



Paediatric non-operating room anaesthesia-the current scenario

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Abstract

Providing complete and integrated anaesthesia care beyond the protected, familiar and controlled boundary of the traditional operating room setting is a challenge to the anaesthesia provider. Over the past few decades, there has been a tremendous surge in the domains where procedures are being performed under sedation in the paediatric age group- imaging facilities, dental offices, subspecialty procedure suites, emergency departments and ambulatory surgery centres. The number and complexity of such cases is increasing over time. Another major shift has been the changing face of the caregivers. Initially, the anaesthetist played an exclusive role in non-operating room anaesthesia. However, it has now emerged as a multispecialty practice and sedation for children is now being provided by a wide range of specialists around the world. In this article we have discussed the guidelines for practicing paediatric sedation in remote locations and the role of the anaesthetist in the current scenario.

Keywords: paediatric non-operating, current scenario

Introduction

The Royal College of Anaesthetists defines a remote site as any location at which an anaesthetist is required to provide general/regional anaesthesia or sedation away from the main operation theatre suite and more importantly, the availability of help from another anaesthetist cannot be guaranteed. Common places demanding these services include radiological imaging, gastrointestinal imaging, paediatric cardiac catheterization, diagnostic/therapeutic interventions, psychiatric treatment and dental offices. The practice of giving sedation in children outside the operation theatre premises differs from adults not only in the indications demanding its use but also in the means adopted to accomplish it. Children require sedation to relieve pain, anxiety and achieve immobility for the safe completion of a procedure. Although many brief procedures in older and cooperative children may be accomplished by means like distraction, guided imagery techniques, play therapy, parental involvement along with the use of topical/local anaesthetics and minimal sedation [1-7], longer procedures requiring immobility in children younger than 6 years or those with developmental delay often require an increased depth of sedation for successful completion of the procedure [8-10].

Clinical and research consequences

Safety concerns in paediatric non-operating room anaesthesia (NORA)

Provision of anaesthesia or deep sedation in remote sites presents potentially significant risks [11-20]. There is no dearth of reports of sedation related adverse events in literature. Cote *et al* [21] reviewed 95 adverse paediatric sedation events using critical incident analysis. Of the 95 incidents 51 resulted in death, 9 in permanent neurologic injury, 21 in prolonged hospitalization

without injury, and in 14 there was no harm. Respiratory events were the most frequent initiating event. These events occurred in all types of facilities- from tertiary care centres to individual practitioner's offices.

The various factors responsible for posing increased risks during paediatric sedation at remote locations are discussed as follows:

- a. **Patient factors:** Children in ASA classes III and IV, neonates, children with airway problems like obstructive sleep apnoea (OSA), difficult intubation, or syndrome with airway abnormalities (Pierre Robin, Apert's or Crouzon's syndrome), children presenting with significant respiratory symptoms or respiratory compromise, children with delayed gastric emptying or aspiration risk, history of cardiac disease, patients with prior adverse response to sedation or sedative/analgesic drug allergy are some of the patients who are at a greater risk for adverse events in remote locations [22-28].
- b. **Manpower:** Sedation in the remote locations in the current scenario is being provided by specialists from multiple disciplines like paediatricians, paediatric surgeons, gastroenterologists, dentists, etc which has resulted in a multitude of problems like inadequate pre-procedural patient evaluation, lack of preparedness for procedure including checking for oxygen supply and availability of resuscitation equipment, administration of inappropriate sedative dosages resulting in oversedation, etc. Furthermore, the ancillary staff in such locations may be less familiar with the management of anesthetized patients and may even have limited medical background.
- c. **Location:** These facilities are located away from the operating room where help and anaesthesia support facilities

are not readily available. The lighting in these locations is generally suboptimal which hinders monitoring of the sedated child. Also, the bulky machines and equipment crowd the room and limit patient visualization and accessibility.

- d. Monitoring and Equipment:** Most problems in remote locations result from lack of monitoring devices like end-tidal carbon dioxide monitor, unfamiliar or outdated anaesthesia machines, lack of availability of age-appropriate airway equipment and emergency cart, etc.

Guidelines for safe anaesthesia

These safety concerns have prompted several international organizations like American Society of Anesthesiologists (ASA) [29-31], American Academy of Pediatrics [32], American College of Emergency Physicians (ACEP) [33], American Society for Gastrointestinal Endoscopy [34], American Gastroenterology Association [35], American Dental Association [36], and American Academy of Pediatric Dentistry [32, 37-39] to develop statements or guidelines concerning the delivery of this care. The various aspects of safe sedation are discussed as follows:

- a. Patients:** An anaesthesiologist must be consulted for patients at increased risk of experiencing adverse events during sedation because of their underlying medical/surgical conditions.
- b. Monitoring and Equipment:** A well-equipped emergency cart to resuscitate patient from adverse events encountered during sedation should be available (Table 1). Minimum monitoring standards required for each level of sedation should be followed.
The American Academy of Pediatrics (AAP) guidelines recommend that vital signs, including heart rate, respiratory rate, blood pressure, oxygen saturation, and expired carbon dioxide, must be documented at least every 5 minutes in deep sedation and every 10 minutes in moderate sedation [32].

