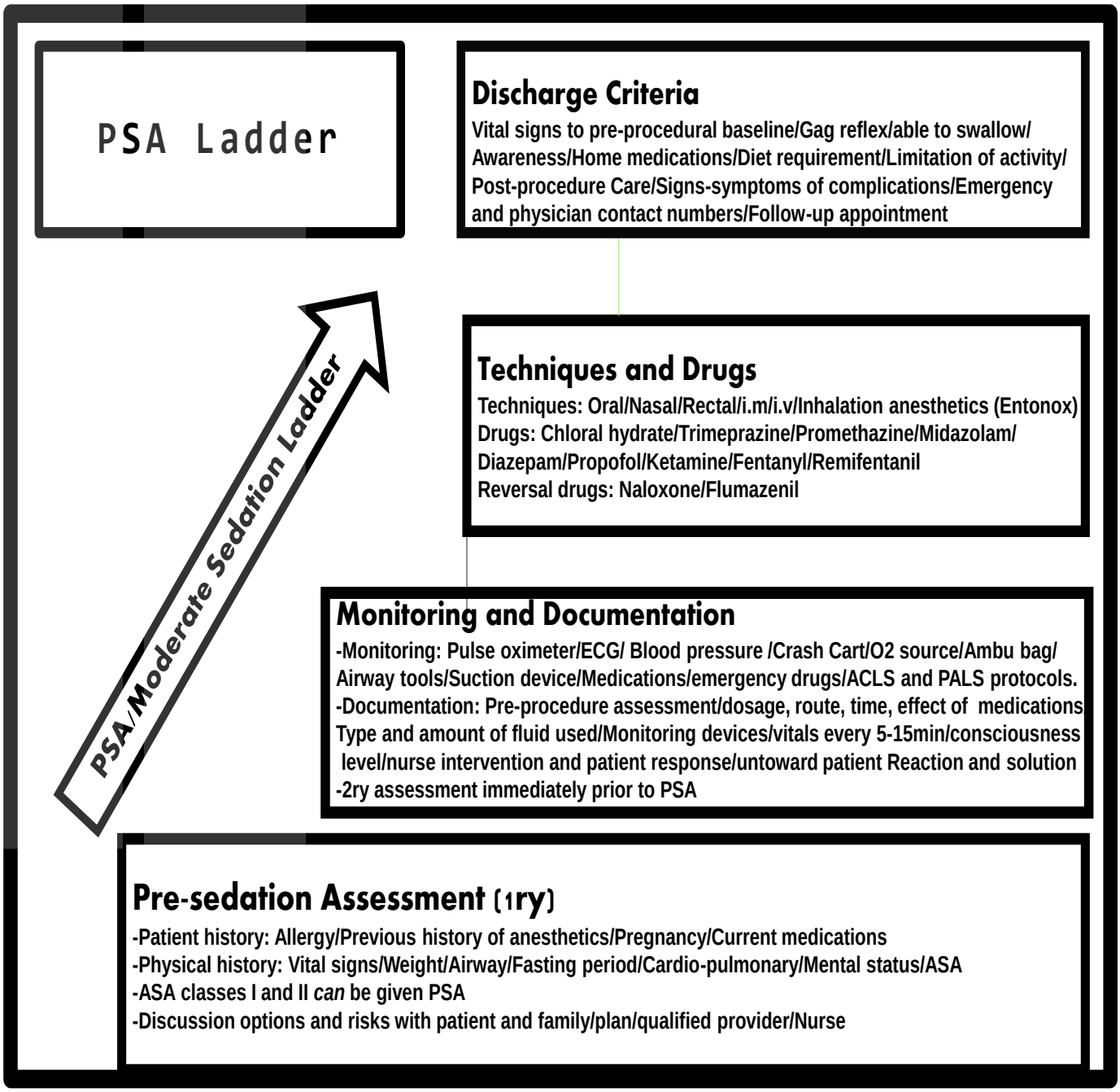
Procedural Sedation and Analgesia (PSA)



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PSA Workshop

-For non-Anesthesiologists-

PSA workshop is designed to educate participants (non anesthesiologists) on the challenges and clinical practice guidelines of sedation and analgesic techniques for different procedures. PSA is a form of anesthesia where the patient does not lose consciousness, and maintains patent airway/spontaneous breathing. Sedative/Analgesic drugs are used in very low doses to diminish patient anxiety and discomfort in order to facilitate certain diagnostic and therapeutic procedures.

