1. A comparison of sugammadex and neostigmine for reversal of rocuronium-induced neuromuscular blockade in children.

Ammar AS, Mahmoud KM and Kasemy ZA

Acta Anaesthesiologica Scandinavica 2017; (**6**): 374-380

The primary outcome was recovery time from administration of sugammadex or neostigmine to TOF ratio>0.9. **Method:** 60 children, aged 2-10 years, undergoing elective abdominal surgery were randomly assigned to 2 groups. Exclusion criteria: BMI>40kg/m2, kidney/liver disease, neuromuscular disease or malignant hyperthermia, mental retardation and hypersensitivity to study drugs. NMB monitoring was at the wrist using TOF and rocuronium was administered in a standardised manner. At the end of surgery in Group S (sugammadex), post-tetanic count (PTC) stimulation was performed every 5 minutes until a PTC of 1 to 2 was reached and 4mg/kg sugammadex was given. Another dose of sugammadex was administered if TOF ratio didn't reach 0.9 within 10 minutes. In Group N (neostigmine) a dose of 0.35mg/kg with 0.02mg/kg of atropine was given when T2 appeared on TOF. A further dose was given if the TOF ratio didn't reach 0.9 within 10 minutes. Extubation occurred in both groups when TOF ratio was 0.95. **Results:** Group S had a significantly shorter anaesthetic time (p-value = 0.038), attributed to earlier and shorter reversal time. Recovery and extubation times were significantly shorter in Group S (p=0.002, p=0.005). 1 patient in Group S needed additional reversal compared to 8 patients in group N. No difference from PACU discharge time in both groups. Incidence of PONV (P= 0.035), tachycardia (P=0.031) and dry mouth(P=0.001) were significantly lower in Group S. No patient in either group developed post-operative residual curarisation, bradycardia or respiratory depression. **Conclusion:** The sugammadex group had a faster recovery and extubation time and lower incidence of PONV, tachycardia and dry mouth. **Limitation:** More relevant if sugammadex compared with best possible alternative agent (glycopyrolate rather than atropine).

2. Pediatric Cardiopulmonary Arrest in the Postanaesthesia Care Unit, Rare but Preventable: Analysis of Data From Wake Up Safe, The Pediatric Anesthesia Quality Improvement Initiative

Christensen RE, Haydar B and Voepel-Lewis TD

Anesthesia & Analgesia 2017; **124**:1231-1236

Interrogate Wake Up Safe database to examine 1) the nature of paediatric post-anaesthesia care unit (PACU) cardiac arrests (CA) and subsequent outcome and 2) factors associated with harm after these events. American database, multicenter, voluntary registry of serious adverse events in paediatric anaesthesia. 2008 - 2015, children < 18 years of age, with CA en route to PACU/in PACU. 552 CA identified, 26 had a PACU CA. For each case 3 anaesthetists (local hospital) not involved in the case analysed the case using a standardised root cause analysis method to identify the causal or contributing factors. 11 surgeries were low severity, 15 of medium severity. **18/26 cases identified**

as preventable. **17/18 were respiratory in nature**, 1/18 was secondary to a drug error. In the events deemed preventable, individual provider factors were most commonly identified as the primary root cause (12/18), and of these 11 were related to decision making and one to human factors. 8 cases were non-preventable secondary to disease. In this group provider decision-making was identified as a contributing factor in 3 cases. Univariant comparison of data showed CAs with cardiac origin were more significantly associated with patient harm (P=0.013). Respiratory origin was less likely to be associated with patient harm (P=0.028).

Limitations: Selection and reporting bias, analysis methodology variable amongst institutions, timing of epinephrine administration at CA not available for analysis, data inputting error, small sample size and absence of PACU population information stops calculations of incidence or analysis of predictors of CA.

Conclusions: 4.7% of paediatric perioperative CAs occurred in PACU and 69% of these were deemed preventable.

