Ultrasound Assessment of Gastric Fluid Volume in Children Scheduled for Elective Surgery After Clear Fluid Fasting for 1 Versus 2 Hours: A Randomized Controlled Trial

Sarhan KA, Hasaneen H, Hasanin A, Mohammed H, Saleh R, Kamel A. Ultrasound Assessment of Gastric Fluid Volume in Children Scheduled for Elective Surgery After Clear Fluid Fasting for 1 Versus 2 Hours: A Randomized Controlled Trial. Anesth Analg. Apr 2023, 136(4):711-718. doi: 10.1213/ANE.0000000000006157. Epub 2022 Jul 16. PMID: 35881513.

This small randomized single-blinded controlled trial is the second such trial comparing gastric fluid volumes after a 1-hour versus a 2-hour clear fluid fast in children undergoing general anaesthesia for elective surgery. It is the first utilising ultrasound. The authors (from a major university hospital in Cairo, Egypt) postulated that a 1-hour fast would result in significantly higher gastric volumes. They did indeed demonstrate that the volumes roughly doubled, and suggest that a 1-hour fast may result in an unsafe stomach. The questions the reader is specifically interested in, however, are: Is there a gastric fluid volume at which the risk of aspiration is significantly increased? Does a 1-hour fluid fast lead to a significantly greater proportion of patients having gastric volumes above this threshold?
The former question has as yet not been clearly answered. It would require a study of 10,000-20,000 patients in order to reliably demonstrate an increase in aspiration rates above baseline levels. What we do have is attempts to define a normal distribution of gastric volumes in small (ranging 34 to 538 patients) observational studies of both adults and children with and without risk factors for regurgitation or aspiration events. These normal distributions seem to demonstrate that around 95% of children have volumes less than 1.5ml/kg and that there are always small groups of outliers with larger volumes occupying the remaining 5% who have volumes greater than this regardless of clear fluid fasts of 2, 5 or 6-hours. This study demonstrates that whether a 1 or 2-hour fast is enforced, a child's gastric volume never lies above this 1.5ml/kg threshold. Other risk thresholds of 1.25ml/kg and 0.8ml/kg (as mentioned by the authors) seem to be based on an arbitrary grading system that has not been related to aspiration risk nor to a normal distribution of the population of interest.

Strengths of the study included a robust overall design, a fairly well powered sample size, standardisation of quantity and caloric content to a maximum of 3ml/kg and 0.42kcal/ml respectively in keeping with standard practices in many countries and international recommendations. They did not comment on exactly how successful they were at enforcing the precise 1 and 2-hour fasts. It would also have been helpful to have some more parameters reported such as mean, standard deviation and range in order to establish the nature of the normal distribution in each sample. Their reference to several different risk thresholds (0.8ml/kg, 1.25ml/kg and 1.5ml/kg) is likely confusing for practical application.

In summary, this study shows that whilst gastric volumes are higher after a 1-hour versus a 2-hour fast, this does not seem to place patients outside of the normal distribution of what is understood to be a fasted stomach and would, contrary to the authors conclusions, support a 1-

hour minimum fast given that we know that most patients who apply this rule in practice fast longer than 1 hour. It would be helpful in the future to better define the normal distribution of gastric volumes in fasted children for the sake of studies like this one since some of the statistical reporting in existing studies is not always crystal clear on this point. A multicentre study is likely necessary to generate the numbers needed to relate this to aspiration risk.

Reviewed by Dr David Stoeter

Videolaryngoscopy in neonates: A narrative review exploring the current state of the art

Rachele Bonfiglio, Robert Greif. Videolaryngoscopy in neonates: A narrative review exploring the current state of the art, Trends in Anaesthesia and Critical Care, Volume 49, 2023, 101232, ISSN 2210-8440, https://doi.org/10.1016/j.tacc.2023.101232.

This article is a narrative review exploring the utility, benefits and pitfalls of the use of videolaryngoscopy in children with a specific focus on the current practice of neonatal tracheal intubation. The authors conducted a Medline search on all published articles between 2010 and 2022 and ultimately included 20 articles in their narrative review including randomised control trials, observational studies, review articles, meta-analyses and editorials.

The authors concluded that in neonates and or children with expected difficult intubation the routine use of a videolaryngoscope (VL) compared to standard direct laryngoscopy (SDL) as first device for tracheal intubation is associated with higher first attempt tracheal intubation and reduced intubation related complications. This conclusion is supported by data from the Paediatric Difficult Intubation registry (PEDI) and the multicentre RCT Videolaryngoscopy in Small Infants (VISI) trial:

- The PEDI trial found initial tracheal intubation success rate in <18yo paediatric patients with a suspected difficult intubation to be 53% with VL group compared to 4% with SDL
- The VISI trial found that VL compared with SDL improved first pass intubation in neonates and infants <6.5kg by 5%.