The workshop includes a review of the ASA guidelines, video presentations and simulation training. Simulation scenarios allow participants to apply the guidelines to patient care scenarios in a team-based environment/improving team communication. Simulation may also improve the standardization of care/ contributing to process/quality improvement. The workshop allows participants to practice their skills on tasks such as bag valve mask/oral airway insertion/suctioning/tracheal intubation. Two simulation scenarios, allow participants to simulate an entire procedure using moderate sedation medications, from pre- through post-procedure patient assessment, including addressing adverse events and patient recovery.

The Workshop **objectives** are to enable the learner to:

1. Prepare patients for sedation (1ry assessment)
2. Perform immediate assessment before the procedure (2ry assessment)
3. Perform a care plan with the team/patient/family
4. Understand the "sedation continuum"
5. Learn the "modified sedation continuum"
6. Understand the "chain of survival"
7. Learn documentation
8. Perform PSA safely
9. Address needs to emergency situations
10. Monitor post-sedation recovery
11. Discharge patients after recovery
12. Rescuing a patient from deeper sedation
13. Titrating sedatives and analgesics drugs
14. Techniques: i.v/nasal/oral/inhalational

The provider must hold valid ACLS/PALS certificate

Contents

Introduction:

This Course/workshop is designed to provide the information necessary to administer PSA safely and effectively. PSA refers to sedation and/or analgesia given under the supervision of a physician to allay patient anxiety and to control of pain during diagnostic or therapeutic procedures. The Policies and Guidelines surrounding facilities that administer sedation are very strict. The physicians who provide medical care in the facility should be organized into a medical staff. This group will assume responsibility for credential review, delineation of privileges and responsibilities, quality assurance, and peer review. The facility must have established policies and procedures to handle unanticipated patient transfer to an acute care hospital. Also, include:

- Pre-operative preparation
- History/physical exam prior to sedation
- Pre-procedure labs as indicated
- General anesthesia administered by anesthesiologist
- Physician is responsible for discharge the patient
- written post-operative and follow-up instructions
- Medical records

Definition:

The American College of Emergency Physicians (ACEP) defines procedural sedation as "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. Procedural sedation and analgesia (PSA) is intended to result in a depressed level of consciousness that allows the patient to maintain oxygenation and airway control independently." Sedation and analgesia introduces an independent risk factor for morbidity and mortality in addition to the procedure itself. The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) recognizes the risks involved with sedation and analgesia for procedures and mandates that sedation practices throughout an institution be monitored and evaluated by the department of anesthesia. The American Society of Anesthesiologists (ASA) has responded to this challenging responsibility by developing practice guidelines for non-anesthesiologists who provide sedation and analgesia.

Levels of Sedation:

Minimal Sedation (Anxiolysis) is a drug-induced state during which patients respond normally to verbal commands. Although cognitive function and coordination may be impaired, ventilatory and cardiovascular functions are unaffected.

Moderate Sedation (Conscious Sedation) is a drug-induced depression of consciousness during which patients respond purposefully to verbal commands, either alone or accompanied by minimal tactile stimulation. No interventions are required to maintain a patent airway and spontaneous ventilation is adequate. Cardiovascular function is usually maintained.

Deep Sedation is a drug-induced depression of consciousness during which patients cannot be easily aroused, but respond purposefully following repeated or painful stimulation. The ability to independently maintain ventilatory function may be impaired. Patients may require assistance in maintaining a patent airway, and spontaneous ventilation may be inadequate. Cardiovascular function is usually maintained.

Anesthesia is a drug-induced loss of consciousness during which patients are not arousable, even by painful stimulation. The ability to independently maintain ventilatory function is often impaired. Patients often require assistance in maintaining a patent airway, and positive pressure ventilation may be required because of depressed spontaneous ventilation or drug-induced depression of neuromuscular function.