3. Defining hypotension in anesthetized infants by individual awake blood pressure values: a prospective observational study

Weber F, Koning L & Scoones GP

Pediatric Anesthesia 2017; **27**: 377-384

Lower limits of BP in anaesthetised infants either use age related absolute values or percentage decrease in BP relative to baseline values taken before induction of anaesthesia. **Aim:** This prospective observational study in Netherlands investigated feasibility of pre anaesthetic BP measurement and the incidence of post induction hypotension under the two definitions. **Methods:** Inclusion criteria: Neonates & infants (<1 year) undergoing elective surgery / diagnostic procedures. Exclusion criteria: preoperative admission to PICU/NICU. A NIBP reading was attempted on ward/holding bay and again on arrival to the operating room. They used the same BP cuff, on the same limb, without force. The first NIBP was performed 1 minute after IV induction and 3 min after initiation of inhalational induction, prior to endotracheal or LMA insertion. The NIBP was measured at 5 min intervals and analysis of the BP data was made until 10 min post induction of anaesthesia. **Results:** 151 participants and 79% allowed measurement in the operating theatre and 85% on the ward, with no differences from neonates to 12 months. Calm patients allowed successful BP measurements more than anxious patients and anxious patients had higher pre-induction MAP values than calm patients. The relative BP approach resulted in a significantly higher incidence of post-induction hypotension than using absolute BP values. Authors concluded that definitions of hypotension using either absolute MAP or value relative to awake baseline were not interchangeable. Limitations: 6 patients born less than 37 weeks included in <3month subgroup. NIBP variable and dependent on site, circumference and type of monitor.

4. Drug safety in paediatric anaesthesia

Kaufmann J, Wolf AR, Becke K, et al.

British Journal of Anaesthesia 2017; **118**(5): 670–679

A narrative review. **Aim:** 'Identify known measures to reduce errors according to their level of evidence and feasibility with paediatric practice.' **Methods:** Database search of the Guidelines International Network, Medline, the Cochrane Library and any international medical societies pertaining to paediatrics, guidelines or anaesthesia. Evidence assessed for level of evidence and feasibility (cost). If high level of evidence (1 or 2) and good feasibility then grade of recommendation =A1. If no published evidence but statements seem reasonable then marked as 'good practice'. **Results:** 11 guidelines, 42 studies and 1 relevant Cochrane Review. **Recommendations (A1 or A2):** *1) Improve Competency:* courses and lectures on paediatric pharmacology and medication errors, tabular and electronic references, and standard operating protocol that is age-group-specific. *2) Improve Drug Prescribing:* Structured sheets or computer generated forms for prescribing, written rather than verbal prescribing for drugs with high risk of potential harm e.g. adrenaline. **Recommendations (B1 or B2):** *1) Improve vigilance and safety culture:* frequent and random checks of anaesthetic protocols combined with critical incident reporting systems. *2) Improve Drug Prescribing:* if weight unknown use weight provided by parents, or length based estimation methods. Use electronic charts combined with pharmacological databases. 3*) Improve drug preparation failures:* pre-prepared and labelled syringes. (*4) Improve drug administration errors:* smart syringe pumps with label readers. **Recommendations (Good practice):** This included, amongst others, avoiding drugs that looked or sounded alike, storing different preparations, for example with or without additives, in different places, having uniform storage places within institutions, selecting drug concentrations that allow easy calculations, flushing of lines, and the use of non-return valves.

5. Early or late fresh frozen plasma administration in newborns and small infants undergoing cardiac surgery: the APPEAR randomized trial

Bianchi P, Cotza M, Silvetti S, et al.

British Journal of Anaesthesia 2017; **118**(5): 788-796

Methods: Computer randomization, surgical and anaesthetic team not blinded, PICU team blinded. **Inclusions:** Elective cardiac surgery, blood priming of CPB, weight <10kg. **Exclusions:** Emergency surgery, known congenital coagulopathy, refusal to participate, previous enrolment in other trials. **Withdrawals:** extracorporeal membrane oxygenation (ECMO) in first 24 hrs postop. **Interventions:** Late FFP group: CPB priming with albumin 5% plus RBCs. During ultrafiltration half volume replaced

with FFP (15ml kg^{-1}) and 15ml kg^{-1} FFP during haemostasis. Early FFP group: CPB priming with FFP plus RBCs and volume replacement with albumin 5%. **Endpoints:** Primary: reduction in postoperative chest drain loss in first 24 hours. Secondary: amount of allogeneic RBCs, FFP and platelets in first 48 hours, length of mechanical ventilation, PICU stay and postoperative hospital stay. **Results:** 40 in each group. 17 cyanotic patients in each group. 3 in early group and 4 in late group withdrawn for ECMO. Postoperative bleeding was significantly higher (P=0.028) in late group (33.1ml/kg SD 20.6) compared to the early group (24.1 ml/kg SD 12.9). A significantly higher volume of FFP was administered to the early group compared to the late group, but this does include the prime volume and numbers are not disclosed. No difference in RBC, platelet or fibrinogen concentrate transfusion, mechanically ventilated days, or length of postoperative hospital stay. **Conclusion:** FFP-based priming was slightly superior to late FFP in terms of postoperative bleeding. (Upheld in the subgroup analysis; cyanotic, <6months)

