



Dexmedetomidine Mitigates Sevoflurane-Induced Neurodevelopmental Effects in Paediatric Anaesthesia: A MetaAnalysis and Preclinical Study

Lao HC, Huang CW, Wang SH et al.

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Introduction

Sevoflurane exposure during foetal and early childhood development has raised concerns regarding potential neurodevelopmental effects. Sevoflurane is associated with emergence delirium/agitation (EA), a common and potentially distressing complication of anaesthesia. Dexmedetomidine is an alpha-2 adrenergic receptor agonist increasingly used in paediatric sedation, analgesia and anaesthesia. This meta-analysis evaluates the effect of dexmedetomidine on EA rates after sevoflurane anaesthesia. Preclinical trials compared the effect of dexmedetomidine against control on preventing neurotoxic effects of repeat foetal or neonatal sevoflurane in mice.

Methods

A systematic review and meta-analysis were conducted in line with the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines and included randomized controlled trials (RCTs) involving children under 8 years old. Risk of bias assessments showed overall low risk of bias.

Preclinical trials assessed effects of repeated sevoflurane exposure on mouse foetus' and pups using neuronal labelling and brain dissection to assess for neurotoxicity, and somatosensory tests to assess the developmental effects.

Results

There were 1280 events of EA out of 4186 children included in the meta-analysis. Dexmedetomidine significantly reduced the incidence of emergence delirium when given intravenously, perineurally or intranasally (pooled RR 0.32 (95% CI: 0.27-0.38)).

The repeated foetal sevoflurane exposure was shown to delay neuronal migration although eventually these reached an appropriate location, pre-treatment with dexmedetomidine mitigated this effect. Repeated neonatal sevoflurane exposure caused dendritic changes in the brains of adolescent mice and somatosensory changes in live adolescent mice, although by day 60 after birth both groups showed similar somatosensory behaviour. Again, dexmedetomidine alleviated these changes.

Take home points

- Dexmedetomidine used with sevoflurane anaesthesia reduced the incidence of emergence delirium in children under 8 compared to sevoflurane alone, although the exact mechanism behind this is not established.

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- Dexmedetomidine pre-medication also prevented neurobehavioral changes in foetal and neonatal mice exposed to sevoflurane suggesting a possible neuroprotective effect in animal models that requires confirmation in human studies
- Further research is required to establish safety of dexmedetomidine in neonates, precluding routine use in pregnant mothers and neonates at present.

Reviewed by Dr Hester Carter

Ultrasound-guided pericapsular nerve group block versus caudal epidural block for postoperative pain management in pediatric hip surgery: A randomized clinical trial.

Amin SR, Elhadad MA, Tabl EA, et al.

British Journal of Pain 2026 Jan 16;20(2):20494637261418203.

Introduction

Appropriate analgesia after surgery is important for many psychological and physiological reasons, especially in children. Caudal injection of local anaesthetic is a well-established technique for intra- and post-operative analgesia in paediatric anaesthesia. Pericapsular nerve group block (PENG) is a newer regional block that may provide more targeted analgesia especially for children in whom caudal analgesia is contraindicated. It blocks the accessory obturator and femoral nerve branches that supply the hip joint capsule.

Methods

This prospective, double-blind, RCT compared ultrasound guided PENG blocks (group P) and caudal blocks (group C) in children having elective hip surgery under GA. 80 children (40 in each group) between 1 and 6 years of age were included. They were all ASA I-II. Group P (PENG block) received an US guided PENG block using 0.5ml/kg of 0.25% bupivacaine, group C (Caudal group) received the same volume and concentration in an US guided caudal block. To maintain blinding dressings were placed over both potential injection sites. The method of inducing and maintaining GA was consistent across the groups. Patients received scheduled intravenous paracetamol (15 mg/kg every 6 h) for baseline analgesia; no other analgesic adjuncts were administered. Post operatively pain was assessed using FLACC scores with a standardised approach to analgesia if scores were ≥ 4 .

Results

There were no significant differences between the groups baseline demographic data. The FLACC scores in the 2 groups were comparable across the first 24 hours, with the exception of group C having significantly lower scores at 30 mins and group P having significantly lower scores at 6 hours post op. Group P had a longer time to first rescue analgesic, 24% less total morphine consumption and higher parental satisfaction. Procedure time was longer in group P. There were no major adverse effects in either group.

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Take home points

- PENG blocks provide a safe, motor sparing alternative to caudal blocks for post-operative analgesia in children having hip surgery and may be a good option where caudal analgesia is contraindicated.
- In this study PENG blocks took longer to perform, although this may represent the current familiarity with caudals and the learning curve associated with PENG blocks.