The Neonate and Children study of Anaesthesia practice in Europe (NECTARINE) observational cohort study of critical events during anaesthesia in neonates and infants found that two-thirds of difficult intubations were unexpected and that the use of VL as first device for tracheal intubation was only used when difficult intubation was expected. In that study, VL was associated with reduced intubation attempts, improved first pass tracheal intubation and reduced intubation related complications. Hence, Bonfiglio and Grief have asked the question as to whether anaesthetic clinicians should be using VL as first devices for tracheal intubation in all neonates

and infants less than 1yo of age – especially given the majority of difficult intubations are unexpected and VL improves first pass intubation in both neonates and children with difficult intubation.

However, the authors' contention has not been reflected in Cochrane reviews by Lingappan et al (2018) and Abdelgadir et al (2017) which concluded that there is insufficient evidence to support the routine use of VL for neonatal intubation. Bonfiglio and Grief surmise that these findings are likely due to the heterogeneity of studies included in the Cochrane reviews and that more recent evidence in the PEDI, NECTARINE, VISI and OPTIMISE studies favour the use of VL to improve tracheal intubation management in neonates and infants with difficult intubations. This study further recommends that routine VL use might accelerate the laryngoscopy learning curve to improve clinician skillset when conducting both routine and difficult VL neonatal intubation.

There is a paucity of evidence for recommending specific VL brands and blade type when performing neonatal intubation. In children with difficult intubation, the PEDI trial found that the use of hyper-angulated blades were associated with a high tracheal intubation success rate compared with VL standard blades (Miller or MAC). However, after multi-variable logistic regression analysis in patients <5kg without an expected difficult intubation, the PEDI trial found that the use of standard VL blades (MAC, MILLER) resulted in improved initial tracheal intubation success. Hence, Bonfiglio and Grief recommend the use of standard VL blades (MAC/MILLER) over hyper-angulated blades for routine neonatal tracheal intubation.

Due to lack of evidence and recommendations from paediatric and neonatal difficult airway societies the authors have not provided specific suggestions with regards to what specific VL brand should be used when conducting both routine and difficult neonatal and infant intubation. This narrative review has highlighted the potential benefit of video-laryngoscopy when managing neonatal and infant intubation and children with a difficult intubation. The authors have discussed the potential benefits of routine use of VL for neonatal intubation, namely:

- Improved first pass tracheal intubation
- Reduced intubation related complications
- Improved safety when training novice intubators
- Improved airway team situational awareness and performance.

Reviewed by Dr Ashton Speed

Rapid sequence induction in Paediatric Anaesthesia: A narrative review. Trends in Anaesthesia and Critical Care

Cools, Evelien & Habre, Walid. (2023). Rapid sequence induction in Paediatric Anaesthesia: A narrative review. Trends in Anaesthesia and Critical Care. Volume 49, 2023, 101215. 10.1016/j.tacc.2023.101215

Bronchial aspiration – dangerous for our patients and medico-legally and morally dangerous for providers. This narrative review presents an overview of rapid sequence induction (RSI) as it pertains to paediatric patients.

Few large studies have examined the incidence of pulmonary aspiration in children and its risk factors. The Near 4 Kids trial found a 4% incidence of regurgitation during intubation, with 0.7% incidence of clinical aspiration, with age >8 and haemodynamic instability among the risk factors. The APRICOT study found 0.1% of their patients had aspiration, with roughly 50% at induction and 50% at emergence / maintenance.

There is a large heterogeneity of RSI techniques in the paediatric literature beyond the classically described pre-oxygenate + muscle relaxant + cricoid pressure + no ventilation. One large survey described in this review noted only 24% of respondents performed cricoid pressure during RSI and nearly a third performed low pressure ventilation. In the APRICOT study half the patients were ventilated and half were not, and 90% of them had muscle relaxants. (Notably in a recent ANZCA survey [Mistry et al, Anaesthesia and Intensive Care 2021] the numbers were closer to 75% amongst those who use cricoid).

The article presents several risk factors for aspiration/indications for RSI in children which would be near identical to a list for adults. Some more information around specific risk factors that might be more unexpected in children versus adults and why, may have been useful for the occasional paediatric anaesthetist.

In terms of fasting the authors note that European recommendations on preoperative fasting in children suggest assessing gastric contents with ultrasound in children before emergency surgery, which may present challenges depending on operator skill and patient compliance.

The article presents a preparation checklist for equipment for RSI. Again, no real surprises here but it may be a useful checklist to have to hand in a crisis. They suggest use of video laryngoscopy as first choice where available, noting there is evidence in infants that it improves first pass success and reduces complications.