6. Videolaryngoscopy versus direct laryngoscopy for tracheal intubation in children (excluding neonates) (Review)

Abdelgadir IS, Phillips RS, Singh D, et al.

Cochrane Database of Systematic Reviews 2017, Issue 5. Art. No.: CD011413

A meta-analysis comparing the adverse outcomes and efficacy of direct laryngoscopy to indirect laryngoscopy (videolaryngoscopy). **Inclusions:** RCTs, subjects aged 28 days to 18 years, any type of indirect laryngoscope or video laryngoscope or direct laryngoscopy. **Results:** 12 studies were included (803 children). The intubation time was longer for indirect laryngoscopy (mean difference 5.49 seconds, 95% CI 1.37-9.60), no difference in the success of first intubation attempt, and significant increase in failed intubation with indirect laryngoscopy when there have been 2 or more attempts. 5 studies commented on oxygen desaturation during intubation. 1 child desaturated with direct laryngoscopy compared to 4 children undergoing indirect laryngoscopy. 2 studies reported heart rate increases post intubation, one reported significant increase with indirect laryngoscopy, the other showed significantly less heart rate increase following direct versus indirect laryngoscopy. 1 study reported no significant difference comparing blood pressures between the two groups. There were 2 reports of trauma secondary to direct laryngoscopy compared to no reports following indirect laryngoscopy. **Conclusions:** Videolaryngoscopy had a prolonged intubation time with increased rate of intubation failure. There was insufficient evidence to conclude regarding trauma or haemodynamic responses. The quality of evidence was mostly rated as low or very low and heterogeneity as high.

7. **Addition of droperidol to prophylactic ondansetron and dexamethasone in children at high risk for postoperative vomiting. A randomized, controlled, double-blind study**

Bourdaud N, Francois C, Jacqmarcq O, et al.

British Journal of Anaesthesia, 2017; **118** (6):918-923

Droperidol is included in the updated APAGBI guidelines on the Prevention of Post-operative Vomiting (POV) in Children (2016). This study aimed to establish whether the addition of droperidol to ondansetron and dexamethasone reduced the incidence of post-operative vomiting (POV) in a high-risk paediatric population compared to the ondansetron and dexamethasone alone. **Methods:** This was a multicentre (14 University hospitals in France), randomised, double-blind, placebo-controlled trial. Children 3-16 years undergoing surgery with general anaesthesia with an increased risk of PONV (VPOP score of ≥ 4) were randomised to receive dexamethasone (125mcg.kg), ondansetron (100mcg.kg) and a placebo injection (Group A: n=153) or dexamethasone, ondansetron and droperidol (50mcg.kg) (Group B: n=162). Children with long QT, preoperative steroid use, preoperative antiemetic use, postoperative sedation and ventilation, parental refusal and allergy to study drugs were excluded. The primary outcome was the incidence of emetic episodes (retching or vomiting) in the first 24 hours following surgery. The secondary outcome was the incidence of adverse effects. **Results:** 315 children. The overall incidence of POV was not significantly different between the two groups: 10.5% in Group A vs. 11.1% in Groups B (p= 0.86). However, overall incidence of postoperative complications differed significantly between the two groups (Group A = 3 vs. Group B= 13 (p= 0.01). Drowsiness and headache were the most frequently reported adverse effects and Group B were noted to have increased drowsiness in recovery. **Conclusions:** The addition of droperidol to prophylactic ondansetron and dexamethasone did not decrease POV frequency compared to the two drugs alone in high risk of POV. However the addition of droperidol did increase the risk of drowsiness.

8. **Outcomes of a failure mode and effects analysis for medication errors in pediatric anesthesia**

Martin L, Grigg E, Verma S, et al.

