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An Overview on Sedative Premedication in Children

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Abstract:
Behind the multiple arguments for and against the use of premedication, sedative drugs in children is a noble principle that of minimizing psychological trauma related to anesthesia and surgery. However, several confounding factors make it very difficult to reach didactic evidence-based conclusions. One of the key confounding issues is that the nature of expectations and responses for both parent and child vary greatly in different environments around the world. Studies applicable to one culture and to one hospital system (albeit multicultural) may not apply elsewhere. Moreover, the study of hospital-related distress begins at the start of the patient's journey and ends long after hospital discharge; it cannot be focused completely on just the moment of anesthetic induction. Taking an example from actual practice experience, the trauma caused by the actual giving of a premedication to a child who absolutely does not want it and may struggle may not be recorded in a study but could form a significant component of overall effect and later psychological pathology. Clearly, attitudes by health professionals and parents to the practice of routine pediatric premedication, vary considerably, often provoking strong opinions. In this pro–con article we highlight two very different approaches to premedication.

Keywords: Sedative premedication, children, Pediatric procedural sedation.

Introduction:

Pediatric procedural sedation (PPS) refers to techniques and medications used to minimize anxiety and pain associated with unpleasant or painful procedures. PPS is used when painful or uncomfortable procedures are unavoidable and incorporates physical, psychological, and pharmacologic interventions to minimize discomfort. In the pediatric population, PPS is not limited to major painful procedures requiring deeper levels of sedation. Common procedures, such as IV cannulation, venipuncture, urethral catheterization, and lumbar puncture, can be associated with significant distress or pain in pediatric patients. Many pediatric patients may require anxiolysis to have CT or MRI imaging, ultrasound, or echocardiography to ensure adequate imaging is obtained and minimize patient stress **[1].**

PPS can be performed skillfully in various settings and is not exclusively practiced by anesthesia practitioners but is now practiced routinely by other specialists, such as emergency and critical care clinicians, along with several nurse specialists. In 2019, the American College of Emergency Physicians (ACEP) developed a multidisciplinary consensus on unscheduled, time-sensitive procedural sedation. According to ACEP, procedural sedation is a 'technique of administering sedatives or dissociative agents with or without analgesics to induce a state that allows the patient to tolerate unpleasant procedures while maintaining cardiorespiratory function **[2].**

It is imperative first to understand the terminology regarding sedation, analgesia, and dissociation. Sedation induces the patient into a state in which they are able to lie still. Analgesia is pain relief typically by local or central interventions. Dissociation is the production of a trance-like mind-body separation. PPS is practiced on a continuum using interventions to provide the optimal amount of sedation and analgesia for the procedure that needs to be performed. This can vary from anxiolysis for imaging or minor nonpainful procedures to moderate sedation for more painful procedures, such as fracture reduction. The approach is tailored to the specific patient depending on their level of anxiety and pain. Per published guidelines, PPS can be performed safely outside of the operating room in settings such as the emergency department, dentistry, gastrointestinal endoscopy, and radiology **[3].**

Different evaluation methods have been developed to define the degree of sedation. The most commonly used is the Ramsey scale that scores on eight characteristics, and a score indicates anxiolysis (2 to 3), moderate sedation (4 to 5), deep sedation (6), and general anesthesia (7 to 8) **[4].**

More practical terms of sedation are the responsive-based sedation definitions:

- **Minimal:** also called anxiolysis; patient awake and relaxed, able to respond normally to verbal stimuli.

- **Moderate:** also called conscious sedation; The patient has a depressed level of consciousness, able to respond purposefully to verbal stimuli alone or accompanied by tactile stimuli. The airway remains intact, and no interventions to maintain the airway are needed.
- **Deep:** the patient has a depressed level of consciousness and cannot be easily aroused but does respond purposefully following repeated or painful stimuli. Patients may need support to maintain a patent airway.
- **Dissociative:** the patient is in a trance-like state where they are unaware of the pain and amnestic to the event but remain awake with intact respirations, airway reflexes, and cardiopulmonary stability.
- **General anesthesia:** the patient has a loss of consciousness and is not arousable even to painful stimuli. The patient has an impaired ability to maintain independent ventilatory function and often needs assistance in maintaining a patent airway along with requiring positive pressure ventilation **[5].**

Pediatric patients are at higher risk of unintentionally moving to a deeper state of sedation than desired. The provider must have sufficient airway management skills and be Pediatric Advanced Life Support (PALS) certified to perform PPS **[2].**

Anatomical and Physiological considerations:

Many of the unique characteristics of the pediatric airway are most prominent in infancy. Anatomic considerations include a relatively larger head and occiput, large tongue and smaller mandible, and more cephalad larynx that appears more anterior than in adults. This more acute angle for visualization can be overcome by extending the neck (unless cervical spine injury is suspected) or placing a small roll under the shoulders to facilitate extension.

Young children also have floppy epiglottis that may obscure the laryngeal view, large adenoids and tonsils that may cause upper airway obstruction, and small cricoid cartilage, making open cricothyrotomy technically difficult. Many skilled laryngoscope practitioners use a straight laryngoscope to directly lift the floppier epiglottis out of view for better visualization **[6].**

Surgical cricothyrotomy is contraindicated in children <10 years old due to the small cricothyroid membrane, and needle cricothyrotomy is the invasive, subglottic airway of choice in this population. Bag mask ventilation (BMV) is often necessary prior to intubation and alone may be sufficient to facilitate oxygenation in situations where rapid recovery is expected, such as deep sedation. A tidal volume of 8 mL/kg is the goal in BMV, and providers should squeeze the bag only enough to cause chest rise to avoid barotrauma or gastric insufflation **[7].**

a pediatric patient requires a procedure that requires anxiolysis for the proper technique or intervention that will cause significant discomfort. The level of sedation is tailored to the amount of sedation needed depending on the amount of pain or anxiety that will be caused by the procedure or the necessity to keep the patient still. For instance, a child may require anxiolysis in order to

obtain CT or MRI imaging or need deeper sedation for more painful procedures such as fracture reduction or complex lacerations.

