a thorough examination, special investigations, etc. Recent cath or echo very important. Chat to cardiology if patient known to them.
- Invasive monitoring is indicated for major surgery, ASA 3 or 4, and patients with limited physiological reserve. SaCvO2 can be useful.
- Physiological goals: maintain MAP and ventricular function, prevent changes in pulm vasc resistance, avoid hypoxaema, and maintain temperature and coagulation haemostasis.
- Propofol drops SVR; ketamine maintains it. Low dose volatile usually well tolerated.
- Beware bubbles!
- With significant R->L shunting, EtCO2 is not equal to PaCO2
- Decide on an acceptably SpO2 for the specific cardiac lesion.
- Avoid hypovolaemia. Hct >30% for acyanotic and >40% for cyanotic lesions
- HCU/ICU setting post-op
- Pulmonary hypertensive crisis can still occur postoperatively after a correction
- Hypoxic respiratory drive may be diminished.

Transcutaneous Pulmonary Valve – Danie Buys, UOFS, Bloemfontein

- Bloemfontein now has a fully hybrid cath lab
- Several recent advances in paediatric cardiology
- First transcutaneous pulmonary valve globally in June 2008
- First valve done in SA March 2012 (Bloemfontein)

- Isolated congenital PR has a progressive worsening natural history, resulting in effort intolerance -> rhythm abnormalities -> failure -> death
- Homograft valves – 75% failure after 15 years. Second homograft tends to fail rapidly.
- Who needs replacement? RV dilation or symptoms; RV pressure 2/3 systemic; tetralogy with PR variants.
- Indications for percutaneous surgery – high surgical risk; >20kg; >moderate regurg; favourable RVOT morphology; adequate size for the valve.
- Contra-indications: active endocarditis, conduits <16mm or >22mm, no stent anchorage
- Melody valve – bovine IJ vein sewn into a stent
- Delivery system is BIB (Balloon-in-balloon)
- Access usually femoral; can be jugular.
- Technical considerations for Melody: coronary compression, good landing zone for stent, size *critical*, sterility in OT.
- Pre-dilation of RVOT with high pressure balloon to 1-2mm above the final Melody lumen.
- Wires are very stiff; despite the soft tips, perforation (especially of the PA) is a significant risk.
- World experience – 95% success
- Complications: dislocation with embolization, tear in RVOT, perforation of PA, Exclusion of PA, coronary compression (main cause of death), endocarditis, haematoma in groin.
- Advantages of transcutaneous approach – no re-re-re-redo. Shorter and ?safer procedure. Much less pain (some discomfort in groin). No redo sternotomy/adhesions/etc). Short admission; less time away from school/work; ?less cost.

Is TOE necessary during congenital heart defect repairs? – Justiaan Swanevelder, University of Cape Town

- Wolf AR, BJA 2012: "…no-one is unfit for anaesthesia or surgery – it is simply a question of ascribing an individual risk and potential benefit…"
- Echo – a haemodynamic monitor vs. a diagnostic tool?
- Not a lot published on the benefit of using TOE intraop in paeds cardiac surgery; the benefits, however, are 'plain to see'. Bettex 2003 showed that TOE provided new information in 18.5%, changed surgical approach in 12.7%, and changed haemodynamic management in 19%
- Practical issues – patient-probe mismatch. "Minimulti" probe in 3-20kg. Adult probe >20kg. Epicardial scan in <3kg. Neonatal probe ("Micro") for less than 3kg patients, but this probe is *very* sensitive to damage.
- Scanning conditions intraop are challenging – time constraints, probe insertion time, ECG electrodes, electrocautery, CPD, pathology vs procedure, cardiorespiratory compromise.
- Learning by doing in the operating theatre is effective; patients arrive with a diagnosis, and we are not pressurised during certain phases of surgery (going on bypass).
- Segmental analysis of congenital heart morphology:
    - Step 1 – analysis of atrial arrangement

    - Step 2 – atrioventricular connections and AV valve morphology
    - Step 3 – ventricular morphology
    - Step 4 – outflow tract morphology
    - Step 5 – Associated malformations and abnormalities
- Many examples of different pathologies given

Management of the Paediatric Patient with Complex and Severe Cardiac Disease – Andrew Wolf, Bristol, UK

