

Pediatric Sedation during Imaging-a Short Review

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ABSTRACT

Pediatric sedation is growing practices in specialties outside anesthesia such as in emergency departments, dental chambers, gastroenterology department, imaging facilities and ambulatory services. In imaging departments usually sedation is needed to immobilize the ill children and adjust behavior to cooperate. The objectives of this article are to make awareness of different levels of sedation, safety measures, need for adequate and advanced training on emergency airway management or resuscitation of non anesthesiologist physicians and medical personnel responsible for sedation. Presedation evaluation of pediatric patients, sedation drugs, necessary equipments for resuscitation, monitoring during sedation and discharge of patients in safe condition have been discussed

INTRODUCTION

Pediatric sedation is growing practices in specialties outside anesthesia such as in emergency departments, dental chambers, gastroenterology department, imaging facilities and ambulatory services. Pediatric sedation is not the same as adults. Sedation and anesthesia in pediatric patients outside operation room have increased tremendously in last two decades and sedation safety is also more discussed (1,2). Sometimes to relief pain or to immobilize pediatric patients different levels of sedation are needed in emergency department, dental chamber and imaging department. In imaging departments usually sedation is needed to immobilize the ill children and adjust behavior to cooperate. Safety is the most priority in sedation process. The objectives of this article are to make awareness of different levels of sedation, safety measures, need for adequate and advanced training of physician responsible for sedation, presedation evaluation of pediatric patients, necessary equipment

for resuscitation, need for monitoring and discharge of patients in safe condition. Pediatric sedation is sensitive issue as physiology and pharmacokinetics in children are different from adult. Firstly different terminology of sedation is clearly noted below- Mild sedation (old term- anxiolysis): is intended to relief anxiety maintaining consciousness. Moderate sedation (previously termed- conscious sedation): state of sleep can be aroused with age wise verbal command; respiratory tract reflexes and airway patency are maintained. Deep sedation: controlled state of depressed consciousness; airway function and patency may not be maintained and ventilatory function may be impaired. Patients can be aroused by purposeful painful stimuli. General Anesthesia: is a drug induced loss of consciousness during which patients are not arousable, even by painful stimuli. The ability to independently maintain ventilator function is often impaired (1,2).

“The purposes of sedation for diagnostic and therapeutic procedures are: 1) to guard the patient’s safety and welfare, 2) to minimize physical discomfort and pain, 3) to control anxiety, minimize psychological trauma and maximize the potential for amnesia, 4) to control behavior, and/ or movement and 5) to return the patient in safe discharge condition from medical supervision, as determined by recognized criteria” (2).

There are continuous and updated publications of guidelines for monitoring and management of pediatric sedation by American Academy of Pediatrics (AAP) and American Academy of Pediatric Dentistry

(AAPD). They usually use the same language and terminology of The Joint Commission on Accreditation of Healthcare Organization, American Society of Anesthesiology (ASA) not to arise controversies (1, 2, 3). These guidelines recommend adherence to high quality of patient care but cannot guarantee individual pediatric patient outcome risk. Emphasis on continuous monitoring is needed as because there may be sudden airway depression, laryngospasm, airway patency impairment and apnea, loss of airway patency, reflexes, pulmonary aspiration, gastroesophageal reflux and cardiovascular instability. Level of sedation in pediatrics may progress rapidly to deeper level than the intended level, so preparedness to rescue from moderate sedation is necessary when mild sedation is intended; thereby rescue skill and facilities for deep sedation are needed when moderate sedation is given. Preparation for recovery from anesthesia is required where deep sedation is intended. ASA guidelines recommend those practitioner should give pediatric sedation who have training on general anesthesia (2, 4, 5).

The qualified practitioner must take preparation for airway and cardiovascular emergencies first and then ensure: adequate pre-sedation evaluation, a sedation plan for particular procedure, adequate monitoring during and after the sedation process, documentation including details of drug administration, monitoring record and occurrence of any complications (eg airway obstruction, emesis, allergic reactions, paradoxical reactions to sedatives), fulfillment of discharge criteria and appropriate management of pain (1, 2, 4)

Pre- sedation evaluation: A careful and detail pre-sedation evaluation of pediatric patients are needed. A clinical history regarding snoring, mouth breathing, asthma, recent respiratory tract infections, medications and allergies are to be taken to manage airway. Careful examination of oropharynx and nasopharynx are to be done to exclude large tonsils.

Cardiovascular history including congenital heart disease, cyanosis, fatigue and failure to growth are notified. Neurological abnormalities and seizure disorder are to be assessed. History of gastro esophageal reflux and liver disease are to be recorded. Dietary considerations are: fasting condition of children needs to be evaluated. Solid food should be taken 6 hours before sedation, milk can be taken 4 hours before sedation and clear fluid may be allowed 2 hours before sedation (4). Parents need to be well informed about risk of sedation and written consent is to be taken. Clinical examination for underdeveloped mandible, mouth cavity for airways, pulse, blood pressure and respiratory examination should be performed.