The Sedation Continuum:

Sedation occurs on a continuum from minimal sedation to general anesthesia and patients progress along that line based on the medication given, the route, the dose and the patient's own current clinical status. **Moderate Sedation** may be administered and monitored by a competent certified learner. **Deep sedation** and **general anesthesia** are to be initiated **only** by an anesthesia provider. **The non-anesthesia provider** caring for the patient must be able to recognize the clinical differences between the levels of sedation, and be able to rescue the patient, should the patient progress to a

deeper level than was intended. For example, the healthcare provider who is capable of monitoring or administering **Moderate Sedation** must be able to recognize when that patient has slipped into **Deep Sedation** and provide any necessary emergency care. This care may include airway support, fluids, more frequent assessments, or an immediate consult with an anesthesia provider or other practitioner with advanced airway skills, if necessary. The following table reviews the levels of sedation, and their effect upon the patients' airway, breathing, and cardiovascular system (Table 1). We have introduced a modified sedation continuum and the moderate sedation ladder where a deeper level was identified (Figures 1 and 2).

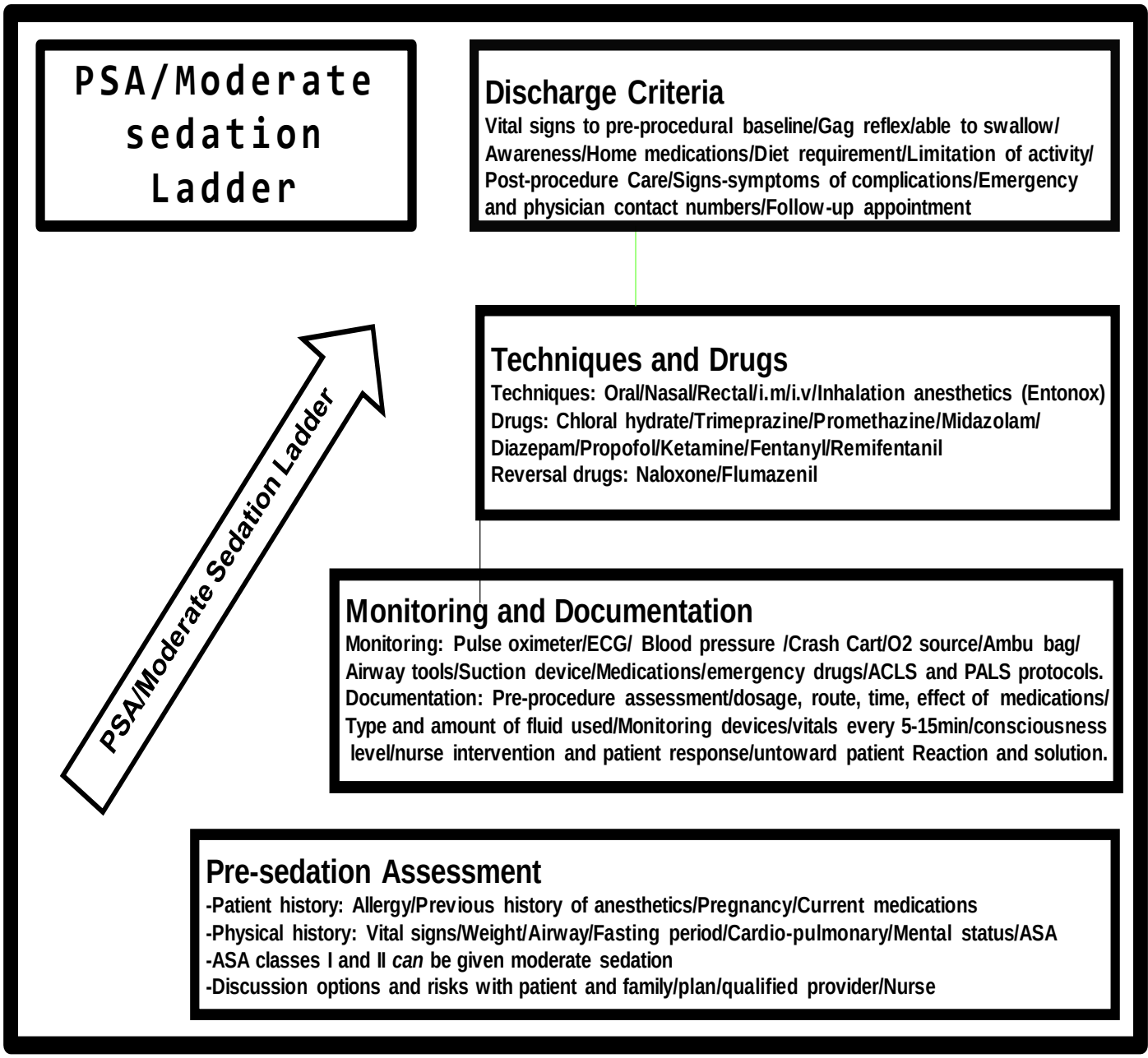
Table 1. Sedation Continuum

Level	Responsiveness	Airway	Breathing	Hemodynamics
Minimal sedation	Responds normally to verbal commands	Unaffected	Unaffected	Unaffected
Moderate sedation	Responds purposefully to verbal commands/ touch	Patent, no intervention needed	Adequate	Usually maintained
Deep sedation	Not easily aroused, but responds purposefully after repeated /painful stimulation	May be impaired/ intervention may be needed	May be impaired intervention may be needed	Usually maintained, possibly change in heart rhythm or blood pressure
General anesthesia	Not arousable even upon painful stimulation	Often impaired/ intervention often needed.	Often depressed/ positive pressure ventilation usually required	May be impaired

Figure 1. Modified Sedation Continuum (Eldawlatly A. Saudi J Anesth 2014;8:449-50)

Level → Signs↓	Minimal	Moderate	Deep	Deeper	GA
Responsiveness	Normal to speech	Purposeful response to speech/touch	Purposeful response to speech/painful stimulation	Purposeful response to repeated painful stimulation	No response to painful stimuli
Airway	Unaffected	Open	May be open or Need help	Needs help to maintain	Airway adjuncts
Breathing	Unaffected	Adequate	May be adequate	Not adequate	Needs ventilation
Hemodynamics	Unaffected	Maintained	Maintained	Maintained	May be affected