Good notes in congress book

- Myocardium in the infant/neonate is not as able to cope with changes as in older children and adults. Parasympathetic dominance (limited sympathetic capability)
- Baby heart does not tolerate afterload well
- Changes in stroke volume are very limited. Compliance is less in the younger patient. The Starling curve is flattened (much like a failing heart)
- Keep rate up, keep afterload down.
- RV is more compliant than the LV
- Blood pressure increases gradually with age and mass.
- Control of BP – flattened baroreceptor response, reduced basal sympathetic tone, reduced response to catecholamines.
- Survival – The Essentials:
    - Not all shock improves with APLS
    - Imperative goals and immediate imperatives are sustainable perfusion and sustainable oxygen delivery
    - MAP of <40mmHg is critical; measures of regional perfusion should be used as well
    - Don't allow the energy substrates to become exhausted
- Sustainable perfusion depends on three variables: pressure, flow, and resistance.
- Look at markers of organ perfusion – SaCvO2, lactate, acid-base (all are individually flawed, but as part of a constellation of signs they are powerful)
- Look at specific organ perfusion measures – urine output, ECG, NIRS
- Measure directly – cardiac output, SVRI, echo
- Pharmacological manipulation – CO changes vs. peripheral vascular resistance changes vs. adding fluid to the system
- Mechanism of action of milrenone still needs to be nailed down. When we understand it better we will be able to use it better.
- Epinephrine has its useful effects…but also causes increased myocardial oxygen demand, increases dysrhythmias, causes tachiphylaxis, etc.
- Cardiopulmonary interaction must be considered
- Fast-tracking patients to extubation is excellent, but requires right surgeon, right patient, right procedure, right nursing team, etc.
- Fast-track and stress-response elimination – use regional, or remifentanil

Approach to interpreting the paediatric ECG – Danie Buys, Bloemfontein

- Breathe, don't panic, and have a systematic approach
    - Name, age, date
    - Calibration, paper speed
    - Rate, rhythm
    - P wave axis, amplitude, duration
    - PR interval
    - QRS axis, amplitude, duration
    - QT
    - T-wave
- Interpretation of the ECG is heavily dependent on the patient's age and heart rate
- **Many changes reflect the RV dominance during neonatal life**
- Rates vary according to age. Note atrial vs. ventricular rate
- RV dominance in early life gives a right axis tendency or 'deviation' (normal!)
- Left axis deviation in a neonate should warn you of a problem
- Tall peaked P-wave in lead II (>3.0mm at 0-6 months, 2.5mm thereafter) indicates RA enlargement (P-pulmonale)
- Broad P-wave (>2.5mm) indicates LA enlargement (P-mitrale)
- PR interval varies with age. Prolongation suggests conduction delay/block in the AV node.
- Q-waves = first downward inflection. Amplitude doubles over first few months. Maximum at 3-5 years. Pathological Q waves are >4mm. Path Q's in I and AVL = ALCAPA.
- QRS duration in children is decreased.
- Bundle branch blocks: WilliaM (W in V1, M in V6 = LBBB) MorroW (M in V1, W in V6 = RBBB)
- RVHT – need to check voltage criteria (there are lots of them…complicated)
- LVHT – several voltage criteria (again lots). Left axis deviation is a possible clue
- QT interval gives an impression of ventricular repolarisation. Age-related norms. Diagnostic criteria (Swartz) can be used to identify a case.
- T-wave has limited value in children. Upright T waves in the praecordial leads for the first 7 days, then they become inverted until adolescence.
- ECG diagnoses of specific lesions:
    - ALCAPA – Q's >4mm in I and AVL
    - ASVD – RVHT with LAD
    - Tricuspid atresia – cyanotic neonate with LAD

Arrhythmias in Children – Annette Schure, Boston Children's Hospital & Harvard Medical School

- Adults or children – all the same. Too fast or too slow, organised or disorganised, or a mess.
- All arrhythmias straighten themselves out in the end…
- Classification: Mechanism (brady or tachy), origin
- Assessing the ECG – rhythm method, p-wave method or 'walk out' method.