Recommended personnel to sedate children: The responsible practitioner who will monitor the sedation should have a clear understanding of pharmaceuticals and drug interactions and skill for management of airway emergency and recovery stage. The same person should not be involved in the procedure of imaging. In ASA Class-I and II patients (a healthy person and mild systemic disease)—mild, moderate and deep sedation can be given by health professionals, physicians having advanced training on pediatric sedation with emergency management. Patients in ASA Class-III and IV with airway abnormalities, extreme tonsillar hypertrophy, patients in special needs require anesthesiologist supervision. Deep sedation and anesthesia should be given by anesthesiologists (2, 5).

Sedation Regimens for Children: There has been debate over appropriate drugs and their dosage and those who sedate children have their favorite regimens. It is important that persons administering the drug are familiar with them and cocktails of more than two drugs are to be avoided because of unpredictability of drug interactions and the increased incidence of important side effects (2, 9, 10,11).

Different sedation regimens with dose and route of administration:

1. Chloral hydrate: 50-100 mg/kg PO
2. Pentobarbital: 4-6 mg/kg IV or PO
3. Midazolam: 0.5-0.75 mg/kg PO; 0.025-0.5 mg/kg IV; 0.2 mg/kg intranasal
4. Propofol: 100-200 µg/kg/min IV
5. Ketamine: 3-4 mg/kg IM; 1-2 mg/kg IV
6. Propofol with fentanyl : Propofol- 50-150 µg /kg IV: >2 years; 1 -2 µg /kg IV
7. Midazolam with fentanyl: Midazolam- 0.02mg/kg IV; Fentanyl- 1-2 µg /kg IV

Chloral hydrate is an extremely useful and safe and can be used with good effect in children upto 10 kg (12). Pentobarbital has a long history of effective use but emergence can be prolonged. Midazolam has track record of safe use both oral and intravenous. Propofol is an ideal agent for nonpainful diagnostic procedures but only for use by expert airway managers with good backup systems (11).

Ketamine is a very popular drug for effective sedation and analgesia for painful procedures, nausea and vomiting is relatively common after procedure and there are reports of laryngospasm (14,15). Propofol combined with fentanyl is best for deep sedation to anaesthesia, but risk of requiring advanced airway management is high (15). Midazolam with fentanyl is another common combination for painful procedures but risk of apnoea and hypoxia is significant. Considering its safety this drug has been used for pediatric sedation for Nuclear Medicine imaging procedures in National Institute of Nuclear Medicine and Allied Sciences.

Monitoring of sedation: Pulse rate, blood pressure, respiration, level of consciousness and level of sedation of pediatric patients are to be monitored carefully and continuously. All records are to be documented. Pulse

oximeter is used to monitor pulse, BP and oxygen saturation. Capnography is the device to monitor expired carbon dioxide and gives information about presence and absence of respiration, airway obstruction and respiratory depression. Patients should not be unattended. Hands and feet should be kept exposed when restraint device is used to immobilize the children. Head position of the child should be checked frequently to ensure airway patency (2, 3, 4).

Criteria of discharge after sedation: Pulse, blood pressure and respiration are to be checked before discharge. In post sedation condition, if child can talk and awake in the quiet room can be discharged. Patients who received moderate sedation are to be kept in longer observation as because they remain at the risk of re-sedation. Parents and guardian are to be counseled about head position during transport, vomiting and aspiration.

“Equipments required for all levels of sedation and resuscitation:

1. Positive-pressure oxygen delivery system capable of administering greater than 90% oxygen at 15 L/min flow for at least 60 minutes.
2. Appropriate sized (age wise) masks (face mask, bag-valve-mask) and oral airways, laryngoscope blades, endotracheal tubes
3. Appropriate drug reversal agents
4. Suction apparatus with suction catheters
5. Pulse oximeter, blood pressure machine, ECG and thermometer
6. Defibrillator
7. Warming devices
8. Appropriate intravenous equipment
9. Capnography
10. Telephone to call emergency assistance” (17).

An acronym for planning and preparation of sedation procedure- SOAPME: S=Size appropriate suction.

O=Adequate oxygen supply. A=Airway; size appropriate airway equipment. P=Pharmacy, emergency drugs to support life. M=Monitors, oximeter, stethoscope and capnography. E= Special Equipment (defibrillator) (2).

Emergency drugs to rescue sedated patients: Sulbutamol for nebulization and inhalation, suxamethonium, atropine, diphenhydramine, diazepam, epinephrine (1:1000; 1:10000), Glucose (25 /50%), lidocaine, lorazepam, hydrocortisone, oxygen and sodium bicarbonate (2)

CONCLUSION

Safe pediatric sedation should be practiced by skilled persons and their ability should be promoted through proper training, improving skill and update knowledge about recent sedating drugs and techniques. Facilities of modern, age wise resuscitation devices and practice of pediatric sedation in safe hands are needed to avoid untoward risks during imaging procedures in children like bone scan, renogram, other nuclear medicine imaging and PET-CT scan in pediatric patients.

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