The Evidence for Dexmedetomidine in Decreasing Emergence Agitation in Pediatrics

HAWAII ASSOCIATION OF NURSE ANESTHETISTS
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Background

- Inhalation induction with Sevoflurane has emerged as a leading technique when anesthesia is required for children
- Unfortunately, Sevoflurane is also associated with the phenomenon of emergence agitation in children
## Emergence Agitation

<table>
<thead>
<tr>
<th>Symptoms/ Consequences</th>
<th>Risk Factors</th>
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<tbody>
<tr>
<td>Uncontrolled crying</td>
<td>Ages 2-5 years old</td>
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<tr>
<td>Disorientation</td>
<td>Preoperative anxiety</td>
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<tr>
<td>Thrashing movements</td>
<td>Baseline temperament</td>
</tr>
<tr>
<td>Agitation</td>
<td>Rapid emergence</td>
</tr>
<tr>
<td>Falls</td>
<td>Intrinsic characteristics of anesthetic - Sevoflurane!</td>
</tr>
<tr>
<td>Increased risk of self injury</td>
<td>Surgery type</td>
</tr>
<tr>
<td>Increased requirements for nursing care</td>
<td>Postoperative pain</td>
</tr>
<tr>
<td>Unpleasant experience for child and parents</td>
<td></td>
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</tbody>
</table>

## PICO Question

Will the administration of IV dexmedetomidine (DEX) to children undergoing Sevoflurane anesthesia, compared to placebo, reduce the incidence of emergence agitation?
Studies Reviewed

- Comparison of the Effects of Dexmedetomidine, Ketamine, and Placebo on Emergence Agitation after Strabismus Surgery in Children (2013)


- Dexmedetomidine Decreases Emergence Agitation in Pediatric Patients after Sevoflurane Anesthesia Without Surgery (2006)

- Effect of Dexmedetomidine on Sevoflurane Requirements and Emergence Agitation in Children Undergoing Ambulatory Surgery (2014)

- Dexmedetomidine Infusion for Analgesia and Prevention of Emergence Agitation in Children with Obstructive Sleep Apnea Syndrome Undergoing Tonsillectomy and Adenoidectomy (2010)

Studies Reviewed


- Effects of Intravenous Dexmedetomidine on Emergence Agitation in Children under Sevoflurane Anesthesia: A Meta-Analysis of Randomized Controlled Trials (2014)

- Meta-Analysis of Dexmedetomidine on Emergence Agitation and Recovery Profiles in Children after Sevoflurane Anesthesia: Different Administration and Different Dosage (2015)
Population

- Children aged between 1-14 years old under general anesthesia with Sevoflurane
  - The patients were undergoing anesthesia for a variety of reasons
  - Some had N2O in addition to Sevoflurane for induction and maintenance of anesthesia
  - None had significant developmental or neurological abnormalities

- Sample size and locations sufficient to represent diverse population
  - Ex: Meta-analysis- 459 patients were given DEX, 353 received placebo

Intervention

- Addition of dexmedetomidine after induction of anesthesia, either as a bolus or a bolus followed by an infusion to decrease the incidence of emergence agitation
  - Doses and routes of administration varied
  - Range 0.2-1 mcg/kg
  - This research study focused primarily on the effectiveness of dexmedetomidine vs placebo, and did not consider alternative therapeutic interventions such as fentanyl and ketamine
Dexmedetomidine

- Brand name: Precedex
- Highly specific alpha 2 agonist
- Indication: sedation, analgesia, anxiolysis
- Side effects: bradycardia, hypotension, and may also cause transient hypertension with loading doses
- No significant respiratory depression
- Opioid-sparing effect

Comparison

- Results of dexmedetomidine administration was significantly different than that of placebo administration in patients undergoing Sevoflurane anesthesia
  - Decreased emergence agitation and pain associated with dexmedetomidine vs placebo
  - See Forest Plots for graphical representation
Forest Plot of Emergence Agitation Incidence


Forest Plot of Pain Incidence

**Outcome**

- Administration of dexmedetomidine in all methods reduced incidence of emergence agitation
  - Dexmedetomidine is an effective addition to prevent emergence agitation in children undergoing Sevoflurane anesthesia
  - It may be more effective than fentanyl and ketamine for prevention of emergence agitation (with a better side effect profile), but more research should be done to compare them
  - In most studies, emergence and extubation were slightly delayed—by only a few minutes on average—but discharge was not
  - No studies examined reported negative outcomes related to bradycardia or hypotension

**Significance**

- Decreasing emergence agitation
  - Lowers the risk for patients self-injury and anxiety
  - Increases parent satisfaction
  - Increases staff satisfaction
  - Minimizes additional health care costs that may accrue as a result of:
    - Prolonged length of stay
    - Increased staffing requirements
    - Potential secondary injuries
Summary of the Research Studies

Stetler’s Evidence Rating Scale

<table>
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<tr>
<th>Level of Evidence</th>
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<tr>
<td><strong>Level I</strong></td>
<td>Meta-analysis, Systematic Reviews, Randomized Control Trials</td>
</tr>
<tr>
<td><strong>Level II</strong></td>
<td>Cohort Studies, Experimental or quasi-experimental</td>
</tr>
<tr>
<td><strong>Level III</strong></td>
<td>Case-control Studies, Non-experimental, qualitative</td>
</tr>
<tr>
<td><strong>Level IV</strong></td>
<td>Case Reports/ Case Series</td>
</tr>
<tr>
<td><strong>Level V</strong></td>
<td>Expert opinion, Clinical Textbooks, Animal Research</td>
</tr>
</tbody>
</table>
Strength of Evidence Base

- Primarily double-blinded randomized controlled trials (RCT) and meta-analyses of RCTs
- Each study by definition falls into either the Level I or Level II, based on Stetler’s evidence rating scale

Strength of Evidence Base

- No major flaws on data collection or research methods were identified
- Outcomes of individual studies:
  - are consistent and clinically relevant
  - have precise conclusions
  - can be classified as high quality evidence from which practice guidelines and clinical protocols can be derived
### Gaps and Limitations

| Lack of standardized assessment tool to quantitatively determine the existence of emergence agitation in children |
| Different scales used |
| ○ Visual scale |
| ○ Agitation scale |
| Evaluation techniques |
| ○ 2 hrs post-op |
| ○ Perioperative period |
| ○ Self-report from parent 24 hrs post-op |
| Factors that may affect pain or the assessment of pain |
| ○ Pain tolerance and expression among different ethnic/age groups |
| ○ Parent-child relationship |
| ○ Parents’ expectations of outcomes |

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| Determining the optimal dosage as well as the administration by which dexmedetomidine (DEX) decreases the incidence of emergence agitation: |
| 10 min infusion of 0.3 mcg/kg of DEX after Sevo induction |
| 0.5 mcg/kg of DEX as a single one-time bolus dose after Sevo induction |
| 1 mcg/kg bolus of DEX followed by 1 mcg/kg/hr continuous infusion after Sevo induction |
Gaps and Limitations in the Evidence

Further research investigating the optimal dosages, timing, and the duration of DEX would significantly aid in the development of emergence agitation protocols and standard guidelines related to DEX in the pediatric population while decreasing the undesired side effects and preventing negative outcomes.

Conclusion

A smaller dose of DEX (0.3-0.5 mcg/kg over 10 minutes) after Sevoflurane inhalation induction may be sufficient to achieve desired outcomes of decreasing emergence agitation while minimizing the side effects and delays in emergence, extubation, and discharge.

More and larger studies are needed
Dextubate!

References


References