- Sinus brady: <80 in infants, <60 in children. Can be physiological. Hypoxia is the most common cause, so always oxygenate and ventilate. If still slow, start CPR. Epinephrine 10mcg/kg. Atropine 20mcg/kg only if you consider vagal stimulation to be the cause.
- Supraventricular tachycardia: P usually invisible. Normal (narrow) appearing QRS. Mechanism is re-entry or automaticity. Problem: may decrease cardiac output and lead to CHF.
- Re-entry SVT: Most common. Abrupt onset and termination. Strictly regular rates.
- WPW first described in 1930. Accessory pathway is the Bundle of Kent. Prevalence is 0.1 to 0.3%. Strong association with congenital cardiac disease – all WPW patients should get a screening echo.
- Treatment of re-entry SVT: Vagal manoeuvres (valsalva, headstand. Infants: ice bag on face for 10sec), Adenosine (0.1mg/kg; can double subsequent dose to max of 0.3mg/kg; can cause hypotension, bronchospasm, pulmonary hypertension; half dose if via CVC) , Cardioversion, other medications (esmolol, amiodarine, procainamide).
- Automatic SVT: gradually accelerates and decelerates. Changing rate with changing sympathetic tone.
- Frequent SVT and anaesthesia:
    - Don't stop routine medications
    - Reduce sympathetic tone (and don't give drugs that increase tone, eg. LA with adrenaline, ketamine, ephedrine, etc)
    - Consider esmolol prior to stimulating procedures
- 3rd degree AV block: complete dissociation.
- Origin in the ventricle – weird and wonderful
    - PVCs: benign are uniform and disappear with exercise. Significant: associated with underlying disease, associated with syncope, etc
    - VT: Multiple causes, rarely benign. Unstable: Synchronised cardioversion, 0.5-1J/kg. Stable: chemical cardioversion, amiodarone 5mg/kg slow IV (20 min)
    - VF: CPR and defibrillate (2-4J/kg)
- Infant paddles for children under 10kg, all >10kg can use adult paddles.
- Congenital long QT syndrome – many subtypes, many triggers.
- Acquired long QT syndrome – variety of drugs; electrolyte disturbances; medical conditions. See www.torsades.org and/or www.QTdrugs.org
- Long QT and anaesthesia:
    - Monitor baseline QT interval
    - Good premed; quiet and calm environment
    - Confirm normal electrolytes
    - Avoid hyperthermia
    - GA with Propofol, vecuronium, isoflurane
    - Antiemesis is a huge problem
    - Continue monitoring in the post-op environment

Mail Annette.schure@childrens.harvard.edu for a full copy of the presentation.

Coagulation and Paediatric Cardiac Surgery – Graeme Wilson, Red Cross War Memorial Children's Hospital & University of Cape Town

- Postoperative bleeding is one of the most commoc complications of cardiac surgery
- Very large quantities of blood products used in paeds cardiac surgery
- Paediatric challenges: immature coagulation system; congenital heart disease; CPD is different in children.
- Contact factors and Vit K dependant factors are significantly reduced at birth, while VWF, F8 and fibrinogen are increased. Neonatal platelets are hypo-reactive for the first 2 weeks after birth. Higher fibrinogen levels probably off-set the lower levels of other factors.
- Supranormal clot strength can be achieved with fibrinogen in the setting of a normal platelet count; so fibrinogen can compensate for low platelet levels. 50% of children with CHD have reduced clotting factors, in particular fibrinogen.
- Polycythaemia in the cyanotic patient decreases plasma volume, so the total amount of clotting factors are reduced despite normal concentrations.
- CPB doesn't only dilute blood; it causes factor consumption, loss of fibrinogen and platelets through microcoagulation.
- Prevention: minimise haemodilution, manage anticoagulation.
- Antifibrinolytics in high-risk cases (cyanosis, complex surgery, re-operations). We only have tranexamic acid available. Dosing: 10mg/kg loading, 10mg/kg to prme, 10mg/kg on separation.
- Suggested management:
    - Platelet transfusion (after protamine) 10-15ml/kg (should raise the platelet count by 50 000
    - Cryoprecipitate 1-2 bags/10kg. Contains concentrated amounts of fibrinogen (>20g/L) and FXIII. Fibrinogen concentrate if you have it (not in SA).
    - FFP is ineffective for reversal of coagulation factor dilution (Two cups of filter coffee mixed together does not an expresso make…)
- Rescue therapy?
    - Prothrombin complex concentration (Vit K dependent factors - 2,7,9,10). In SA = Haemosolvex
    - rFVIIa seems to work in our experience, but needs serious further research.

Paediatric OSA – Charles Cote, Harvard Medical School

No rough notes – very detailed notes in congress book.

Muscular Dystrophies – Jonathan Smith, Great Ormond Street Hospital, London, UK

- See notes in congress book
- Multiple types and patterns of weakness
- Prevalence – Duchene 32 per million (1:3600)
- Duchenne is X-linked; 30% are de novo mutation

- Lack of sarcolemmal protein Dystrophin
- Cell becomes very porous to calcium; intracellular calcium levels very high
- Clinical course – onset under 5 years, muscle weakness, contractures. Average age of loss of walking = 9.5 years. Progress to scoliosis, respiratory failure, cardopmyopathy. Death in teens or early 20's.
- Why important? Common, lifespan is increasing. Increasing demand for surgical procedures.
- What's the problem?
    - Anaesthetic induced rhabdomyolysis
        - Malignant-hyperthermia-like reaction
        - All volatile agents have been implicated
        - Use a TIVA; avoid sux;
        - In the event: serial measurement of the potassium; huge doses of calcium; continue resus until potassium is normal
    - Respiratory failure
        - Good recommendations in CHEST
    - Cardiomyopathy
        - Less than 6 years <25%
        - Teenagers 95%
    - Blood loss
- Good case report presented
- How do we assess cardiovascular risk? Clinical assessment, ECG, 24 hour Holter monitor, echo (technically difficult due to scoliosis, body casts, inactivity, etc), MRI (excellent, but not great for the patient to get scanned awake), BNP (correlation between echo deterioration and BNP levels).
- Regional anaesthesia has been used.

