

# An Overview of Procedural Sedation

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## Abstract/Introduction

Emergency physicians need to be knowledgeable and capable in the techniques of procedural sedation. The management of pain and agitation in the emergency department has received more attention in recent years and is part of JCAOH credentialing. Procedural sedation allows for more successful procedures to be performed more humanely. Many of these occur among the pediatric population where patients demonstrate much more anxiety. Situations appropriate for procedural sedations include orthopedic trauma, laceration repair, foreign body removals and diagnostic testing. A sedation team using written protocols can minimize the risks of complications that might occur during sedation. Careful preparation and management of procedural sedation may lead to a more successful, safe and effective therapeutic intervention in the emergency department. Our objective is to describe the basic principles and techniques of procedural sedation so that physicians in the emergency department may more effectively and safely provide this service to their patients.

## Definitions

Sedation implies a depressed level of consciousness (table 1). During procedural sedation (PS), the provider's goal is

sedation to a point where the patient's ability to maintain an airway and respond appropriately to physical or verbal command is not compromised.

On many occasions emergency physicians encounter patients who want to be "put to sleep" during a certain procedure. For example, the physician may have a child who needs laceration repair or a CAT scan of the head. In this age of medicine we should be able to minimize our patient's anxiety and pain during medical procedures. Long banished should be the days of patients being held down in order to get a medical procedure completed in the emergency department (ED).

## Patient Assessment

In order to optimize safety and comfort, providers should carefully screen candidates. Patients should have a focused history and physical to make sure they can undergo the sedation with minimal risk. Otherwise, more formal anesthesia may be necessary. Important factors include the patient's allergies, past experience with anesthesia, anxiety level, expectations of the procedure and previous postoperative complications such as nausea, vomiting or prolonged sedation.

The American Society of Anesthesiologists' classification of physical status is a standard that many emergency physicians follow (table 2).

Most Class I, II and selected class III patients are appropriate candidates for PS in the ED. Patients and or their guardians should also be informed why sedation is needed and the risks and benefits should be discussed. Finally, a consent should be signed.

Table 1: Levels of Sedation

	Responsiveness	Airway	Ventilation	Cardiovascular
Minimal Sedation (anxiolysis)	Normal response to verbal communication	Unaffected	Unaffected	Unaffected
Moderate Sedation/Analgesia (previously conscious sedation)	Purposeful response to verbal or tactile stimulation	No intervention required	Adequate	Usually maintained
Deep Sedation/Analgesia	Purposeful response following repeated or painful stimulation	Intervention may be required	May not be adequate	Usually maintained
General Sedation	Unarousable even with painful stimulation	Intervention usually required	Usually not adequate	May be impaired

(Adapted from DeArmendi, St. Jude Children's Research Hospital Dept. of Anesthesiology)<sup>1</sup>

I	Healthy patient with no known health problems
II	Mild systemic disease - no functional limitations; Hypertension, DM
III	Severe systemic disease-definite functional limitation; CAD
IV	Severe systemic disease that is a constant threat to life
V	Moribund patient unlikely to survive 24 hours with or without operation
VI	Donor patient with documented brain death

Adapted from Shimmer, Ratner<sup>2</sup>

### Patient Preparation

Since airway protection is a constant concern during sedation, providers need to be vigilant in minimizing the risk of aspiration during the procedure. Optimally, patients should not have eaten solids for six hours before the procedure nor ingested clear liquids for two hours. Clear liquids are defined as anything you can read print through: water, apple juice, clear soft drinks, etc. Medications can be taken with a sip of water one hour before sedation. CAT scan contrast can be given up to two hours before sedation. Of course many ED patients may have problems that require PS and not be able to meet these restrictions. For example, acute shoulder dislocations, foreign body impalements, severe laceration repair, or patients in need of stat CT studies may have to be sedated anyway. In such cases, the risks and benefits of not proceeding with PS must be considered as well. Recent reports by Agrawal<sup>3</sup> and others indicate no major differences in morbidity and mortality between those who meet these criteria and those who do not.

### Team Approach to Sedation

Complications are much less common when there are two providers. One provider administers and manages sedation, while the other performs the actual procedure. The provider administering sedatives and monitoring the patient must be able to do so during the entire procedure. Both must be familiar with sedation/analgesia drugs, reversal agents, dosages, physiology and adverse effects. They should be able to manage patients during all levels of sedation. At no time should a provider sedate the patient and do the procedure without an appropriate individual monitoring and managing the sedation. Institutions with few complications attribute this to having a provider solely responsible for managing sedation.

