BOTTOM LINE RECOMMENDATIONS

Procedural Sedation

trekk Translating Emergency Knowledge for Kids

EIIC EMSC Innovation and Improvement Center

Performing safe and effective procedural sedation in children requires the same foundational elements as other age groups—skilled personnel, an equipped setting, and an ability to manage patients across the sedation continuum. However, children have unique developmental and physiologic factors that require special consideration.

Children are often fearful during the pre-sedation period:
- Provide a calm, quiet environment
- Provide a simple explanation, distraction (games, music, video/TV), and/or visual imagery
- Allow a caregiver to stay at the bedside with the child as they are being sedated, and, if possible, during the procedure

PRE-SEDATION RISK ASSESSMENT

The sedating team should be ready to perform patient rescue at any time.[1-4] Perform a focused pre-sedation screening history. All of the following risk factors are associated with airway adverse events, unless otherwise indicated.
- Infants <12 months of age; strongly consider pre-procedure discussion with Pediatric Referral Centre
- Obesity (body mass index ≥95th percentile)
- Active asthma or an upper respiratory tract infection (URTI) within the past 2 weeks
- Snoring or sleep apnea
- Procedures that involve the posterior pharynx
- Opioid administration within 30 minutes prior to procedural sedation is associated with oxygen desaturation and vomiting

AVOID procedural sedation if ASA classification ≥3, has high-risk airway/craniofacial abnormalities on examination, and/or is undergoing an upper airway procedure.[2] Consult Anesthesia and/or Pediatric Referral Centre if a patient has risk factors for pulmonary aspiration (e.g., age <12 months, obesity ≥95th percentile, ASA ≥3, upper airway procedure).

DO NOT delay sedation based solely on fasting time. Large ED cohorts show no association between preprocedural fasting duration and sedation-related adverse events.[3]

PREPARATION FOR SEDATION

- Obtain informed consent to address the risks, benefits, and alternatives
- Perform consistent room set-up every time: capnography, pulse oximetry, heart rate, and blood pressure monitoring
- Ensure availability of appropriately-sized equipment: oral/nasopharyngeal airways, endotracheal tubes, and rescue medications
- Connect AND test airway bag with mask and suction prior to the start of sedation
- Ensure personnel present are skilled to detect/rescue patients from adverse events (e.g., oxygen desaturation, apnea, airway obstruction, laryngospasm, and progression to a deeper sedation level than intended)
- Review age-based norms for heart rate, respiratory rate, and blood pressure
- Place patient in a neutral sniffing position (+/- roll under shoulders)
- Perform a timeout immediately prior to the procedure (e.g., confirm patient identity, weight, procedure site, planned procedure, and gather all medications and supplies/equipment needed during the procedure)

DURING SEDATION

- One healthcare provider is responsible for patient monitoring/rescue and a second provider performs procedure
- Monitoring:
    - Minimal sedation: continuous pulse oximetry and heart rate; blood pressure documented every 15 minutes
    - Moderate sedation: continuous capnography and pulse oximetry; heart rate, respiratory rate and blood pressure documented every 5 minutes
- Administer weight-based dosing (in kilograms) of sedation medications
- Recognize and treat adverse events early to prevent more serious events that require significant intervention

MEDICATIONS

Ketamine is the most common and most recommended agent used in pediatric procedural sedation in the emergency department.
- Provides the best procedural conditions with fewest adverse events (safest medication)
- Lowest risk of needing positive pressure ventilation compared to any other parenteral drug or drug combination