Anaesthesia for Cleft Lip and Palate Surgery – Clover-Ann Lee, Johannesburg, SA

- Good notes in conference book
- Incidence 1:800. Lifetime morbidity and mortality
- Centre of face formed in 4th week of gestation. By week 7, the 5 prominences that form the major facial features have formed. Palate comprises 2 parts – the primary palate anteriorly, which merges with the two medial nasal prominences, and the secondary palate, consisting of the two palatine shelves that fuse in the midline
- What goes wrong? Genetic (expression, signalling) and environmental factors (smoking, alcohol, teratogens, folate deficiency).
- Major anaesthetic issues – AIRWAY and CARDIAC
    - Are there problems related to the cleft? Failure to thrive, anaemia, RTI's
    - Is there another syndrome involved?
    - Will this be a difficult intubation? (7.4% difficult laryngoscopy, of which 99% were successful intubations, however)

- Anaesthetic management is fairly standard. Don't forget a throat pack. Extubate awake (tonsil position?) unless you're confident the airway is not a big issue.
- Multimodal analgesia – paracetamol, NSAID if available, opiate, regional.
- Regional anaesthesia relies on:
    - Maxillary nerve, V2. See Bosenberg 1995. 0.5-1ml of 0.5% bupivacaine around the foramen. Bosenberg believes in adrenaline. Pressure on the spot for 10-15 seconds. Analgesia for mean of 19 hours. Must do bilateral blocks as there is crossover of the innervation. Superior to incisional infiltration.
    - Suprazygomatic maxillary nerve block – pterygopalatine fossa. No reported complications in the literature. 0.5ml to each side.
- Postoperative complications – morbidity is 15-20%; 2% need reo-operation. Bleeding (mx as per bleeding tonsil) and airway obstruction (often due to the Dingman Gag causing compression and severe swelling.

Anaesthesia for Tracheoplasty – Josephine Tan, KK Woman's and Children's Hospital, Singapore

- Tracheal stenosis in children is most commonly caused by trauma from tracheal intubation, and is less commonly congenital.
- Tracheal stenosis = >50% reduction in diameter compared to the rest of the trachea.
- Elements implying severity – see Elliot et al
- Newborn trachea 3-4mm.
- Long segment tracheal stenosis (LSTS) if more than 2/3 length involved.
- Congential tracheal stenosis is associated with other malformations in >50% of cases – Vascular slings are a common event; AVSD, PDA, coarctation, GIT abnormalities, etc
- Presentation – stridor (biphasic), recurrent chest infections, respiratory distress ('dying spells')
- Initial management – stabilise airway, ventilate. Consider heliox, ECMO
- Flexible bronchoscopy most useful for assessment
- Echocardiography is mandatory
- CT/MRI is very useful to delineate the anatomy and formulate a surgical/anaesthetic plan
- Slide tracheoplasty has become the technique of choice for medium and lengthy sections.
- Airway strategies – conventional ventilation, jet ventilation, or CP bypass
- 3 main phases – induction (stenosed airway), surgery (open airway), post-op (repaired airway)
- Normal ETT can be used for low lesions. Narrow long tubes (eg "Croup tube") are useful for proximal lesions. Jet ventilation effective otherwise.
- "Cross-table anaesthesia" can be performed during the open airway period, with the surgeon intubating the carina stump with a sterile re-inforced tube; alternately, endobronchial tubes can be used.
- CPB is best used when simultaneous repair of a cardiac lesion is planned.
- Practical points:
    - CVP lines under USG or femoral line rather than blind
    - Don't cut the ETT; the extra length can be useful

    - Make sure your tube ties are secured well but can be removed easily when needed
    - May need to drop vent pressures when the trachea has been repaired (less resistance)
- Post-op – humidification is important
- Flexible bronchoscopy prior to extubation.
- Excessive granulation and restenosis is a well-known complication.
- KK experience – procedure-related mortality = 30%
- Key factors: Understand pathology, anticipate course of surgery, ensure good communication and co-operation, be able to employ a variety of techniques to maintain the airway and ventilation.