### Common Pharmacologic Agents

There are no set guidelines to the use of agents in procedural sedation. Many agents are commonly used (table 3). Choice of medication depends on the provider's familiarity with the drugs, the state of the patient, and risk factors that may warrant a specific agent. In general providers should use the least amount of the drug necessary for sedation and comfort. Providers should preferably start with a single agent and possibly add a second for a complimentary effect; for example, propofol for sedation and fentanyl or morphine for analgesia. Multiple medications are more likely to cause adverse reactions, but many providers use them without complications. Here are a few of the common categories and agents used.

**Benzodiazepines** (Are very widely used. They can be used alone or combined with a narcotic.)

*Example: Midazolam is water soluble with a rapid onset, has a short therapeutic effect and a half-life of two to three hours. It is a potent amnestic agent with side effects including respiratory depression and apnea.*

**Narcotics** (Widely used for analgesia)

*Example: Fentanyl is a potent narcotic causing sedation with onset two to four minutes after IV administration. Analgesia lasts 30 to 60 minutes and can cause respiratory depression. Fentanyl is often combined with a benzodiazepine.*

*Example: Morphine sulfate is very sedating with long duration of analgesic action.*

All the opioid narcotics can cause nausea, vomiting, dizziness and respiratory depression.

**Sedative/Hypnotic** (No analgesic properties)

*Example: Chloral hydrate is primarily used for imaging procedures (CT, MRI, echocardiography) in pediatrics. Used orally it leads to mild sedation.*

*Example: Pentobarbital is a short acting barbiturate causing sedation with no analgesia properties, also primarily used in pediatrics. It is added to other agents for procedural sedation.*

*Example: Propofol is an increasingly popular and effective agent with an excellent safety profile. It has no analgesic or amnestic properties. It can be used alone. Usually, a bolus is given to induce sleep, which is then followed by an infusion if needed. Doses of propofol should be titrated to result in rapid recovery with few post-sedative side effects. Typically patients are awake within three to 10 minutes of termination of an infusion regardless of duration. The incidence of nausea and vomiting is much less compared with other agents. Avoid use of this agent if there are allergies to eggs or egg products, glycerol, EDTA, soybean. 🚫*

*Example: Etomidate is a commonly used non-barbituate induction agent with rapid onset, a relatively short half-life and an*

excellent risk benefit ratio. There are minimal effects on the cardiovascular system and blood pressure is unaffected, making it very useful in hypotensive patients, including trauma cases. There is also a neurocirculatory protective effect via reduction of cerebral blood flow and oxygen intake is positively enhanced. However, the pressor effect of intubation remains so precautions, including lidocaine administration, are still important. Adverse effects include nausea, myoclonus, lowering of the seizure threshold and short-term adrenal suppression (even after a single dose).

**Other**

Example: **Ketamine** is a dissociative agent that is useful for

sedation and analgesia primarily in pediatric patients. It is often combined with a benzodiazepine to avoid unpleasant but transient psychomimetic emergence reactions. Transitory laryngospasm is rare and can be treated with bag-valve mask ventilation momentarily until resolution. Atropine may be useful to decrease secretions.

**Antagonistic/Reversal Agents**

Example: **Naloxone** antagonizes opiate receptors and counteracts their effects.

Example: **Flumazenil** antagonizes benzodiazepine receptors.

**Table 3 Common Agents Doses Used In Procedural Sedation Suggested**

Agent	Dose-usual	Route	Pharmacokinetics	Adverse Effects
Midazolam	0.3-0.35mg/kg (adult) 0.05-0.15mg/kg (pediatrics)	IV	Onset 2-3 minutes Duration 30-120 minutes	Respiratory depression Paradoxical agitation
Fentanyl	1-2mcg/kg	IV	Onset 2-3 minutes Duration 45-60 minutes	Respiratory depression Pruritis Chest wall rigidity
Morphine sulfate	0.05-0.1mg/kg	IV IM	Onset 5-10 minutes Duration 4 hours	Respiratory depression Hypotension Nausea/vomiting
Chloral hydrate	50-100mg/kg Max-2gm (pediatric only)	PO	Onset 15-60 minutes Duration-1-2 hours	Delirium Nausea/vomiting Paradoxical agitation
Propofol	1mg/kg/ bolus then 0.5mg/kg PRN	IV	Onset 15-30seconds Duration 6-8 minutes	Respiratory depression Hypotension Opisothtonos
Etomidate	0.1-0.2mg/kg	IV	Onset 30 seconds Duration 8-10 minutes	Myoclonus Nausea/vomiting
Pentobarbital	1-6 mg/kg Max. 100mg (Pediatric only- especially for CT)	PO/IV	Onset 1-10 minutes Duration 1-4 hours	Respiratory depression Paradoxical agitation Nausea/vomiting
Ketamine	0.5-1mg/kg (Pediatric only) Preferably <10 years old	IV	Onset 30-60 seconds Duration 5-10 minutes Laryngospasm	Potent Sialagogue Hypertonicity  Emergence reaction
	2-3 mg/kg	IM	Onset 5-15 minutes Duration 30-90 minutes	
	4-6 mg/kg	PO	Onset 20-45 minutes Duration 60-120 minutes	
Naloxone	0.1mg/kg for (Pediatrics<5years or <20 kg) 0.4-2mg (older children and adults)	IV	Onset 30-120 seconds Duration 45-60 minutes	Nausea/vomiting Opiate withdrawal
Flumazenil	0.02mg/kg (for pediatrics to max of 0.2mg/kg) 0.2mg.kg (adults)	IV	Onset 30-120 seconds Duration 40-60 minutes	Seizure Nausea/vomiting

