Comparison of postoperative pain in children after maintenance with propofol or sevoflurane: a systematic review and meta-analysis

Aballah et al. ***British Journal of Anaesthesia 2024: Jul; 133(1):93-102***
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This meta-analysis aimed to compare postoperative pain following anaesthesia maintenance with sevoflurane or propofol by analysing 13 randomised controlled trials (RCTs). Previous studies have shown conflicting evidence as to whether propofol maintenance can lead to less postoperative pain than sevoflurane. This meta-analysis showed that sevoflurane maintenance had higher odds of postoperative pain in comparison to propofol.

The studies included were all RCTs taken from an extensive search of reputable databases, and either had a primary endpoint of need for rescue analgesia as a marker of postoperative pain, or pain scores using pain assessment tools. The quality of the studies included was assessed using a recognised tool (MASTER scale), with the studies scoring highly across the domains of this tool, but some lacked safeguards around concealment and blinding. An important limitation was moderate heterogeneity between the studies.

The RCTs included 1174 children, with an age range from 2 months to 16 years, and ASA scores from 1-2. The types of surgery included were hernia repair, cleft lip and palate repair, adenotonsillectomy, strabismus, urological surgery, orthopaedic lower limb surgery, and dental surgery which represent a wide range of relevant paediatric surgeries.

Overall the analysis showed that with moderate certainty in the primary outcome there were higher odds (almost two fold) of postoperative pain (odds ratio (OR) 1.88, 95% Confidence Interval [CI] 1.12-3.15) and a 60% higher need for rescue analgesia (OR 1.60, 95% CI 0.89-2.88) in the sevoflurane group.

The authors note that keeping in mind some of the limitations of the studies included, better quality RCTs may be required to definitively answer this question.

Reviewed by Dr Rahul Bandopadhyay

High-flow nasal oxygen for children's airway surgery to reduce hypoxaemic events: a randomised controlled trial

Humphreys et al. ***Lancet Respir Med*** **2024 Jul;12(7): 535-543**
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This randomised controlled trial aimed to compare the efficacy of high flow nasal oxygen (HFNO) in comparison to standard oxygen therapy (6L/minute flow) in tubeless upper shared airway

surgery procedures, looking at the frequency of rescue oxygenation/interruption events. The study showed that HFNO did not reduce the proportion of rescue oxygenation events.

The study took place in five tertiary centres in Australia from September 2018 to April 2021, and included 483 children undergoing 528 procedures after exclusions. Children between 37 weeks up to 16 years of age were randomised in a 1:1 fashion to either HFNO, or standard oxygen therapy via a nasopharyngeal or oropharyngeal tube. Oxygen therapy could not be masked but study investigators were blinded until the data was locked. Anaesthesia delivery was not standardised and was maintained either using intravenous or inhalational agents.

The primary outcome was rescue oxygenation events, defined as interruption of the surgical procedure to deliver positive pressure ventilation (via bag-mask, endotracheal tube, or laryngeal mask). The other secondary outcomes and adverse events assessed included desaturation below 90%, epistaxis, laryngospasm, bronchospasm, bradycardia, cardiac arrest, hypotension or death.

Findings were similar in both groups. There were successful procedures with no interruption in 236/267 (88%) of HFNO procedures and 226/261 (88%) of standard care (Risk ratio [RR] 1.02, 95% CI 0.96 -1.08, p = 0.82). 51 (19%) of procedures had a hypoxaemic event in the HFNO group, and 57 (22%) in the standard care group (RR 0.86, 95% CI 0.58-1.24). The other secondary outcomes and adverse events were similar in both study groups.

With no difference in proportion of interruptions or adverse events, the study suggests that both approaches (HFNO or standard care) would be suitable for maintaining oxygenation in children's upper airway surgery.

Reviewed by Dr Rahul Bandopadhyay

Efficacy of different routes of acetaminophen administration for postoperative pain in children: a systematic review and network meta-analysis

Bernat et al. *Canadian Journal of Anesthesia* August 2024, Vol 71:1103–1116;
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Systematic review of randomised controlled trials concerning paracetamol administration in children between 30 days and 17 years and the analgesic efficacy of various routes (intravenous, rectal and oral).

Methods

A literature search was conducted via MEDLINE and Google Scholar databases to identify appropriate papers comparing the efficacy of various paracetamol routes of administration. 4,596 articles were identified with 2,252 duplicates removed.

Following expert panel screening 2,316 articles were removed leaving 14 randomised controlled trials. The identified trials included 829 patients.

