Pediatric Anesthesia Severe Adverse Events Leading to Anesthetic Morbidity and **Mortality in a Tertiary Care Center in a Low and Middle-Income Country: A 25-Year Audit**

Khoso N, Ghaffar WB, Abassi S, et al. Anesthesia Analgesia. 2021;132(1):217-222.

An audit of paediatric adverse events following general or regional anaesthesia from 1992 to 2016 at a large teaching hospital serving as a referral centre for southern Pakistan.
Publications of data of this kind are rare in low to middle income settings.

In this centre, adverse anaesthesia events are mandatorily reported to a 'M&M database'.
This database was searched to identify significant events, which affected patients from birth to 16 years and resulted in death, major morbidity (permanent disability, cardiac arrest, neurologic or spinal cord injury), or intermediate morbidity (serious distress or temporary but significant sequelae resolving within 48 hours). Cardiac surgery patients and non-theatre anaesthesia events were excluded.

Thirty nine patients experienced significant adverse events from a total of 48,828 paediatric cases (8 patients per 10,000, 95% CI 5.7-10.9). Events were primarily respiratory (33.5%) the majority occurring at extubation, or cardiovascular (23.1%). 33.5% of events occurred in patients <1 year old and 38.5% in patients aged 1-5 years. Two thirds of events were associated with emergency procedures. Over half of events were intraoperative, most post-operative events took place in recovery. Eleven patients died within 48 hours of their anaesthetic (crude perioperative mortality rate of 0.02%). Thirteen patients had cardiac arrest; 7 were infants and 5 had congenital heart disease. Regional anaesthesia contributed to morbidity in four patients, one case of quadriplegia after epidural and three cardiovascular events after bupivacaine caudals.

Limitations of this audit include potential under-reporting and under-detection of anaesthetic complications. Missing data limited breakdown of mortality rates between age groups. However, crude post-operative mortality rates do provide an indicator of safety and a metric to track improvement within and across institutions.

Dr. Georgia Ellis

Major Short-term Complications of Arterial Cannulation for Monitoring in Children
Gleich SJ, Wong AV, Handlogten KS, et al. Anesthesiology. 2021;134(1):26-34.

Background

Arterial cannulation is commonly employed for intraoperative monitoring and sampling.
There are few large-scale studies of complications of this technique in children.

Methods

In this single centre (The Mayo Clinic, Minnesota) retrospective cohort study patients <18 years who underwent arterial cannulation from 2006 to 2016 were identified from electronic perioperative records. Exclusion criteria were lack of consent for research, and the arterial cannula not sited for anaesthetic use. Authors interrogated institutional electronic patient records, perioperative, and Infection Control Committee data to identify vascular, neurologic, or infectious complications occurring within 30 days of catheter placement. All records of complications were manually reviewed to confirm findings and a random sample of 100 patient records in which complications were not identified were checked to ensure data queries were robust.

Results

5142 arterial cannulations in 4178 patients were included in the study. Most cannulations were radial (66%), or femoral (29.7%). 11 short-term major complications were identified (overall complication rate: 2 per 1000 lines, 95% confidence interval 1-4). All complications related to femoral lines in children <5 years old, and 91% of these lines were sited for cardiac procedures. Overall complication rate in neonates was 11 per 1000 lines (95% CI 3-39), infants 16/1000 (CI 7-34), and toddlers 7/1000 (CI 3-21). Eight complications were vascular (developing at a median of 1.5 days post insertion, interquartile range 1-2.75) and three were catheter-related blood stream infections (occurring at a median of 11 days, IQR 6-23).

Take home message

The methodology of this study is such that lesser complications, or those not coded in the data sources could not be identified; potentially a cause of the comparatively low complication rate found. This study adds to evidence for the low complication rate of the technique in older children and when catheters are inserted in distal arteries.

Dr. Georgia Ellis

Risk of Hypoxemia by Induction Technique Among Infants and Neonates Undergoing Pylorotomy

Park RS, Rattana-arpa S, Peyton J et al. Anaesthesia and Analgesia 2021; 132 (2): 367-373.

Background

The primary aim of this single (tertiary) centre retrospective study was to compare the rate of hypoxaemia associated with Rapid Sequence Induction (RSI) versus modified RSI (mRSI) in patients presenting for pylorotomy. There were four secondary aims, the most significant were to investigate the influence of single versus multiple intubation attempts and to compare hypoxaemia in the neonatal subgroup.

Methods

RSI was defined as 'Intravenous induction and neuromuscular blockade without mask ventilation before initial intubation attempt' and mRSI as the same but with mask ventilation prior to intubation. Electronic medical records were used to identify patients and collect data, 2 investigators collected the data and 2 independently verified it. Hypoxaemia was defined as SpO2 nadir <90% the contemporaneous heart rates from pulse oximeter and ECG were compared and if there was a >10% difference the data was deemed artifact and excluded.

Statistical tests were appropriate to the data including multivariate analyses against potential confounders. A conservative P cut off of 0.025 was used to attempt to protect against type 1 error and power calculations showed adequate sample size to provide 80% power to detect a 25% difference in the main and subgroups.

Results

A total of 296 patients were included, the demographics between groups were similar.

Regarding the primary outcome there was an overall incidence of hypoxaemia of 25%; this was greater in the RSI group (30% vs 17%, OR 2.8 p 0.03). Regarding secondary outcomes,

hypoxaemia was more likely with multiple intubation attempts (OR 11.4, p <0.001). In 108 neonates the same pattern was observed – hypoxaemia was more likely with RSI (OR 6.5,

p <0.001) and multiple intubation attempts (OR 18.1, p<0.001).