Pediatric Anesthesia 2017; **27**:571-580

This quality improvement project involved industry-validated failure model and effects analysis (FMEA) to prospectively evaluate processes and identify risk. A “bundle” of changes based on best practice recommendations and observational data was implemented at Seattle Children’s hospital over 12 months. An audit was undertaken before and after the implementation. Post implementation audit data for 61 randomly selected cases over a 2-month period were collected.

They observed improvements in syringe labelling (73% vs. 96%), standardisation of the workspace (none before, 100% after) and improvement in a standard two-provider infusion check process (23% non-standard process before and 59% standard process after). After the interventions the median medication error rate decreased from 1.56 to 0.95 per 1000 anaesthetics. Harm events

were noted to trend downwards from 9/year to 4/year post-implementation suggesting an associated improvement in medication safety.

The presence of an observer in the operating room may have produced a "Hawthorne effect" which would have influenced behaviour towards a positive outcome. The decrease in reporting may be due to reporting fatigue rather than an actual decrease in medical error. They demonstrated the use of FMEA in a quality improvement project.

9. Validation of a simple tool for anxiety trait screening in children presenting for surgery

Bellon M, Taillardat E, Hörlin A-L, et al.

British Journal of Anaesthesia, 2017; **118**(6): 910-917

Anxiety trait in children is considered a major predisposing factor for perioperative anxiety state and is associated with increased pain and neurocognitive complications postoperatively. State-Trait Anxiety Inventory (STAI) is a validated tool in identifying these patients but is time consuming to perform. The primary aim of this study was to determine the performance of the simple faces pain scale (Bieri et al) as a tool for assessing preoperative anxiety trait in children when compared with STAI.

This prospective observational study recruited children between the ages of 8 and 18 years and ASA 1-3 presenting for elective surgery. Refusal and neurodevelopmental delay were exclusions. Children were asked to rate their level of anxiety at home using the faces pain scale when asked "how anxious do you feel in daily life". They also completed the trait component of the STAI. The final number of subjects totalled 298. The cohort was divided into a construction cohort (n= 207) during the initial 4 months and a validation cohort (n=91) in the last 2 months. The validation cohort was used to assess the accuracy of the results.

30% of patients had preoperative anxiety trait defined by STAI. The optimal threshold value for the faces score was 4 with a sensitivity of 0.61 (95% CI 0.59, 0.62) and a specificity of 0.82 (95% CI 0.81, 0.83). When this threshold was applied to both cohorts, 61.3% and 44.4% of positives were *true* positives in the construction and validation cohorts respectively and 82.1% and 81.3% of negatives were *true* negatives respectively.

Although the faces scales shows promise as a quick and simple screening tool for perioperative anxiety risk, it should not be used in isolation. Many patients would be misclassified with faces scale alone. It may highlight patients that need targeted management for preoperative anxiety.

10. Pediatric upper airway dimensions using three-dimensional computed tomography imaging

Wani TM, Rafiq M, Talpur S, et al.

Pediatric Anesthesia 2017; **27**:604-608

Classically the paediatric airway has been defined as funnel shaped with the cricoid as the narrowest portion. There is an increasing body of evidence suggesting the subglottic region is the narrowest point. The aim of this study was to use CT-based measurements from a sample population to define the geometry at three key reference points in the paediatric upper airway (subglottis, cricoid and trachea).

A database search of the electronic medical records identified children ≤8years with CT imaging of the neck. Patients who had a history of respiratory disease, surgery involving the airway or genetic syndromes were excluded. All images were obtained in the supine position, with spontaneous ventilation during natural sleep, under sedation or general anaesthetic without airway intervention.

54 patients qualified for the study (25 boys and 29 girls) 2 months to 8 years. There was a statistically significant difference between the subglottic and cricoid regions (p=0.002) with the subglottic volume being less than the cricoid. In turn the cricoid volume was significantly less than the tracheal volumes (p=0.001). However, using ANOVA there was only a statistically significant difference observed between the subglottic and cricoid regions (p=0.009).

This study provides additional evidence to suggest the subglottic region is the narrowest portion of the airway. Although the subglottic region was found to be the narrowest portion of the airway the authors could not make judgements on which area was most rigid and hence produce the most resistance to passing an ETT, with potential for trauma and complications.

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