Fasting guidelines

Before Elective Sedation: Children undergoing sedation for elective procedures generally should follow the same fasting guidelines as those for general anaesthesia. Table 2 outlines the recommendations of the American Society of Anesthesiologists (2011) [40] for clear liquids, breast milk, formula, and solid food.

For the Emergency Patient: The practitioner must always balance the possible risks of sedating nonfasted patients with the benefits of and necessity for completing the procedure.

- c. Personnel:** As per AAP guidelines, the practitioner responsible for the treatment of the patient and/or the administration of drugs must be sufficiently skilled to rescue a child with apnea, laryngospasm, and/or airway obstruction, including the ability to open the airway, suction secretions, provide CPAP, and perform successful bag-valve-mask ventilation, tracheal intubation should the child progress to a level of deep sedation. Training in, and maintenance of, advanced paediatric airway skills and paediatric advanced life support [PALS] is required. In addition to the practitioner, a person is required whose responsibility is to monitor appropriate physiologic parameters and to assist in any supportive or resuscitation measures, if required. This individual may also be responsible for assisting with interruptible patient-related tasks of short duration, such as holding an instrument or troubleshooting equipment in moderate sedation. In deep sedation, his only responsibility is the continuous monitoring of the patient. This individual should be trained in and capable of providing advanced airway skills.
The support person shall have specific assignments in the event of an emergency and current knowledge of the emergency cart inventory. It is recommended that at least 1 practitioner be skilled in obtaining vascular access in children.

Table 1: Equipment cart for emergency resuscitation

<p>Intravenous equipment</p>	<p>Gloves Tourniquets Alcohol wipes Sterile gauze pads Intravenous catheters [24-22-gauge] Intravenous tubing [pediatric "microdrip" (60 drops/ml)] Intravenous fluid Assorted needles for drug aspiration, intramuscular injection [intraosseous bone marrow needle] Appropriately sized syringes [1-ml syringes] Tape</p>
<p>Basic airway management equipment</p>	<p>Source of compressed oxygen (tank with regulator or pipeline supply with flowmeter) Source of suction Pediatric suction catheters Yankauer-type suction Face masks [infant/child] Self-inflating breathing bag-valve set [pediatric] Oral and nasal airways [infant/child-sized] Lubricant</p>
<p>Advanced airway management equipment (for practitioners with intubation skills)</p>	<p>Laryngeal mask airways [pediatric] Laryngoscope handles (tested) Laryngoscope blades [pediatric] Endotracheal tubes [Uncuffed 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0 mm ID] Stylet (appropriately sized for endotracheal tubes)</p>

Pharmacologic Antagonists	Naloxone Flumazenil
Emergency medications	Epinephrine Ephedrine Vasopressin Atropine Nitroglycerin (tablets or spray) Amiodarone Lidocaine Glucose, 50% [10 or 25%] Diphenhydramine Hydrocortisone, methylprednisolone, or dexamethasone Diazepam or midazolam

Table 2: American Society of Anesthesiologists (2011) fasting guidelines

Substance	Minimum Hours of Fasting
Solid food	8
Commercial formula	6
Milk or milk products	6
Citrus juices	6
Breast milk	4
Clear liquids	2

Conclusion: What is the current role of the anaesthesiologist?

Anaesthesiologists have helped in improving the safety of practice of paediatric sedation through the thoughtful application of the same concepts that improved safety in the operating room. In the current scenario, where sedation is jointly being handled by the physicians like dentists, gastroenterologists etc., anaesthetist plays a crucial role:

1. Formulation of customised protocols/ guidelines for sedation:

The major concern is the implementation of these guidelines.

Despite the multiplicity of published guidelines for sedation in both adult and paediatric specialties, these are not being applied consistently in clinical paediatric practice. The anaesthesia department can take a lead in formulating the local institutional guidelines, customised to the set up.

2. Development of training programs of paediatric sedation:

In 2016, the ASA passed an amendment on its advisory on deep sedation by non-anaesthesiologists. It states that non-anaesthesiologists may not recognize that sedation and general anaesthesia are on a continuum; and thus fail to recognize and respond to higher levels of sedation. Only physicians, dentists or paediatricians who are qualified by education, training and licensure to administer moderate sedation should supervise the administration of moderate sedation. Therefore, the anaesthesiologists can play a pivotal role in the development of training and privileging programs for non anaesthetist delivering sedation.

3. Supervision of difficult cases:

In ASA 3 and 4 children, neonates, children with airway problems, multisystemic disorders, cardiovascular diseases, etc the anaesthetist should be the primary person involved in providing sedation. Therefore to conclude, despite the involvement of multitude of specialists involved in paediatric NORA, the role of anaesthetist is still pivotal in ensuring safe sedation in remote locations by formulation of institutional guidelines, keeping an oversight on sedation practices in the institute and most importantly developing training programs for caregivers.

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