The primary outcome of the study included validated pain scales at various time frames in the post-operative period. Secondary outcomes included opioid requirements converted to equivalent doses of morphine in mg/kg dosing.

Results

Given the typical duration of action of paracetmol, the primary outcome was measured using pain scales reported for the 0-2 hour period following administration. This focused on seven trials and included 525 participants with the three administration arms compared against each other. When comparing IV and rectal routes at 0-2 hours, the mean difference in pain score was 0.28 lower (95% CI, -0.62 – 0.06). The mean difference in pain score in the IV vs oral route was 0.60 lower (95% CI, -1.20 to 0.01). The mean difference in pain score in the oral route vs rectal route was 0.88 lower (95% CI, -1.44 to -0.31).

Discussion

Due to the signfiicant heterogenity of the papers compared, the certainty of evidence was evauluated using the GRADE approach (grading of recomendations assessment, develop and evaluation). Combining this with the statistical analysis, the paper found low certainty evidence favouring the oral route of adminsitration, however there was no clinical significance in these findings.

Conclusion

The available evidence is very uncertain about the effect of the route of paracetamol administration on postoperative pain in children. Included RCTs presented significant heterogeneity mainly due to differences in participant's ages, dosages and outcome measurement strategies. As such, clinical context should be applied when deciding which route of paracetamol is preferable.

Of note, the meta-analysis reports that the oral dose of paracetamol costs roughly 19 pence, compared to £1.95 when given intravenously. As such, oral paracetamol is ten times cheaper

Reviewed by Dr Will Creasy

Comparison of volume-controlled ventilation, pressure-controlled ventilation and pressure-controlled ventilation-volume guaranteed in infants and young children in the prone position: A prospective randomized study

Bao et al. *Journal of Clinical Anesthesia* August 2024, Vol 95: 111440;
DOI: 10.1016/j.jclinane.2024.111440

Prospective single centre study to investigate effects of ventilation strategies on respiratory mechanics in children aged 1 month to 3 years underoing prone position for spinal cord detethering surgery.

Methods

120 paediatric patients undergoing spinal cord detethering surgery were prospectively recruited and randomised into one of three ventilation strategy arms (VCV [volume-controlled ventilation], PCV [pressure-controlled ventilation], PCV-VG [pressure controlled ventialtion volume garunteed]). Exclusion criteria included ASA 3≤, cardiac disease, recent respiratory disease, lung/thoracic deformities and similar co-morbidities.

The study protocol mandated a uniform anaesthetic technique to minimise variance within the data sets. This included premedication technqiue, induction, maintenance (propofol and reminfetanil TIVA) and monitoring.

The primary outcome was peak airway pressure (Ppeak), and secondary outcomes included additional collected / calculated data such as respiratory physiology parameters (mean inspiratory pressure (Pmean), dynamic compliance, respiratory rate, tidal volume and $ETCO_2$), arterial blood gas sampling and haemodynamic parameters (heart rate, mean arterial pressure).

Data was recorded at mandated time sets:

1) T1 - induction
2) T2 - 10 minutes after prone position
3) T3 - 30 minutes after prone position
4) T4 - 10 minutes after supine position
5) T5 - two hours after surgery

Results

As expected, peak airway pressures increased and Cdyn declined during prone position in all three groups. When comparing the ventilation strategies at the same time point, the VCV arm displayed high peak airway pressures at T2 and T3 than the PCV and PCV-VG groups (T2: $P = 0.015$ and $P = 0.002$, respectively; T3: $P = 0.007$and $P = 0.009$, respectively). Cdyn was statistically

significantly lower in the VCV group compared to the PCV and PCV-VG groups at T2 (P = 0.008 and P = 0.015, respectively) and T3 (P = 0.015 and P = 0.014).

No clinical difference in gas exchange values, haemodynamic parameters or clinical prognosis was seen at any time points during the study.

Conclusion

In infants and young children undergoing spinal cord detethering surgery in prone position, PCV-VG ventilation mode generated a lower Ppeak and higher Cdyn compared to VCV and PCV, in addition to delivering a more stable V_T than PCV mode. As such PCV-VG may reduce risks of both barotrauma and volutrauma in infants and young children during the proning.