Dissociative/Deep Sedation for Major Painful Procedures (e.g., orthopedic reduction, burn debridement)		
Drug(s)	**Dose**	**Comments/Cautions**
Ketamine	**IV:** 1-2 mg/kg/dose, slow push (MAX dose 50 mg). May repeat 0.5-1 mg/kg/dose, q5-15min PRN (risk of adverse events increased >3 mg/kg). **IM:** 4-5 mg/kg/dose (MAX dose 200 mg). May repeat 2-2.5 mg/kg/dose (MAX 100 mg) after 5-10 min PRN x 1.	• Do not use in infants <3 months or if known/suspected psychosis • Increased risk of laryngospasm with active asthma, URTIand/or posterior pharynx procedures • Vomiting is common; consider ondansetron pre-procedure inchildren ≥5 years • Significant recovery agitation is rare (<1%) • May have prolonged recovery with IM ketamine
Ketamine + Propofol	**Ketamine – IV:** 0.5 mg/kg/dose, slow push (MAX dose 50 mg). May repeat 0.5 mg/kg/dose, q5–15min PRN. Usual total MAX 2 mg/kg or 100 mg, whichever is less. **Propofol – IV:** 0.5–1 mg/kg/dose, slow push (MAX dose 100 mg). May repeat 0.5–1 mg/kg/dose, q3min PRN. Usual total MAX 5 mg/kg.	• Requires advanced airway skills; protective airway reflexes notmaintained, consider patient and procedure risk factors when assessing aspiration risk • Less vomiting compared to ketamine alone
FentaNYL + Propofol	**FentaNYL - IV:** 1 mcg/kg/dose, slow push (MAX dose 50 mcg). May repeat 0.5–1 mcg/kg/dose, q5min PRN. Usual total MAX 2 mcg/kg or 200 mcg, whichever is less. **Propofol – IV:** 1 mg/kg/dose, slow push (MAX dose 100 mg). May repeat 0.5 mg/kg/dose, q3min PRN. Usual total MAX 5 mg/kg.	• Requires advanced airway skills; protective airway reflexes notmaintained, consider patient and procedure risk factors when assessing aspiration risk
Minimal/Moderate Sedation for Minor Painful Procedures (e.g., laceration repair)		
Midazolam +/- FentaNYL	**Midazolam – IntraNASAL:** 0.3-0.5 mg/kg/dose, (MAX 10 mg or 1 mL/nostril). **Fentanyl - IntraNASAL:** 1.5 mcg/kg/dose, (MAX 100 mcg, or 1 mL/nostril).	• Intranasal route preferred • For intranasal administration, give 50% of dose in each nostril anduse atomizer for increased absorption (MAX 1 mL/nostril) • Use concentrated midazolam (5 mg/mL) • Intranasal midazolam burns. If using fentanyl, administer it first
DexmedeTOMidine	**IntraNASAL:** 2–4 mcg/kg/dose (MAX 200 mcg).	• Do not use if patient has heart block, renal or hepatic impairment,or on beta blockers • Give 50% of dose in each nostril and use atomizer forincreased absorption (MAX 1 mL/nostril) • Onset 30 min, duration 60-90 min • For lacerations, wash wound at time of intranasal administration; allow topical anesthetic enough time for peak effect prior to repair
Nitrous Oxide	Minimum 50–70% with oxygen; administer via continuous flow or demand valve.	• Do not use if asthma exacerbation, cystic fibrosis, trapped air (e.g., bowel obstruction, pneumothorax), altered level of consciousness,first trimester pregnancy
Moderate/Deep Sedation for Non-Painful Procedures (e.g., diagnostic imaging)		
Propofol	**IV:** 0.5 mg/kg/dose q3 min PRN, slow push (MAX dose 100 mg). Usual total MAX 5 mg/kg.	• Requires advanced airway skills; protective airway reflexes notmaintained, consider patient and procedure risk factors when assessing aspiration risk
Midazolam	**IntraNASAL:** 0.3–0.5 mg/kg/dose (MAX 10 mg or 1 mL/nostril) x 1. **IV:** 0.05–0.1 mg/kg/dose, (MAX 5mg) x 1.	• For intranasal administration, give 50% of dose in each nostril anduse atomizer for increased absorption. (MAX 1 mL/nostril) • Use concentrated midazolam (5 mg/mL) • If using midazolam alone, limited evidence suggests pre-treatmentwith lidocaine 2% or 4% 0.2 mL in each nostril 5 min prior to administering midazolam may lessen irritation • Does not produce complete motion control; administer on bedwhere imaging test will be performed as movement can rousethe patient

POST-SEDATION CARE

- Monitor until patient is able to perform their baseline activities as developmentally appropriate
- Pain may persist after sedation wears off. Consider early administration of oral analgesics and/or topical adjuncts, refer to **TREKK/EIIC Procedural Pain Recommendations**.

Information on drug dosing & administration is current as of the writing of this document. Please refer to your hospital formulary/ protocols and jurisdictional regulations for more detailed information. For a full list of references and development team members, please see the following page.

The purpose of this document is to provide healthcare professionals with key facts and recommendations for performing procedural sedation in childrenin the emergency department. This summary 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 and EIIC are 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 and EIIC also assumes no responsibility or liability for changes made to this document without its consent.

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Bottom Line Recommendations are short summaries for healthcare providers of the latest knowledge related to the diagnosis and management of pediatric emergency conditions. This resource is not intended to be used as a step-by-step guide. It is ideal for educational purposes and to summarize existing evidence on procedural sedation. Development of this resource involved a rigorous and iterative process, bringing together experts from a variety of specialties (nursing, simulation, emergency medicine, intensive care, and pharmacy). To learn more about the development, see the References & Development Team section below.

REFERENCES

1. Bhatt M, Johnson DW, Chan J, et al. Risk factors for adverse events in emergency department procedural sedation for children. JAMA Pediatr. 2017;171(10):957-964.
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3. Green SM, Roback MG, Krauss BS, et al. Unscheduled procedural sedation: A multidisciplinary consensus practice guideline. Ann Emerg Med. 2019 May;73(5):e51-e65.
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DEVELOPMENT TEAM

Thank you to the following **content advisors** who led the development of the Procedural Sedation Bottom Line Recommendations Resource.

Maala Bhatt, MD, MSc, FRCPC Director of Emergency Research, Children’s Hospital of Eastern Ontario (CHEO); Associate Professor of Pediatrics, University of Ottawa

Corrie Chumpitazi, MD, MS, FAAP, FACEP Chief, Pediatric Emergency Medicine; Professor of Pediatrics Duke University School of Medicine; Member Duke Clinical Research Institute

Danica Irwin, BSc.Phm Pharmacist, Children’s Hospital of Eastern Ontario (CHEO)

Tracy Furst Pharmacist, HSC Children’s Hospital Winnipeg

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Robin Goodman, MSN, RN, CPEN Project Manager, EIIC Knowledge Management Domain

Mona Jabbour, MD, MEd, FRCPC TREKK Co-Director, Associate Professor, Pediatrics and Emergency Medicine, University of Ottawa; Children’s Hospital of Eastern Ontario (CHEO)

Mary Anne Nurmi, Ms TREKK Knowledge Broker

Mark Vasquez, MHA/MBA, PMP EIIC Knowledge Broker

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