Consent Update on South African Law – Rita-Marie Jansen, University of the Free State, Bloemfontein

- Volenti non fit iniuria – "He who consents cannot be wronged/injured
- Constitution of the Republic of South Africa, Act 108 of 1996:
    - Sect 12(2) Right to control and security over own body
    - Sect 28(2) Child's best interests are paramount
- Requirements for informed consent:
    - Knowledge of the extent of harm/risk
    - Appreciation of the nature of the harm/risk
    - Consent to harm/risk
    - Accept all consequences
- National Health Act, Act 61 of 2003, Sections 6-8
    - Type of information – health status, range of diagnostic procedures and treatment options available, benefits, risks and consequences generally associated with each option, right to refusal of treatment.
    - Use language and in a manner the user understands
    - Practitioners must take all reasonable steps to obtain consent
    - A person may be mandated in writing to give consent on behalf of an individual
    - If no-one is mandated, there is a specific order: spouse, partner, parent, grandparent, child, sibling
    - Consent can be circumvented when a real risk exists to public health
    - A person has the right to participate in any decision affecting their health (this is of particular application to children, even if they do not have legal standing to give their own consent).
- Children's Act, Act 38 of 2005
    - Child's wishes must be considered even when they do not have capacity to give consent.
    - Two main distinctions – medical treatment vs. surgical operation; age greater or less than 12 years
    - Choice on termination of pregnancy act trumps the Children's Act – A girl/woman of any age may consent to termination of pregnancy or any surgical or medical procedure related to the pregnancy.

    - Age >12 and able to understand implications -> may consent to medical treatment; may consent for surgery with assistance of parent/guardian
    - Age <12 or age >12 and unable to understand implications -> parent/guardian may consent
    - Superintendent may consent if delay will cause death or irreversible injury/illness and treatment cannot be delayed.
    - Minister (of Social Development) may consent if the parent/guardian unreasonably refuses to consent, is incapable, cannot be trace, or is deceased, or if the child unreasonably refuses to give consent.
    - A High Court order or children's court may give consent in all cases
    - No parent/guardian/care-giver may refuse to give consent by reason only of religious or other beliefs, unless they can show a medically acceptable alternative treatment.
- Risks:
    - "Reasonable patient" test – a reasonable patient would be concerned and wish to know of a certain risk or outcome
    - Consumer Protection Act has thrown a spanner into the works… we as practitioners are classified as 'suppliers' – we must warn SPECIFICALLY of ANY risk of serious injury or death. Is this practical? Noooooooooo!
- Record the explanations in the medical records.
- Nobody may be refused emergency medical treatment (Constitutional requirement)
- Research – National Health Act, section 71
    - Research in adults according to the prescribed manner after written informed consent
    - In a minor, if therapeutic, it must be with written informed consent from the parent/child
    - In a minor, if non-therapeutic, it must be with all of the above plus written consent from the Minister of Health.

Ethical Dilemma Panel Discussion

Day 3 – Sunday 4 November

Use of Adjuncts in Paediatric Regional Anaesthesia – Per-Arne Lonnqvist, Karolinska University Hospital, Stockholm, Sweden.

- Good review Walker & Yaksh, Anesth Analg
- Recently – ketamine has been implicated in neuroaptosis in rats; should we be using it in caudals? Therapeutic index (in rats) of ketamine is <1! Avoid ketamine in children under 1
- Ketamine prolongs block for average of 4 hours
- Clonidine definitely prolongs the block; therapeutic index >300
- Preservative-free morphine (30-50mcg/kg) as effective as clonidine; don't need to give it at the right spinal level; does increase risk of nausea, vomiting and pruritis
- Adding fentanyl to epidural infusions doesn't seem to make a difference in children
- Dexmedetomidine – 3 studies now, looks very positive. Prolonged block, cardiovascular stability.
- Mechanism of action of alpha-2 agonists on peripheral nerves is not well understood, but the data shows it works.
- Work on-going with steroids and bupivacaine-containing microspheres
- Dexamethasone certainly seems to prolong blocks – but do these studies have systemic controls? There is not sufficient evidence to advocate use outside of trials.
- Bottom line:
    - Single shot, <1: Clonidine
    - Single shot, >1: Clonidine, ketamine, preservative-free morphine
    - Peripheral blocks: Probably clonidine, maybe dexmedetomidine.

Simulation in Paediatric Anaesthesia – Agnes Ng, KK Woman's and Children's Hospital, Singapore

- Simulation well established in other critical industries (eg. aviation, nuclear)
- Allows practice of critical skills in safe environment
- Famous simulation in history – Madame du Coudray's "Childbirth Machine"
- Rescusci-Anne created in 1950 by toymaker moved by drowning of girl
- Tools: Passive task trainers, standardised patients, hybrid simulation, full body mannequin systems
- Full body high-fidelity systems can mimic an enormous range of signs, symptoms and events.
- In paeds anaesthesia: high risk, low tolerance situation; centralised tertiary services reduce peripheral experience
- Common scenarios: Pre-op assessment; RSI, laryngospasm, malignant hyperthermia drills, LA toxicity.
- Useful for initiation of new programs (eg. ECMO, EXIT)
- Leadership, teamwork and communication skills built very well by simulation training.
- Deliberate practice with clinical and teaching feedback in a structured learning environment