Skating delicately over the huge area of controversy that is use of cricoid pressure, the authors state “many paediatric anaesthetists wonder whether cricoid is performed as a ritual”, noting the potential issues relating to cricoid pressure in children – smaller cricoid size, application of correct pressure and potential for decrease in lower oesophageal sphincter tone leading to aspiration.

They note that several European paediatric anaesthesia societies no longer recommended use of cricoid pressure during RSI, and that the Near 4 Kids trial showed an increased incidence of aspiration with the use of cricoid – though this was not significant after adjusting for patient and practice factors. Notably cricoid pressure can help prevent gastric insufflation when ventilating children <1 year old. As always – more RCTs are needed! The authors' final opinion is not to recommend cricoid pressure.

The authors give a concise summary of a suggested standard operating procedure for RSI in children. Mostly sensible stuff that fits with local practice. Injecting opioids or atracurium slowly and use of thiopentone might raise eyebrows.

The planning and equipment as described in this article assumes that all patients will have an IV placed as part of the preparation for RSI. This is all well and good, but discussion around use of sedatives and adjuncts (e.g. N2O) and their safety (or lack thereof) would be helpful for the children who would not tolerate IV placement.

With regards to oxygenation the authors note the difficulty in pre-oxygenating smaller, non-compliant children. They suggest a number of strategies to achieve a "controlled RSI" which have been demonstrated to have improved outcomes:

- gentle ventilation – <8mL/kg, APL at 10cm, which appears to only cause gastric insufflation in children <1 year old
- maintain FRC by fixing APL at 10cm and applying "manual high frequency tiny ventilation"
- nasal oxygenation via standard nasal prongs during intubation

The authors do not describe how nasal oxygenation could be achieved smoothly without interfering with effective mask ventilation, if desired.

For the child where aspiration does occur, the authors give a nice summary of management techniques – head down, suction, bronchoscopy if large pieces obstruct. Use PEEP, more suction and bronchodilators depending on the clinical picture. Systematic bronchial-alveolar lavage, chest XR and steroids are not routinely required. Handy disposition suggestions are also provided – asymptomatic patients can be sent to their pre-planned destination (home / ward) after two hours of observation, while symptomatic patients should go to the ward, and those requiring ventilatory support or if SaO2 cannot be maintained over 90% should go to ICU.

Finally, a timely reminder of the use of capnography and consideration of human factors in confirmation of tracheal intubation, particularly in the light of recent publicized tragic events: no trace = wrong place.

Bottom line

This review gives a succinct summary of the issues surrounding RSI in children and the important steps to consider, with useful discussion of some specific techniques that can be applied.

It could have used a little more depth as to the evidence base for some of their recommendations, or included more recommendations from international societies where the evidence base is weak. It would be useful to know more about which risk factors for pulmonary aspiration are more prevalent in children and why, in order to better prevent these events.

Some more real-world consideration of management of the non-compliant child without an IV who requires an RSI would be helpful.

Reviewed by Dr Christopher Dawson

The effect of hyperventilation versus normoventilation on cerebral oxygenation using near infrared spectroscopy in children undergoing posterior fossa tumor resection: A randomized controlled cross-over trial

Sharhan KA, Emad R, Mahmoud D, Hasanin A, Hosny O, Al-Sonbaty M, Abo El-Ela A, Othman S. The effect of hyperventilation versus normoventilation on cerebral oxygenation using near infrared spectroscopy in children undergoing posterior fossa tumor resection: A randomized controlled cross-over trial. Anaesth Crit Care & Pain Med. Jun 2023; 42(3):101190. doi: 10.1016/j.accpm.2022.101190. Epub 2022 Dec 21. PMID: 36565745.

This study examined the effects of hyperventilation versus normoventilation on cerebral oxygenation in children undergoing posterior fossa surgery.

Fifty children were enrolled and randomised into two groups; an early hyperventilation group (ETCO2 target: 26-30 mmHg) and an early normoventilation group (ETCO2 target: 31-35 mmHg). The study was a cross-over trial, so after 30 minutes in the prescribed ventilation strategy (phase 1) the patient was then switched to the alternative ventilation strategy for a further 30 minutes (phase 2). Near infrared spectroscopy (NIRS) was used to assess cerebral oxygen saturation with measurements taken at baseline and then every 5 minutes until the end of phase 2. Other measurements collected were: three intracranial pressure (ICP) measurements and a neurosurgical score of brain relaxation at the end of phase 1.

During the study period blood pressure (BP) was kept within 20% of baseline. If BP dropped below this a 10-20 ml/kg fluid bolus was administered. Any patients requiring vasopressors during the study were excluded.

The results demonstrated that cerebral oxygen saturation was significantly lower in the hyperventilation phase compared to the corresponding normoventilation phase. Linear regression showed that for every 1 mmHg decrease in ETCO2 there was a 1.4% reduction in NIRS values. There was no statistically significant difference in brain relaxation score or ICP measurements between the groups.