Reviewed by Dr Will Creasy

Long-term outcomes of early exposure to repeated general anaesthesia in children with cystic fibrosis (CF-GAIN): a multicentre, open-label, randomised controlled phase 4 trial

Wainwright et al. *The Lancet Respiratory Medicine 2024;* 12(9): 703-713
DOI: 10.1016/S2213-2600(24)00170-X

Population	97 children (mean age 12.8 years), who had completed the ACFBAL trial until 5 years of age (which randomised infants younger than 6 months, from eight sites in Australia and New Zealand, with cystic fibrosis diagnosed through newborn screening)
Intervention	BAL-directed therapy under repeated episodes of brief general anaesthesia (mean of 10 GAs by study consent date)
Comparison	standard-therapy, which did not require general anaesthesia (mean of 4 GAs by study consent date)
Outcome	Primary: processing speed, response inhibition, and sustained attention via a composite score (CPT-II) Secondary: battery of standardised neurocognitive and neurobehavioural scores (via child and parent assessments), brain MRI

Primary outcome:
No significant difference between the trial groups in the CPT-II scores: 51 (SD 8·1) in intervention group vs 53 (SD 8·8) in the comparison group; difference –1·7 (95% CI –5·2 to 1·7; p=0·32). There was also no evidence of a cumulative effect of GA exposures.

Secondary outcome:
No significant differences between the two groups for neurocognitive or behavioural outcomes. There was a difference in the number of children who had been held back a year in schooling (16% in intervention vs 2% control), which was attributed to maturity reasons.
There were similar volumetric and diffusion MRI measures between the two groups. Differences in grey matter volume and body or corpus collosum were felt to be small and due to chance.

Strengths: multi-site, RCT aiming to answer an important question in paediatric anaesthesia. Previous observational studies have been limited by the presence of confounding factors. Previous RCTs have not explored the cumulative effect of repeated GAs.
The demographics and clinical variables of the two CF-GAIN groups remained similar.
Psychologists administering the tests and the MRI team were blinded

Weaknesses: relied on the original ACFBAL trial randomisation and study design
Small sample size, underpowered- only 97 of 132 eligible ACFBAL trial children (73%) consented.

Participants in both arms also had GAs outside of the study protocol. Exposure included 13 different anaesthetic agents, around half sevoflurane, with 14% unknown. This study does not explore whether the agent used has any impact on the outcomes. There were also incomplete datasets regarding duration of GA exposure.

Study design meant the children and their families were not blinded to treatment arm.

Reviewed by Dr Charlotte Leahy

Usefulness of a virtual reality educational program for reducing preoperative anxiety in children: A randomised, single-centre clinical trial

Carbó et al. ***European Journal of Anaesthesiology 2024; 41(9): 657-667***
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Population	241 children (3–13 years), ASA 1-2, scheduled for elective NICE grade I-II surgery in Barcelona, Spain
Intervention	watch a 5 minute VR-based educational video about the surgical process, 7-10 days pre-op, plus usual information. 2 video options, for different age groups.
Comparison	receiving oral or written information
Outcome	Primary: pre-operative anxiety: mYPAS scoring when separated from parents, prior to entering theatre Secondary: baseline anxiety, parental anxiety, anxiety and co-operation at induction, postop pain score, post-op delirium, parental satisifaction

Primary outcome:
Pre-operative anxiety was reduced in the intervention group; both in dichotomous assessment of score i.e. y/n anxiety [30 (25.0%) vs 101 (83.5%); P<0.001], and in the numerical mYPAS scores. There was an inverse relationship between age and anxiety.

Secondary outcome:
Intervention was associated with reduced anxiety at induction, higher levels of co-operation, lower pain levels at admission to recovery and transfer to ward. However, the pain level was similar between the groups by discharge home. Baseline anxiety and parental satisfaction showed no significant difference between the two groups. Post-op emergence delirium occurred less in the intervention group.

Intervention was associated with less delay in surgery starting, and less patient resistance, as well as reduced post-op analgesia requirements.

Strengths

RCT: randomisation effectively distributed most baseline characteristics. Adequately powered study, sample size 241, awaiting various surgical procedures across multiple specialties.
Use of standardised validated measures for primary and secondary outcomes.
Interaction analysis used to show that the results were not significantly impacted by patient sex.

Weaknesses
Single-site, predominantly male patients, particularly skewed in intervention group (83% male). Covid disrupted the study, leading to a prolonged recruitment period of 3.5 years.

Inconsistent blinding of outcome assessors, as baseline and parental anxiety scorers were not blinded. Patients were not blinded to treatment but were unaware of the outcome measures.
Many of the secondary outcome measure scores were very low in both groups, therefore their statistically significant differences should be interpreted with some caution due to a floor effect.

Reviewed by Dr Charlotte Leahy

Edited by Dr Shivan Kanani
APAGBI Trainee Representative