



BOTTOM LINE RECOMMENDATIONS:

Procedural Sedation

Performing safe and effective procedural sedation in children requires the same foundational elements as other age groups – skilled personnel, an equipped setting and a structure to manage patients across the sedation continuum. However, children have unique developmental and physiologic vulnerabilities that require special consideration when planning and performing sedation.

PEDIATRIC CONSIDERATIONS

DEVELOPMENTAL

- » Children are often fearful during the pre-sedation period:
 - » **DO** provide a simple explanation, distraction (games, music, video/TV) and/or visual imagery
 - » **DO** allow a family member to stay **at the bedside** with the child as they are being sedated
 - » **DO** allow the family to stay **in the room** while the procedure is being performed

ANATOMIC

- » Children are at higher risk of airway obstruction.
- » Small caliber and floppy airways are subject to collapse when relaxed; larger tongues can occlude airways.
- » The young child's large occiput places the head and neck in flexed position when supine:
 - » **DO** evaluate airway alignment and maintain a neutral sniffing position; a roll under the shoulders may be helpful
 - » **DO** consult anesthesia to perform sedations for all patients who are American Society of Anesthesiologists (ASA) classification ≥ 3 or who have a high risk airway by exam

PHYSIOLOGIC

- » Children have higher oxygen consumption because of increased metabolic rates and less alveolar space.
- » Decreased respiratory rate in sedation can cause significant respiratory compromise.
- » Circulatory response to hypoxia in young children is bradycardia.
- » Normal parameters for heart rate, respiration and blood pressure vary based on age.
- » Early recognition and treatment of adverse events prevents events requiring significant intervention and sedation accidents:
 - » **DO** administer weight-based dosing of sedation medications
 - » **DO** monitor patients as appropriate for the depth of sedation; know age-appropriate vital signs
 - » **DO** have the equipment, skill and personnel to detect and rescue patients from events such as oxygen desaturation, apnea, laryngospasm
 - » **DO** use capnography if patient was pre-oxygenated and/or direct visualization of the chest wall is not possible

FASTING

- » The duration of pre-procedural fasting is controversial
- » It is unclear whether strict adherence to ASA fasting guidelines is necessary to maintain patient safety however there is insufficient evidence to suggest that they can safely be disregarded.
- » Truly emergent procedures should not be delayed to wait for fasting guidelines to be fulfilled, but the risk of aspiration increases as you pass through the sedation continuum.
- » **DO** consider using ketamine if deep sedation is required in the unfasted patient as protective airway reflexes are retained.

POST SEDATION CARE

- » Monitor until the patient is able to perform their baseline (developmentally appropriate) activities (speech, motor, cognitive) as well as tolerate oral intake.



NON-PAINFUL PROCEDURES (EG. DIAGNOSTIC IMAGING)

MODERATE TO DEEP SEDATION

GOAL: Reliable motion control without analgesia

- » **Pentobarbital:** Effective and reliable in all ages with intravenous (IV) dosing; physician administered/monitored.
 - » **Caution:** a) respiratory depressant but generally tolerated in healthy children b) induction agitation can be seen. **Dose:** IV 2-4 mg/kg over 30-45 sec; after 5 minutes if not asleep, give 1-2 mg/kg.
- » **Propofol:** Effective and reliable with quick recovery; physician administered/monitored.
 - » **Caution:** a) advanced airway skills are needed b) protective airway reflexes not maintained, consider adequate fasting. **Dose:** 1 mg/kg slow push (1-2 min); additional doses 0.5 mg/kg.
- » **Midazolam:** Safe in all ages; registered nurse administered/monitored.
 - » **Caution:** a) not for studies where complete motion control is required b) if possible, administer on the bed where imaging test will be performed as movement can arouse the patient. **Dose:** intranasal (IN) 0.2-0.3 mg/kg (IN max 1mL per nostril); IV 0.05-0.1 mg/kg.

