After nectarine: how should we provide anesthesia for neonates?

G Bertolizio et al. Curr Opin Anesthesiol 2022; 35(3):337–342

This review summarised findings from NECTARINE (NEonate and Children audiT of Anaesthesia pRactice IN Europe) including its limitations. Subsequently deductions from the findings of NECTARINE were used to review relevant literature to suggest how practice and care of neonates and infants could be optimised from an individual practitioner to institutional level.
Some of the take home points include:

- Interestingly hypotension (50%) rather than hypoxaemia (36%) was the most common intraoperative critical event.
- Risk factors for critical events included younger age, pre-existing medical conditions, preoperative intensive support and prolonged surgery. However, low body weight was not.
- Difficult tracheal intubation was not uncommon but only 1/3 were anticipated to be difficult. Therefore, treating all children <60 weeks post menstrual age as difficult may be a more appropriate approach.
- The triad of hypotension, hypoxia and anaemia increased the risk of morbidity and mortality by 20-fold.
- Standard heart rate and blood pressure parameters used as a surrogate marker of tissue perfusion is inadequate. The concept of using NIRS to approximate oxygen delivery in high-risk patients was raised.

Take home message
Neonates and infants are at high risk of critical events leading to potential morbidity and mortality. Recognition of these patients and transfer of care to trained paediatric practitioners and specialised paediatric units may help mitigate some of these complications. However, the evidence on optimal management is still deficient in this realm.

Reviewed by Dr Sorcha Evans

Complications associated with paediatric airway management during the COVID-19 pandemic: an international, multicentre, observational study

MB Peterson et al. Anaesthesia 2022; 77(6): 649–658

This multicentre observational study was designed to bridge the gap in knowledge about potential adverse respiratory events during airway management in children with COVID-19 with a lot of earlier data reliant on adult studies.

Data was collected from 78 centres internationally in 2 phases over a two week period each. In phase 1, outcome data was collected for all general anaesthesia cases in children for that period and in phase 2, outcomes were assessed for proven or suspected (symptomatic but untested or awaiting testing) COVID-19 positive children. In total, 7896 children were analysed of which 329 were proven or suspected COVID-19 positive.

The primary aim was to compare the incidence of hypoxaemia between COVID positive and negative patients and the secondary aim to study the incidence of complications with airway management in this cohort. The type of devices used for airway management and the differences in the incidence of complications in the symptomatic versus asymptomatic COVID positive patient were also noted amongst other parameters.

Children with COVID-19 were more likely to have an intravenous rapid sequence induction and have their airway secured with tracheal intubation($P<0.001$) compared to the COVID negative cohort. COVID positive children were also less likely to be ventilated via face mask($P<0.001$). The use of video laryngoscopy and seniority of the anaesthetist attempting to secure the airway also achieved significance ($P<0.001$) when comparing with the COVID negative group.

The incidence of hypoxaemia in the COVID positive group was 7% compared to 3% in the COVID negative group and the peak of this occurrence was at airway device removal. The overall risk of all airway management related complications was 12% in the COVID positive group as compared to 6% in the COVID negative group. Symptomatic children were more likely (25% versus 6%) than asymptomatic children to have adverse airway events. The use of barriers such as plastic drapes during airway management was associated with greater risk of airway complications, primarily at extubation in COVID positive patients.

Take home message

The study looked at over 8000 cases but less than 5% of them were COVID positive, limiting the ability to detect differences in the outcomes. Nevertheless, this study provides useful insight and highlights the morbidity and adverse airway events in a COVID positive child undergoing a general anaesthetic. Children who are proven or suspected COVID positive have a 2.7 times greater risk of hypoxaemia during a general anaesthetic with increased risk of both severe hypoxaemia and laryngospasm. The use of barriers, especially during emergence, increases the risk of hypoxaemia in these children. This reinforces the thought that general anaesthesia in COVID positive children does carry a significant risk. Studies reviewing longer term outcomes beyond the immediate postoperative period in larger numbers of COVID positive children are still required to validate these findings.

Reviewed by Dr Priya Sreedharan

Consistency of remifentanil concentrations in propofol–remifentanil infusions. A laboratory-based study

N Wylie et al. Paediatr Anesth 2022; 32(6):727–731

Background

This laboratory study assessed whether propofol combined with remifentanil in the same syringe resulted in consistent remifentanil concentration delivery throughout a 57 min administration period. This is important as many anaesthetists choose to use a single-pump, multi-agent technique when administering a propofol-remifentanil, paediatric, TIVA anaesthetic.

Methods and Drug sampling

• 30mL syringe contained 28.5mL of 1% propofol with 1.5mL of remifentanil (100mcg/mL, reconstituted with 0.9% saline) to yield a 1% propofol and 5microg/mL remifentanil solution.