- In-situ simulation in the clinical environment makes access for medical staff easy, tests environmental and system flaws, and builds familiarity with the working environment. There are problems with logistics, interruption in workflow, and concealing the "command and control centre".
- Does it really result in improved patient care?
    - Gaba, Anaesthesiology 1992: Other industries demonstrate clear improvements
    - Several other references given
- Useful as an assessment tool (formative or summative): define pertinent skills and use appropriate metrics. Test validity and reliability of the test scores. See Fehr Anaesthesiology 2011.
- Israel has incorporated a simulation OSCE into the national anaesthesia board exams.
- What do we need? Funding, space, buy-in from management, trained and dedicated faculty.
- A way to start – "simulation on wheels"?
- Trained and dedicated faculty - Continuous upgrading of knowledge and skills
- Scenario design challenging – must have clear objectives and outcomes
- Debriefing skills are essential – interactive and guided discussion. Facilitate, don't preach. Help close the gaps.
- Maintain confidentiality – maintain a supportive learning environment
- Limitations – cost, manpower and time intensive, faculty development takes time, monitor focused (rather than focusing on the patient)
- Scenarios are crisis driven, but we should also build scenarios that focus on avoiding crises.

The Value of a Good Case Report – Adrian Bosenberg, Seattle Children's Hospital

- Many journals are moving away from taking case reports, as they tend to dilute the impact factor.
- Opinions differ:
    - "The value of a case report is an oxymoron" (Paeds Editor, A&A)
    - "Will it change practice?"
    - "Why don't we create a case report template?" Annette Davis, APA 2008
    - Morton classification (tongue in cheek) – I'm an idiot vs. I'm so clever
- Typically does not add much to the literature, unless new technique/procedure/drug
- Should have a review of the literature
- Case series – some trend towards a conclusion – not published
- Children with under-reported syndromes and what was used
- Can be overused or underrated; can lead to major discoveries and major insights
- Can lead to more robust and controlled studies.
- Can lead to significant wrong conclusions (eg. Hyder et al "Compartment syndrome in a tibial shaft fracture missed because of a local nerve block" J Bone Joint Surgery 1996; 78B:499). Pain in the lateral compartment of the thigh (supplied by the sciatic nerve) cannot be masked by a femoral block!
- Can lead to withdrawal of a drug (eg. rapacuronium due to bronchospasm)
- Propagating the wrong message is unfortunately common.

- Definitely valuable if never describe before
- Don't pad the CV's of authors by padding the author's list

Anorectal Malformations – Esme le Grange, Department of Paediatric Surgery, Bloemfontein

- Aetiology unknown. Some weak genetic links
- Variety of systems of classification – confusing
- Gross classification is high (above levator ani) or low (below). Not really useful for clinical or prognostic use.
- Pena (1995) classification still widely used; based on the fistulae present.
- Krickenbeck (2005) classification further delineated this system
- Complex interplay – bowel control, levator ani, external anal sphincter
- Associated abnormalities are the usual cause of mortality (VACTERL, CHARGE). The higher the ARM, the more likely that there will be severe or life-threatening abnormalities.
- TOF and VSDs most common cardiac abnormalities
- Sacral abnormalities in 30%
- Poor renal function due to urinary obstruction in many patients
- Diagnosis is unfortunately missed. Routine clinical examination is essential. Rule not to discharge before passage of meconium has caught many cases.
- Special investigations – antenatal ultrasound; invertogram; echo; loopogram; MRI
- Management for first 24hrs: Fluid resus, NPO, NGT, special investigations, colostomy
- Staged surgery: colostomy at birth, then definitive surgery at 1-3 months, then closure of colostomy at 6 months.
- Loop colostomy is contra-indicated.
- Early surgery improves outcome. Brain-defecation reflexes must be trained early
- PSARP is preferred management.
    - Anaesthetised (With caudal as well if sacrum normal)
    - Urinary catheter
    - Prone position
    - Midline incision
    - Rectal pouch identified, incised, fistula identified and closed, pouch brought to skin
- Persistent cloaca - 3 goals: bowel control, urinary control, sexual function.
- Pain management: caudal, paracetamol, morphine.
- 8 hourly Sitzbaths
- Broad spectrum antibiotics for 48 hours
- At 10-14 days -> anal assessment and dilation. Weekly dilatations until satisfied with rectum.
- Mortality is 10-20%, usually from complications of other abnormalities

Anaesthesia for Paediatric Orthopaedic Surgery – Eddie Oosthuizen, Charlotte Maxeke Johannesburg Academic Hospital & University of the Witwatersrand