Reviewed by Dr Hester Carter

Efficacy and safety of dexmedetomidine versus midazolam for sedation in mechanically ventilated pediatric patients: a randomized clinical

M. Sezavar, H Akhavan, G Khademi, M Naseri, T Sadeghi and A Kaveh.

Journal of Anaesthesia, Analgesia and Critical Care, 2026;

Introduction

Critically ill paediatric patients needing mechanical ventilation require sedation to alleviate pain, prevent tracheal tube displacement and aid patient-ventilator synchronisation.

Therapeutic sedation involves analgesics to provide pain relief, and sedatives to reduce anxiety and induce sedation.

Research demonstrates dexmedetomidine has comparable sedative effects in adults to midazolam and propofol, with reduced ventilation duration and shorter ICU stay. Studies have questioned its efficacy in mechanically ventilated children. This study aims to compare the efficacy of dexmedetomidine versus midazolam in paediatric patients undergoing mechanical ventilation.

Methods

Ethical approval was granted. Children aged 1 month-18 years requiring mechanical ventilation were randomised to receive dexmedetomidine or midazolam.

All patients admitted to PICU underwent continuous cardiac, blood pressure and oxygen saturation monitoring. Sedation was assessed using the Ramsay Sedation Scale, targeting scores of 5 or 6.

During intubation, patients received fentanyl bolus followed by allocated sedative boluses and maintenance.

Success was defined as achieving target sedation within the prescribed range.

Ramsay scores and vital observations were recorded at baseline; at sedation onset and 6 hours later.

Outcomes included sedation success rates; drug effectiveness at 6 hours; haemodynamic complications; duration of mechanical ventilation and PICU admission and mortality rate.

Results

120 patients were included in the final analysis – 60 in each group. In children up to 18 years the success rate in achieving target sedation was lower in the dexmedetomidine group compared with midazolam ($p < 0.05$). The dexmedetomidine group required higher doses to maintain

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sedation over 6 hours, whereas the midazolam group requirements were more stable ($p < 0.001$). Haemodynamic complications were less frequent in the dexmedetomidine group (< 0.01). Duration of mechanical ventilation, PICU stay and mortality rates were similar between groups.

Summary

Dexmedetomidine achieved target sedation less reliably than midazolam in this study, although it was associated with fewer haemodynamic complications.

Reviewed by Dr Karen Mackintosh

Effects of avoidance versus use of neuromuscular blocking agents for facilitation of tracheal intubation in children and infants

A systematic review with meta-analysis and trial sequential analysis

M Christensen, A Creutzburg, M Vested, AK Nørskov, LH Lundstrøm, and A Afshari.

European Journal of Anaesthesiology (2026) 43(4):p 335-348,

Introduction

Tracheal intubation can be associated with serious complications including hypoxia and brain injury. Difficult intubation remains the leading cause of severe anaesthesia-related morbidity and mortality.

Children can experience these complications with increased risk due to their higher oxygen consumption and reduced oxygen reserve increasing their vulnerability to hypoxia.

There is no consensus in the paediatric population regarding the use of neuromuscular blocking agents (NMBAs) for tracheal intubation beyond the age of 1 year.

Studies suggest NMBAs could improve intubating conditions and first-pass success rates in children. However, their benefits must be weighed against potential side effects such as anaphylaxis.

This systematic review evaluates the existing evidence about the use of NMBAs for tracheal intubation during laryngoscopy in children and infants across different populations and the use of concomitant drugs.

Methods

An electronic search was conducted through MEDLINE, EMBASE, CENTRAL, BIOSIS and CINAHL databases. Trial registers were searched for unpublished data and supplementary trials.

Randomised controlled trials assessing the effects of avoidance versus the use of NMBAs for tracheal intubation during laryngoscopy in patients < 18 years of age were included.

Primary outcome was defined as the incidence of difficult tracheal intubation. Secondary outcomes included the incidence of serious adverse events, failed intubation and incidence of upper airway discomfort.

Results

Forty-seven trials were included in the review including 30 trials which assessed the primary outcome 'incidence of difficult tracheal intubation'. There was a significant increased risk of

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difficult tracheal intubation and failed intubation when avoiding NMBA compared with those using NMBA ($p < 0.001$). There was no significant increase in the incidence of serious adverse events.

Summary

The use of NMBA to facilitate tracheal intubation significantly reduces the risk of difficult tracheal intubation in children and infants with moderate certainty of evidence.

Reviewed by Dr Karen Mackintosh

Pre-Operative Fasting for Breast Milk, Formula Milks, and Cow's Milk: A Narrative Review of the Literature and Implications for Fasting Guidelines for Children Undergoing Elective Surgery

Stoeter DJ

Pediatric Anaesthesia 2026; 36(1): 21–29

Introduction

In the current climate of enhanced recovery after surgery and with new emerging evidence concerning gastric emptying (GE) of milks in children there now exists significant global variation in peri-operative fasting times.