Commentary

This study helps to clarify the utility of different ventilation strategies during neuro anaesthesia. Hyperventilation has historically been used as a strategy to emergently reduce ICP through its effect on cerebral vasoconstriction and decreased cerebral blood flow. This study demonstrates the reduction on cerebral oxygenation associated with hyperventilation but without significant beneficial effects on brain relaxation or ICP. The results are in keeping with other studies showing a variable reduction in NIRS with hyperventilation in adult and adolescent populations undergoing non neurosurgical procedures.

A limitation of this study is that patients who had significant mass effect or oedema on their preoperative MRI were excluded, suggesting the patients who arguably would most likely benefit from hyperventilation may not be represented within this cohort. Another limitation is that there was no study into the post operative outcomes of patients undergoing hyperventilation and a reduction in cerebral oxygenation. Other studies in cardiac and non-cardiac surgery have, however, demonstrated long term cognitive delay and post operative behavioural changes associated with drops in cerebral oxygenation suggesting it is not a benign finding.

Reviewed by Dr Rosalyn Boyd

Impact of fatigue on anaesthesia providers: a scoping review

A Scholliers, S Cornelis, M Tosi, T Opsomer, D Shaproski, C Vanlersberghe, D Vanhonacker, J Poelaert, L Goudman, M Moens. Impact of fatigue on anaesthesia providers: a scoping review. BJA May 2023; 130(5):622-635. doi: 10.1016/j.bja.2022.12.011. Epub 2023 Jan 24. PMID: 36697276.

The effects of fatigue on patient safety and clinician welfare are not well studied. Limited evidence exists, compared to fatigue in the aviation industry for example. Hence this scoping review.

The stated aims are twofold:

- To establish the prevalence of fatigue in anaesthesia providers
- To explore its impact on performance

To examine prevalence, the review included 8 studies. These used a variety of questionnaires. They show high levels of fatigue in the specialty. Further qualifying and quantifying this finding is made difficult by the fact that the concept of fatigue is complex and a broad range of definitions exist. Additionally, the studies are relatively small, the responders limited, and use of validated scores sparsely used. Regardless, it will surprise few that fatigue is more prevalent in anaesthesia compared to other medical specialties and to the general public. Specific findings from individual

studies, such as the number of anaesthetists reporting dozing in theatre overnight, or fatigue adversely affecting physical and mental health are concerning.

22 studies were included to assess the effect of fatigue on performance. These included results from clinical performance, simulated clinical scenarios, driving simulators (which might make you rethink driving home after an on-call!) and psychomotor testing. In summary, they show that anaesthetist fatigue is associated with:

- Poorer laboratory psychomotor performance
- A decline in non-technical skills
- But, a less convincing impact on technical skills, overall clinical performance, executive function.

Understandably, the reviewers recommend targeted, in-depth studies on fatigue mitigation strategies. And in general: more recognition, respect and discussion of fatigue in the specialty.

Reviewed by Dr David Rawson

Pediatric intraoperative cardiopulmonary arrests: A survey to evaluate if Medical Emergency Teams are utilized in paediatric operating rooms

Charles, A, Williams, SA, Dolan, J, Rehman, M, Arnold, J, Chandler, NM. Pediatric intraoperative cardiopulmonary arrests: A survey to evaluate if Medical Emergency Teams are utilized in pediatric operating rooms. Pediatr Anaesth. June 2023; 33(6): 454- 459. doi:10.1111/pan.14665

Paediatric intraoperative cardiac arrests are rare events however they are associated with a relatively high mortality rate of 18%. There is limited data associated with the use of Medical Emergency Team (MET) responses to intraoperative cardiac arrests and this survey study sought to identify the use of METs in response to paediatric intraoperative cardiac arrests as an exploratory step in establishing evidence-based practice in American hospitals.

This survey study had a response rate of 41%, however the majority of respondents worked in a university affiliated free-standing children's hospital with 95% of respondents already having a dedicated paediatric MET at their hospital. From the study, it seemed that in the majority of cases MET involvement was requested rather than automatic in operating room cardiac arrests. Interestingly in 65% of institutions, simulation-based training for cardiac arrest is supported but lacking a paediatric intraoperative focus. The authors comment that studies have shown that simulation-based training decreases time to initiation of chest compressions, time to defibrillation and improves overall team performance.

This survey study highlights that although hospital-based MET team simulation training was common, they infrequently focused on intraoperative events. There certainly seems to be a lack of perioperative team training with MET teams and our intensive care colleagues which could improve team performance and potentially outcomes.
This study suggests that there is certainly room for improved collaboration and multidisciplinary simulation team training, all of which may improve outcomes of paediatric intraoperative cardiac arrests.

Reviewed by Dr Su May Koh

Edited by Dr Su May Koh