Very good notes in conference book

- Common paediatric orthopaedic operations – club feet, hip dysplasia, SUFE (slipped upper femoral epiphysis), scoliosis repair, fractures, etc.
- Disease conditions regularly presenting for orthopaedic surgery:
    - Cerebral palsy
        - Static encephalopathy
        - Disorder of posture and movement
        - 2/1000 live births in European registry
        - M:F ratio 1.33:1
        - 31% significantly mentally disabled (IQ<50)
        - Multiple systems of classification
        - Anaesthetic considerations – cooperation, communications, positioning, venous access, reflux, LRTIs, prone to intraoperative hypothermia, postoperative analgesia can be challenging.
        - 30% on anti-epileptic medication; consider other chronic meds
        - Intubation usually not problematic
        - OSA 20-50%
        - Avoid sux (significant increase in K^+ in 30%)
        - Decreased MAC
        - Increased sensitivity to opioids
    - Joint disorders, eg. arthrogryposis
        - Incidence in USA 1:3000 live births. Amyloplasia is most common type.
        - Typical sign = contractures
        - Non-progressive. Normal intellect.
        - Surgical goal: Mobilisation before 24 months and improvement of hand function.
        - Can have high arched palate.
        - Positioning issues.
        - Avoid sux. Normal response to NDMRs.
        - No link to MH
    - Chondrodysplasias
    - Osteodysplasias
    - Genetic muscle disorders

The Displaced Anaesthetist: EDs, ICUs and Elsewhere – Simon Robertson, Canberra Hospital, Canberra, Australia

- Stimulus for discussion: Downes, J Perinat 2012. 362 intubations taking 785 attempts…
- Most commonly called to the ED for:
    - Airway trouble (eg. Stridor)

    - Respiratory failure plus difficult airway
- NAP4 data: 34 and 67 times more likely to suffer brain injury or death if intubated in the ED or ICU versus the operating therapy
- Kerrey, Ann Emerg Med 2012: 114 intubations in the ED in one year: First time success 52%, Desat 33%, Cardiac arrest 2%.
- Difficult airway planning needs adherence to protocols!
- Plan A – DL or VL
- Plan B – Laryngeal mask + FOI assistance; (or VL)
- Plan C – Surgical airway (open vs. needle)
- Team briefing is essential
- A few tricks:
    - Apnoeic oxygenation (or continued ventilation)
    - Downsized cuffed ETT (get control; change the tube later if necessary)
    - Waveform capnography essential
- Anaesthetist called to the ICU:
    - Airway problems
    - Ventilation problems – ARDS less common than in adults, but does occur. Pre-intubation SpO2 is a useful predictor of mortality. NIV more commonly used. Ventilate in the safe zone between the two inflection points. Make sure lung is recruited. In barotrauma, it's the trans-alveolar pressure that is most important. There is no lower limit for plateau pressure.
    - Transport problems – transport medicine is almost a medical discipline in its own right. Multiple societies' guidelines exist. Fewer adverse events when transport is done by skilled persons (ie. Anaesthetist). Problems during transport: loss of airway, cardiac arrest, sustained hypotension.
- Anaesthetist called to the ward:
    - Could be any problem!
    - Sudden acute deterioration/arrest
    - Aggregate callout scores (MET situation, using PEWS, CEWT etc.) – definitive evidence is lacking calibration may be difficult, but they do encourage more focus on the patient's condition.

The Child in Neuro ICU: TBI and Epilepsy – Eric Hodgson, Albert Luthuli, Durban

- TBI:
    - Get evidence/review files from http://tinyurl.com/d6bhws2
    - ABCs paramount (hypotension & desaturation worsen outcome)
    - Normothermia & normoglycaemia
    - ICP monitoring & reduction
- Epilepsy
    - Prevalence 0.5-1%
    - Wide variety of non-epileptic causes
    - Febrile seizures peak from 8-20 months; seldom after 4 years; Usually only 1 in 24 hours; Resolve spontaneously

    - Stress-related non-epileptic seizures – vocalisation, no injury, no loss of bladder control. Needs to be treated -> psychiatric. Particular feature of child abuse.
    - Examination:
        - Look for syndromic features
        - Exclude infection
        - Focal neuro signs
        - Seek injury
        - Check for aspiration
    - Studies: bloods incl. tox; imaging (CT or MRI), LP if infection Is suspected; glucose
    - Seizure recurrence: check family history, head injuries
    - Treatment of seizure, if longer than 5 minutes: midaz, loraz, diaz. Rectal absorption variable. Midaz is the only drug that can be given IM. IV is good if you have it. IM midaz is better than IV loraz
    - Refractory seizures:
        - Duration > 30min despite anticonvulsants
        - 5% of epileptics
        - Ketamine can be used (1mg/kg followed by 1mg/kg/hr up to 5mg/kg/hr)
        - Load with 2nd line agents
    - FIRES = Fever and Infection Related Epilepsy Syndrome
    - Anti-NMDAR antibody-mediated refractory seizures
    - Second-line agents: phenytoin, valproate, etc
    - Third-line agents: lignocaine, phenobarbital, paraldehyde, clonazepam
    - Unanswered questions:
        - Propofol/thiopentone GA
        - Dose/Target/Duration?
        - Anticonvulsants under GA?
    - Beware PrIS if using Propofol – have a high index of suspicion
- Durban: 3x Propofol coma; if unsuccessful, discuss withdrawal
- See slides and references: http://tinyurl.cm/dy6nerp

Paediatric Resuscitation: What is the Evidence for the New Guidelines – Jonathan Smith, Great Ormons Street Hospital, London, UK.