MINOR PAINFUL PROCEDURES (EG. LACERATION REPAIR, DENTAL EXTRACTION)

MILD TO MODERATE SEDATION

GOAL: Anxiolysis and moderate analgesia

- » **Intranasal Fentanyl + Midazolam:** Does not require IV access; no lower age limit.
 - » **Caution:** a) midazolam burns, administer fentanyl first b) administer with an atomizer to improve absorption. **Dose:** fentanyl 1.5 mcg/kg IN + midazolam 0.2-0.3 mg/kg IN (max 1 mL per drug per nostril).
- » **Nitrous Oxide:** Analgesic and amnestic properties with quick onset; patients must be cooperative (> 4 years).
 - » **Caution:** Do not use if acute asthma exacerbation, suspected pneumothorax/other trapped air or head injury with altered level of consciousness. **Dose:** Minimum 30% oxygen; self-administered via demand valve.

MAJOR PAINFUL PROCEDURES (EG. ORTHOPEDIC REDUCTION, COMPLEX LACERATION REPAIR)

DISSOCIATIVE OF DEEP SEDATION

GOAL: Profound analgesia and motion control

- » **Ketamine:** Most common agent in pediatric ED sedation. **Do not use:** age < 3 months or known schizophrenia.
 - » **Caution:** a) laryngospasm: risk increased with active asthma, upper respiratory infection and procedures involving posterior pharynx b) vomiting occurs commonly; administer ondansetron pre-procedure in age > 5 years). Significant recovery agitation occurs rarely. **Dose:** IV 1.5 mg/kg slow push; additional doses of 0.5-1.0 mg/kg. Intramuscular 4-5 mg/kg; single 2-2.5 mg/kg additional dose. **NOTE:** No additional benefit has been demonstrated from pre-treatment with atropine and/or midazolam in ketamine sedations.
- » **Propofol+ Fentanyl:** Shorter recovery times; anti-emetic.
 - » **Caution:** Advanced airway skills are needed. **Dose:** propofol 1mg/kg slow push (1-2 min) + fentanyl 1mcg/kg; additional doses: propofol 0.5 mg/kg; fentanyl 0.5-1 mcg/kg.
- » **Ketamine + Propofol:** Theorized to reduce adverse events compared to single agent sedation with short recovery.
 - » **Caution:** see above cautions for ketamine and propofol respectively. **Dose:** IV ketamine 0.5 mg/kg followed by propofol 0.5-1 mg/kg. Additional doses: ketamine 0.5 mg/kg, propofol 0.5-1 mg/kg.

INFORMATION ON DRUG DOSING & ADMINISTRATION IS CURRENT AS OF THE WRITING OF THIS DOCUMENT; PLEASE REFER TO YOUR HOSPITAL FORMULARY FOR MORE DETAILED INFORMATION

The purpose of this document is to provide healthcare professionals with key facts and recommendations for procedural sedation in children. This summary was produced by the procedural sedation content advisors for the TREKK Network, Dr. Lisa Evered of the Stollery Children's Hospital and Dr. Maala Bhatt of the Children's Hospital of Eastern Ontario, and uses the best available knowledge at the time of publication. However, healthcare professionals should continue to use their own judgment and take into consideration context, resources and other relevant factors. The TREKK Network is not liable for any damages, claims, liabilities, costs or obligations arising from the use of this document including loss or damages arising from any claims made by a third party. The TREKK Network also assumes no responsibility or liability for changes made to this document without its consent.

This summary is based on:

- 1) Lancet. 2006 Mar 4;367(9512):766-80. Procedural sedation and analgesia in children. Krauss B1, Green SM.
- 2) Cote CJ, Wilson S, the Work Group on Sedation. Guidelines for monitoring and management of pediatric patients during and after sedation for diagnostic and therapeutic procedures: an update. Pediatrics 2006; 118(6):2587-602.
- 3) Krauss BS, Brauss BA, Green SM. Procedural Sedation and Analgesia in Children. N Engl J Med 2014;370:e23.

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