The patient's vital signs and overall stability must be taken into account in unscheduled procedures, along with consideration of the patient's history of chronic disease or genetic abnormalities (e.g., cardiovascular or respiratory disease, Down syndrome, cerebral palsy), medication history, and allergies. **The physical status evaluation of the airway is based on the American Society of Anesthesiologists (ASA) classification system: [8]**

- **ASA Class I:** Healthy patient with no acute or chronic disease, normal BMI percentile for age
- **ASA Class II:** Patient with mild systemic disease without acute worsening or exacerbation. Examples include asymptomatic congenital heart disease, well-controlled dysrhythmia, well-controlled epilepsy, asthma without exacerbation.
- **ASA Class III:** Patient with severe systemic disease without immediate danger of death, including uncorrected stable congenital cardiac abnormality, poorly controlled epilepsy, cystic fibrosis, morbid obesity, metabolic disease, history of organ transplantation.
- **ASA Class IV:** Patient with severe systemic disease that represents a constant threat to life, such as symptomatic congenital cardiac abnormality, severe trauma, sepsis, severe respiratory distress, congestive heart failure, acute hypoxic-ischemic encephalopathy.
- **ASA Class V:** Moribund patients not expected to survive without operation, including massive trauma, a patient requiring ECMO, intracranial hemorrhage with mass effect, respiratory failure or arrest, multiple organ system dysfunction.
- **ASA Class VI:** Patient declared brain dead whose organs are being harvested for donor purposes.

In general, PPS in an emergency setting should be limited to ASA class I or II. For children in ASA class III or IV or with anatomic cervical spine or airway anomalies, consultation with an anesthesiologist or appropriate subspecialist is recommended **[9].**

Contraindications

PPS is not appropriate in certain conditions and contexts.

- Appropriate equipment for monitoring and resuscitation is not available.
- Operator training. If the provider is not PALS certified or does not have the skill set required to secure an unstable airway, from intubation to emergent cricothyrotomy, PPS cannot be performed.
- The patient has known allergies or adverse reactions to medications used in PPS.

- The patient requires more than a brief painful procedure, necessitating general anesthesia in the operating room setting.
- At the time of the procedure, the patient's condition is high-risk ASA class III or higher and may be safer with management by an anesthesiologist or subspecialist.
- Published guidelines recommend a 2 hour fast for clear liquids, 4 hours for breast milk, and 6 hours for solid food before scheduled procedures. High risk of aspiration has been considered a contraindication in the past. Still, recent studies demonstrate no significantly increased risk of adverse events based on fasting times for unscheduled procedural sedation. Waiting for previously recommended fasting times can cause increased stress on pediatric patients and families in the emergent setting **[2].**

Equipment

Before starting PPS, the provider should ensure that the following necessary equipment is available, functional, and correctly sized for the child:

- Suction apparatus and catheter
- Oxygen supply that is flowing with adequate administration equipment ranging from a nasal cannula to a nonrebreather mask
- Airway equipment includes bag valve mask, appropriately sized oral and nasal airways, laryngeal mask airway, direct and video-assisted laryngoscope with correctly sized blades, appropriately sized endotracheal tube, surgical and needle airway.
- Pharmacologic agents including anxiolytic, analgesic, dissociative, and reversal agents
- Monitoring devices including a pulse oximeter, end-tidal carbon dioxide, noninvasive blood pressure, ECG leads, respirations.
- IV, running, or functional saline lock if administering IV medications or risk of progressing to a deeper level of sedation
- Medications and equipment for cardiac resuscitation **[10].**

Personnel

Ideally, there are two providers to perform PPS. One provider will perform the indicated procedure, and the other will oversee the sedation and patient monitoring. There are circumstances, particularly in the emergency setting while performing unplanned procedures, where having two operators is not possible. It is still recommended that a nurse or other qualified

individual monitor the patient while the provider is performing the procedure. The provider performing the PPS must be able to:

- Properly select patients for PPS
- Understand and manage medications and reversal agents
- Monitor airway patency, identify signs of airway obstruction and identify and distinguish between obstructive and central apnea
- Monitor ventilatory adequacy by observing chest wall motion along with pulse oximetry and capnography
- Monitor cardiovascular stability using cardiac rhythm, blood pressure monitoring, and physical assessment
- Recognize when a pediatric patient is inadequately or excessively sedated
- Perform advanced airway management skills
- Perform intervention for any complications **[11].**

Preparation

Once the need to perform PPS has been identified, a thorough medical evaluation should be performed to mitigate risk during and after the procedure. A standard checklist should be performed, and guidelines from the American Academy of Pediatrics are useful:

1. Physical status evaluation based on the ASA classification system. In general, PPS in an emergency setting should be limited to ASA class I or II. For children with ASA class III or higher or anatomic airway or cervical spine anomalies, anesthesiology or another appropriate subspecialty should be consulted.
2. Obtained informed consent
3. Obtain comprehensive health evaluation to determine baseline status and identify any specific health conditions that require additional considerations or consultation. This includes sex, age, weight, current medications, allergies, and relevant personal or family medical history.
4. Consider the NPO status of the patient in the context of the urgency of the indicated procedure.
5. Assess airway patency using the Mallampati score and assess mouth opening, tonsillar hypertrophy, mandibular anomalies, lingual anomalies, and cervical spine mobility.

Ensure equipment is available, appropriately sized, and functional **[12].**

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