Methods

This narrative review examines the existing guidelines and supporting evidence.

Results

Current Published Guidelines: the majority of guidelines proposed a 4h for Breast Milk however ESAIC, ANZCA and CPAS have recently updated to 3h. Formula milk was either 4h or 6h often qualified with 'infant formula' or an age cut off (< 12 months). Cow's milk was often not specified or assigned the same time as Formula Milk.

Benefits and Safety Profile of Shorter Milk Fasts: significant discomfort (up to 50%) and potential metabolic sequelae needs to be weighed against the safety profile of a shortened fast. The Eurofast study demonstrated no increase in aspiration-risk with a 4h rule for both breast and 'infant formula' milk. This was supported by large scale German and Swedish studies where even a 4h rule for 'light breakfast' did not convey an additional risk.

Physiology of Gastric Emptying: GE appears to be determined by particle size with those $> 1-2$ mm demonstrating a slower zero-order emptying pattern where as liquids exhibit a negative mono-exponential pattern. This process is governed by neuroendocrine feedback pathways as foodstuff enters the small intestine.

Variation in Gastric Emptying with Age and Substrate: several studies have demonstrated that both breast and formula milk exhibit a similar mono-exponential pattern. Furthermore GE times for different substrates (breast, formula, cow's) were found to be broadly similar which is

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supported by the fact that caesin:whey ratio (previously thought contributory) is now similar to breast milk in modern formulas. Age similarly did not appear to have a significant affect on GE.

Discussion

The review concludes that there is both a strong evidence base and international governing body support for 3h and 4h fasting times for breast and infant formula milk respectively in children <12months of age. It also suggests there is evidence that a 4h rule for all milk types across all ages is potentially safe but suggests that controlling feed volume to 10-20ml/kg and that conducting more standardised research on GE would help to clarify this.

Reviewed by Dr Steven Morrison

Correlation Between Injected Volume and Cranial Spread in Broad-Aged Paediatric Caudal Anaesthesia: A Retrospective Ultrasound-Guided Study

Feng-Fang Tsai, Ming-Han Hsieh, Hsing-Hao Huang, Chih-Min Liu

Local and Regional Anaesthesia 2026; 19(1): 1-9

Introduction

The aim of this study was to analyse the relationship between injected volume of local anaesthetic and cranial spread in caudal blocks. They proposed that the traditionally used Armitage formula, which does not account for either height or body habitus, may potentially lead to under- or over-dosing particularly in obese or underweight children.

Methods

This retrospective observational study collected data from anaesthetic and medical records for patients (ASA 1-3) undergoing lower abdominal or lower extremity surgery between 01/04/17 and 31/12/18. Patients with extreme developmental abnormality (height/weight <3rd or >97th percentile) and those with congenital abnormality of the spine were excluded.

The spinous process of the 12th rib and then the L1-S1 spinous processes were identified. Caudal was then performed under real-time ultrasound guidance. Chirocaine (0.25%) was injected manually at a rate of 1mL/3s. Recorded injection volumes were documented at the point where epidural space widening reached S1, L2 and L1. Injection was discontinued when spread reached L1 or total volume reached 1.25ml/kg.

Results

25 patients were collected. All patients achieved cranial spread to L2 level, however only 13 reported spread to L1 before injected volume reached 1.25ml/kg. These 13 patients were analysed using univariate and multivariate linear regressions to estimate block volume according to age, height, weight and BMI for S1 and L2.

It was found that the optimal model for spread to S1 correlated most closely with body weight and height ($\text{mL} = 0.1741 \times \text{weight (kg)} - 0.0324 \times \text{height (cm)}$). Spread to L2 was optimally predicted with a simplified weight-based formula ($0.5339 \times \text{weight (kg)}$).

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Discussion

This study concluded that the traditional Armitage formula of 0.5ml/kg may lead to overdosing for S1 level block, especially in lean children. The study further concluded that accuracy can be improved by accounting for patient height to achieve S1 block.

It also observed the presence of LA pooling at an L2 level, with horizontal intra-segmental distribution and soft-tissue blocking spread in certain patients.

The study included a diverse, non-homogenous cohort of patients (age 10 - 106months) and multivariate regression models to improve statistical strength and generalisability of results however acknowledge it's limited number and single-centre design constraining it's external validity. Larger prospective studies are needed before alternative dosing formulas can be recommended for routine clinical practice.

Reviewed by Dr Steven Morrison

Edited by Dr Lisa Dewar

APAGBI Trainee Representative

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