Adapted from Epocrates, Krauss, B (ACEP) and from Tejedor, J<sup>4</sup>

### Equipment and Monitoring

- Oxygen plus facemask and nasal canula
- Suction apparatus: tubing, Yankhour
- Emergency crash chart w/defibrillator
- Appropriately sized laryngoscopes and endotracheal tubes
- Cardiac monitor
- Pulse oximeter
- Blood pressure monitor
- Endotracheal carbon dioxide monitor
- Temperature monitor
- Pharmacologic antagonists
- Surgical airway equipment: cryothyrotomy set, etc.
- Laryngeal mask airway

All the above equipment should be available during sedation. The patient should be connected to a cardiac monitor, pulse oximeter, blood pressure cuff and temperature monitor with vitals logged every five minutes. In addition constant observation should be maintained with recording of airway potency, respiratory effort, and level of consciousness. Having close verbal and tactile contact with the patient will help the provider recognize problems before they show up on monitors. Most ED procedures are fairly brief and lengthy procedures usually are best done in the operating room for logistical reasons.

### Recovery and Discharge

Patients can be sent to a recovery area with appropriate monitoring devices or stay in the room where the sedation occurred. A registered nurse or trained individual must be present until discharge. Vital signs, level of consciousness and breathing status should be recorded at five to 15 minute intervals until the patient meets the institution's discharge criteria. Vomiting should have ceased with nausea diminishing and the patient should be able to tolerate fluids. Many

**Table 4 Aldrete Post-anesthetic Recovery Score**

Activity	Able to move all extremities	2
	Able to move 2 extremities	1
	Unable to move extremity	0
Respiration	Able to breathe and cough freely	2
	Shallow, limited breathing	1
	Apneic, no spontaneous exchange	0
Circulation	B/P stable, HR normal	2
	B/P fluctuating, HR irregular/ weak	1
	Unable to palpate B/P or HR	0
Consciousness	Fully awake	2
	Arouses to stimuli	1
	No response to stimuli	0
O2 saturation	Maintains O2 sat.>92% on room air	2
	Needs O2 to maintain O2 sat.>90%	1
	O2 sat. <90% even with O2 supplement	0

institutions follow the Aldrete score (table 4).

All patients being discharged after sedation should be alert and oriented with an Aldrete score of eight or at least be at their previous baseline before sedation. Vital signs should be stable and acceptable within their age range. Sufficient time must have elapsed after the last administration of reversal agents to determine if the patient will relapse because some reversal agents have a shorter half-life than the PS agent. Patients should be discharged to a responsible adult with written instructions on post-procedural sedation management with signs to watch for and a phone number to contact if there are any questions or concerns.

### Documentation

Documentation is vital to procedural sedation. The hospital and the emergency department should agree to the format. A checklist form reduces adverse medical outcomes and legal complications. The form should include a brief history including allergies and results of the physical examination emphasizing the cardiorespiratory system. A consent form should be included substantiating that risk and benefits were discussed and that the patient or guardian agrees to proceed with the sedation.

### Conclusion

Procedural sedation should be a part of today's emergency department routine, providing a humane way of easing anxiety and discomfort to our patients. It increases the success of procedures, diagnostic testing and the patient's overall satisfaction. Implementing a sedation team with standard protocols and documents will minimize complications. Regular evaluations of quality control issues, safety procedures and risk assessment will also help to assure continued success in the art of procedural sedation.

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