• The solution was infused by an Alaris PK pump using a Paedfusor TCI model with infusion conditions intended to mimic a typical infusion. (Terumo 30mL syringe with BD lever lock cannula, B braun 180cm minimum volume extension line, Baxter interlink injection site and a 22G, 25mm IV cannula)

• Drug samples were taken during 5x different experimental runs:

1. 10kg hypothetical patient with the TCI infusion run three times. Samples were taken at time 0, 1min and 2 min post initial bolus and then every 5 minutes until 57 minutes.

2. 20kg hypothetical patient with the TCI infusion run two times. Samples were taken at time 0, 1min and 2 min post bolus and then every 5 minutes until 57 minutes.

* 57 minutes was chosen as this was the median duration of paediatric surgery in a previously published large case study.

Sample analysis

Following preparatory steps, the samples were analysed via a mass spectrometer to determine the remifentanil concentrations using a standard curve created from known remifentanil concentrations.

Findings

• Of all the models run, the largest variation in remifentanil concentration was 0.8 microg/mL (range 4.8-5.6 microg/ mL) in the first 10kg model. The average concentration administered in the 57 min was 5.2 microg/mL.

• The remainder of the models had a lower variation in remifentanil concentration (10kg run 2 = 0.4 microg/mL, 10kg run 3 = 0.6 microg/mL, 20kg run 1 = 0.6 microg/mL, 20kg run 2 = 0.6 microg/mL)

Discussion

This study demonstrated that the greatest variation in remifentanil concentration was within 12% of the intended concentration for administration. Whether this is clinically significant would depend on the clinical situation. Arguably, the short half-life of remifentanil would preclude this from causing any clinically significant adverse effect. Previous studies have demonstrated issues with miscibility and de-emulsification when high concentration mixtures of propofol and remifentanil (25-100mcg/mL) were held static and positioned vertically. This study did not assess the effect on propofol in this solution. However, it did demonstrate that the remifentanil concentration remained reasonably consistent when a concentration of 5 microg/mL is combined with 1% propofol and continuously moved through an infusion within 10 minutes of combination.

Take home message

This study demonstrated relatively consistent remifentanil concentrations under the following conditions:

1. The drugs were combined within 10 minutes of commencing the infusion

2. The infusion ran continuously for 57 minutes

3. The remifentanil concentration was 5microg/mL in a 30mL syringe of 1% Propofol

However, what is still unknown:

1. Is propofol susceptible to de-emulsification or does it become unstable in this studied admixture?

2. Using this same experimental model, what is the effect on concentration administered if a higher remifentanil concentration is used?

3. Does an infusion duration of greater than one hour result in less predictable remifentanil concentration administration?

Reviewed by Dr Anita Flynn

Global pediatric surgery and anesthesia inequities: how do we have a global effort?

JA Niconchuck JA and MW Newton, Curr Opin Anesthesiol 2022; 35(3): 351-356

Niconchuck and Newton open their review with some long-known but unsettling statistics:

1. 5 billion people worldwide lack access to safe surgery

2. Paediatric perioperative mortality may be 100 times higher in low-resource than high-resource settings

3. At an individual level, delays in access to surgical care can add 8.4 years of disability to a child's life

The authors also highlight ongoing funding and research inequities, more than three decades after it was recognised that only 10% of health research resources were directed to low-middle income countries (LMICs), despite these countries accounting for more than 90% of preventable global mortality. Research attribution remains equally uneven; authors from high income countries (HICs) are far more likely to be named first and last in collaborative efforts, even when the research itself occurs in the LMIC, whose researchers may not even be credited at all. Ironically, this effect is most clear in editorials on ethics in global surgery, of which this paper is an excellent example, a fact the authors (both of a HIC) are good enough to acknowledge.

How then can we address these longstanding issues? It is clear that the short-term surgical project model so beloved of advertisers and donors does not generate meaningful sustainable change, and moreover is vulnerable to the effects of global pandemics. Instead, the authors propose education, partnership and collaboration between LMICs and HICs to create self-sustaining in-country training models for current and future LMIC providers. Importantly, these endeavours need be informed by priorities identified by LMIC stakeholders (not presumed by HICs) and require a long-term commitment from both. The review concludes with a suite of five consensus key indicators in global surgery, anaesthesia and obstetrics (covering access to care, workforce, volume, outcome and expenditure), albeit again with a largely HIC authorship.

In summary, this is an interesting, wide-ranging and well-meaning call-to-arms and review of the current literature but yields little concrete change. The list of references is comprehensive, with useful summaries provided for interested readers.

Reviewed by Dr Jon Stacey

The new European resuscitation council guidelines on newborn resuscitation and support of the transition of infants at birth: An educational article

Buis et al. Paediatric Anaesthesia 2022; 32(4): 504-508

This article uses a fictional case to illustrate the main changes to the European Resuscitation Councils updated "Newborn Resuscitation and Support of the Transition of Infants at Birth" which was updated in 2021 (The Australian Resuscitation Council Guidelines were also updated in 2021).