- Is there any evidence for paediatric resuscitation?
    - ILCOR 5-yearly reviews; all the evidence; graded evidence; expert consensus
    - Survival rates have gone from 9 to 24% over last 20 years
    - Children more likely to survive a cardiac arrest than an adult (child and adolescent)
    - Children arrest much less frequently
    - NNT 13
    - Rhythm in children – 73% non-shockable, 27% shockable. Survival for VF arrest 35%!
    - Yes, it works, and we're getting better.
- How have the 2010 guidelines changed, and why?
    - Resuscitation 2012;81

    - Start CPR if there are no signs of life unless absolutely certain there is a pulse >60/min
    - Compress chess by 1/3 AP diameter – rib fractures exceptionally rare (3 in 963)
    - Push hard, push fast, don't stop
    - Interruptions in CPR are bad – keep going and minimise interruptions
    - Assess quality of compressions with capnography (or a-line)
- Is breathing important in paediatric resuscitation?
    - Compression-only CPR for adults
    - Hypoxic arrest much more common in children
    - Optimal CPR ratio in children – more ventilation for smaller children
    - 15:2 if not intubated
    - Asynchronous if intubated – respiratory rate 8-10/min
    - Too much positive intrathoracic pressure reduces venous return and drops cerebral perfusion pressure.
    - Must always allow full chest recoil and time for expiration
    - Compression-only CPR in children (see Kitamura et al Lancet 2010): Bystander CPR vs. none 4.5% vs. 1.9% favourable neurological outcome. Conventional CPR better than CCR
- Cuffed vs. uncuffed ETTs:
    - Cuffed tubes decrease requirement to change tube
    - Allows high vent pressures and HFOV
    - BUT: cuff pressures must be measured (<20cmH_2O)
- AEDs
    - Public-access AED programs have been incredibly successful in adult arrest
    - Very good sensitivity and specificity (100% in last decade's papers).
    - LD50 for fatal myocardial damage is 470J/kg, so an adult shock is hugely unlikely to cause harm. Guidelines on the fence – no evidence either way.
    - Use attenuated pads if available

Paediatric Anaesthesia: A Risky Business? – Jenny Thomas, Red Cross War Memorial Children's Hospital & University of Cape Town

- "Man is fallible, men less so"
- We work better in teams
- Paediatric anaesthesia is risky for the patient, the parents, the anaesthetist, the nurse, the hospital, insurers, politicians…
- How can error be minimised in paediatric anaesthesia?
    - Protocols vs. judgement
    - Need to get basics right
    - Leave room for craft and judgement
    - Have ability to respond to unexpected difficulties
    - Minimise distraction
    - Control noise
    - "Mission critical"

- Do we have any idea of where we are with safety in SA?
    - Within our own hospitals, private practice and State?
    - Morbidity and mortality reporting
    - Outcome measurement (what metrics?)
    - WHO checklist usage?
    - Who provides care (peripheral places = junior doctors)
- Checklists DO work in medicine (Formula One handover from theatre to ICU; WHO SSC)
- Value of checklists: Go read Atul Gawande "The Checklist Manifesto"
- Good checklists are good. Bad checklists are horrible.
- Reason's "Swiss Cheese" model
- Make it harder to do things wrong, and easier to do things right.
- Team huddle only takes effort until it becomes a habit
- Build an environment of trust
- Anaesthetist's non-technical skills (we are actually often pretty good…):
    - Interpersonal communications
    - Conflict resolution
    - Assertiveness training
    - Teamwork, leadership and fellowship
    - Stress and fatigue management
    - Situational awareness
    - Decision-making
    - Problem-solving
- CRM (Crew Resource Management) principles
    - Risk avoidance (prevention)
    - Risk trapping (detection)
    - Risk mitigation (correction)
    - Belief in an organisational culture that creates safe systems
        - Humans ARE fallible
        - Errors are to be EXPECTED
    - Create systems that present error
- Manage the personal risks of our profession
    - Emotional (stress -> distress, lack of resources)
    - Physical (fatigue, illness)
    - Professional (critical superiors, poor reporting)
- Don't be afraid to be afraid; don't be afraid to feel.

Any feedback or commentary is welcomed.