Conclusion

Despite limitations of a retrospective single centre study, the results compellingly suggest that hypoxaemia is reduced in infants (including neonates) presenting for pylorotomy if a mRSI technique is adopted and only one intubation attempt needed. It seems reasonable to strongly consider a mRSI approach in this patient group and continue to make all preparations to increase the likelihood of a successful first intubation attempt.

Dr. Katherine Brooks

Evaluation of the factors related to difficult ultrasound-guided radial artery catheterization in small children: A prospective observational study
Oh EJ, Min JJ, Kim CS et a. Acta Anaesthesiologica Sandanavica 2021;65:203-212

Background
The primary aim of this single centre, prospective, observational study was to 'identify variables related to difficult ultrasound-guided radial artery catheterisation, defined as the first attempt failure, in children under two years old.'

Methods
Patients under two undergoing elective surgery were prospectively enrolled. Exclusion criteria were wounds near puncture site, abnormal circulation on Allen's Test, skin infection, flexion contracture of wrist, recent radial arterial line and peripheral vascular disease. Anaesthetic technique was standardised as was the technique and equipment for performing the radial artery catheterisation. All procedures were done by the same operator to exclude inter-operator variability. The puncture site was identified and then scanned with measurements taken prior to puncture. The procedure was timed. Failure of first attempt, overall failure and procedure time were clearly defined in the protocol.

Results
183 patients completed the protocol. The overall first attempt success rate was 65.6% and procedure success rate was 90.2%. When all analysis was complete cross-sectional area of $<1mm^2$ was an independent predictor of first attempt failure rate (OR 5.26 $p<0.0001$), as was presence of anomalous radial artery branch (OR 3.347, $p =0.005$). Cross-sectional area was also found to be negatively associated with procedure time. The rate of anomalous radial artery branches was 19.7%.

Conclusion
Two independent predictors of failed first attempt at radial artery catheterisation in under 2's have been identified. The study cannot be generalised completely as in real life skill level of operators is variable however it does suggest that pre-procedure scanning to identify any anomalous branches and the puncture site with the largest cross-sectional area may increase chances of success.

Dr. Katherine Brooks

Morbidity and mortality after anaesthesia in early life: results of the European prospective multi-center observational study, neonate and children audit of anaesthesia practice in Europe (NECTARINE)

Disma, Veyckemans, Virag et al. BJA. 2021. (*Electronic publication ahead of print)*

Background

The NEonate and Children audiT of Anaesthesia pRactice IN Europe (NECTARINE) study examines peri-operative outcome data in a cohort of children less than 60 days post menstrual age.

Methods

NECTARINE is a prospective multicenter observational study in neonates and infants undergoing a variety of both elective, emergency surgical and non-surgical procedures. 165 centres from 31 European countries recruited 5609 patients for 6542 procedures in 2016. The primary outcome was to determine thresholds for critical events, which required intervention in eight pre-defined physiological parameters. Secondary outcomes were defined by the authors as risk factors associated with morbidity and 30 and 90 day mortality.

Results

The overall incidence of severe critical events requiring intervention was reported as 35.5%. Cardiovascular instability related to hypotension was the most common physiological parameter requiring intervention (60.7%), followed by hypoxaemia. Notably 55% of hypoxaemic events occurred during maintenance of anaesthesia.

Risk factors for critical events requiring intervention included neonatal medical and congenital abnormalities, intensive pre-operative support, current co-morbidities and duration of surgery. Younger patients < 32 weeks accounted for 70% of critical events and also had a higher chance of requiring red cell transfusion. Overall mortality was 3.2% within 90 days, with 2% mortality at 30 days. In the neonatal population, 30 day mortality was 4.1%.

Limitations

The major limitation to the study is the reliance on self-reporting, and operator dependent thresholds on incidents requiring intervention.

Conclusion

The rate of severe perioperative complications is significant in neonates and infants. This study further highlights the unique challenges and vulnerability of this population. It also provides clinicians with robust data to counsel peri-operative risk with both families and our surgical colleagues.

Dr. Barny Allan

The Pediatric-Specific American Society of Anaesthesiologists Physical Status Score: A Multicenter Study

Ferrari, Leahy, Staffa and Jay G. Berry. Anaesthesia and Analgesia. 2021. Vol 132;3: 807-817

Background

The application of the American Society of Anaesthesiologists physical status (ASA-PS) classification has historically been a variable and subjective undertaking in both adults and children. There are a number of child specific considerations that are not taken into account by the ASA-PS including: prematurity, age and acute illness.

Methods

This prospective multicenter study uses a mixed methods questionnaire to apply the ASA-PS classification to a paediatric population. Fifteen cases were presented by survey to 197 paediatric anaesthetists from 13 paediatric hospitals worldwide. Anaesthetists were asked to assign the ASA-PS score for each case using paediatric adapted ASA-PS guidance. Quantitative analysis of interrater reliability of ASA-PS scoring was assessed using interclass correlation co-efficient (ICC). Feedback comments informed further qualitative analysis.

Results

The overall inter-rater reliability of ASA-PS scoring was moderate, ICC of 0.58 ranging from 0.34 to 0.79. There was large variation between hospitals in interrater reliability, which was not seen with anaesthetic experience. The cases showing best interrater agreement were those considered to be ASA-PS I, IV and V and least agreement in those assigned as either ASA-PS II or III.

Take home message

This study highlights the difficulty in applying an adult scoring system to the paediatric population despite further guidance. Future refinement is required to improve consistency in ASA –PS scoring used to describe and communicate the risk posed to a child undergoing anaesthesia.

Dr. Barny Allan

Edited by Dr. Kira Achaibar