The updated flowsheet is in the article and outlines the resuscitation of the neonate, both term and preterm. For term neonates the guidelines are:

- Dry wrap, stimulate and assess for tone, breathing and heart rate, ensure kept warm throughout
- Open the airway and apply 5 inflation breaths with a pressure of 30 cmH20 and an inspired oxygen of 21%, during this time ensure monitoring is placed to measure HR and SpO2
- Reassess, initiate further airway support if required – this may involve suctioning, insertion of an LMA, intubation
- Repeat 5 inflation breaths and monitor chest expansion
- Reassess, if HR <60 commence chest compression by encircling the thorax and overlapping the thumbs on the lower half of the sternum. Compressions should be performed at a ratio of 3 compressions to 1 ventilation. Increase inspired oxygen to 100% (Aims for saturation are 68% at 2 mins, 85% at 5 minutes and 90% at 10 minutes)
- Reassess every 30 seconds and if ongoing resuscitation required consider vascular access (umbilical vein cannula recommended as first line and intraosseous access as second line) and drugs – adrenaline 10-30mcg/kg IV/IO or 50-100mcg/kg ETT if no access, repeated every 3-5 minutes
- Ensure monitoring of hypo and hyperglycaemia, if it is a prolonged resuscitation 2.5mls/kg 10% dextrose can be given

The main changes to the previous guidelines are

1. Delaying the umbilical cord clamp for at least 60 seconds to transfer approximately 30ml/kg of blood from the placenta, if this is not possible consider milking the cord
2. Immediate ventilatory support via a facemask is prioritised over suctioning
3. An initial inspired oxygen of 21%, increase to 100% if chest compressions required
4. Inflation pressure should be 30cmH20
5. Chest compressions should be performed by encircling the thorax and overlapping the thumbs on the lower half of the sternum
6. Resuscitation should be continued for 20 minutes, as outcomes are not necessarily poor even if there is an undetectable HR at 10 minutes

For Preterm infants

- Place in a plastic wrap undried if <32 weeks gestation
- Inspired oxygen should be 21% if >32 weeks, 21-30% if 28-31 weeks, 30% if <28 weeks
- Do not milk the cord if <28 weeks
- Inflation pressures should be 25cmH20 (not less)

Reviewed by Dr Shona Chung

Update on Perioperative Pediatric Pulmonary Hypertension Management

Wadia et al. Journal of Cardiothoracic and Vascular Anaesthesia 2022; 36(3): 667-676

This is a comprehensive review of paediatric pulmonary hypertension from the John Hopkins University School of Medicine, Baltimore, USA. The article is split into two sections; the first summarises definitions, diagnosis, investigation and treatment of the disease, and the second highlights anaesthetic considerations preoperatively, intraoperatively and postoperatively and the management of pulmonary hypertensive crisis.

The new areas to highlight are the modified definition of pulmonary hypertension of mean pulmonary arterial pressure >20mmHg (based on the adult definition) but that it must be in a child over three months of age in contrast to the previous definition of mean pulmonary arterial pressure $\geq$ 25mmHg. It is implied the change has come about because the new definition is more statistically relevant. A very detailed summary of preferred echocardiography investigations and mathematical calculations of pulmonary arterial pressure follows whilst other investigations have limited applicability in paediatrics.

Anaesthetic management is essentially unchanged from what has been described previously, but there is a new suggestion of a pre-surgical risk assessment model and multidisciplinary collaboration which may be useful in planning non-cardiac surgery, including involvement of surgeons, cardiac anaesthetist, intensive care, theatre schedulers and ECMO teams. There is also a useful table that displays the impact of anaesthetic agents, vasopressors and inotropes on SVR, PVR and contractility.

The benefits of the paper are the introduction of the new definitions of pulmonary arterial hypertension and pre-surgical risk assessment model in paediatrics, however most of the rest of the content has already been described in the literature.

Reviewed by Dr Patrick Rubie

Substance use disorder in the anaesthetist: Guidelines from the Association of Anaesthetists

Misra et al. Anaesthesia 2022; 77(6): 691-699

This is a guideline published by the Association of Anaesthetists in the UK. It summarises the risks of substance use disorder specifically for anaesthetists and critical care physicians and suggests a pathway of management. It explores the risk factors of substance use disorders specific to anaesthetists, the regulation and monitoring of individuals identified as having the disorder, the role of the Medical Director in coordinating the care of the clinician and referral to appropriate services as well as the pharmacological and counselling treatments available and the strategies for returning to work.

The article does a good job of highlighting the major issues of substance use disorder in the anaesthetic workplace. The suggestions made are generally very broad sweeping statements (e.g. there needs to be a return to work program, there needs to be support for the clinician with the disorder, there needs to supervised return to work with regular follow-up), but there are some occasional specific suggestions that are useful (e.g. utilising specific support groups such as SMART recovery, planning a return to work in another centre when relationships have broken down and having a senior colleague trained in mentoring to help trainees with the disorder return to work successfully).

Its major benefit is to highlight the issue of substance use disorder in anaesthesia and critical care and to try to de-stigmatise it, however, the practical suggestions for implementing the programs are mostly broad over-arching statements with few specific strategies.

Reviewed by Dr Patrick Rubie

Edited by Dr Su May Koh