Drugs	Benzodiazepine	Benzodiazepines Opioids Propofol	Endoscopist Directed Propofol (EDP)	High doses of Opioids/Benzod/ Propofol	Anesthetics

Figure 2. PSA/Moderate sedation ladder **(Eldawlatly A. Saudi J Anesth 2014; 8:449-50)**



What Procedures for PSA:

- Bronchoscopy
- Colonoscopy
- Endoscopy
- Sigmoidoscopy
- Cardiac catheterization
- Cardioversion
- Dental procedures
- Lumbar puncture
- ICU

Sedation in the ICU

On a daily basis, patients in ICU require sedation and analgesia during painful and invasive procedures. Regardless of the patient's age, underlying medical condition or comorbidities, admission to and subsequent care in the ICU can be a frightening and painful experience. As in other locations, procedures may be brief (burn dressing changes, placement of central venous or arterial cannulae), and require only a short period of analgesia, anxiolysis, or immobility. However, the ICU is often different from other locations, as the need for procedural sedation may last days or even weeks as children may require prolonged sedation to overcome the pain and anxiety associated with the presence of an endotracheal tube (ETT) and the requirement for ongoing mechanical ventilation. The pain and anxiety may be further magnified by various psychological factors including periodic separation from parents (PICU), disruption of the day–night cycle, unfamiliar people, the noise of imposing machines and monitoring devices, fear of death, and loss of self-control can lead to emotional distress, anxiety, and sleeplessness. In a recent prospective cohort study of adult patients, Mendelsohn et al. reported that

26.3% of their cohort remembered mechanical ventilation and approximately 25% would have chosen not to receive mechanical ventilation had it been any more painful.

Process of Sedation:

The process of administering and/or monitoring a patient for PSA involves:

1. Determining if the patient is a candidate for PSA.

2. Preparing the patient and the setting.

3. Patient care during the procedure.

4. Recovery of the patient after the procedure.

5. Discharge from the sedation level of care.

6. ASA

ASA classes:

ASA 1 - Normal, healthy patient with no systemic disease

ASA 2 - Mild to moderate systemic disease, controlled on medication.

ASA 3 - Severe systemic disease with functional limitation that is not incapacitating

ASA 4 - Severe systemic disease that is incapacitating and life- threatening

ASA 5 - A moribund patient not expected to survive 24 hours regardless of intervention.

ASA 6 – A patient declared brain-dead whose organs are to be removed for donation.

An anesthesia consult is **highly recommended** for any patient with an ASA class of 4 or 5. Patients with an ASA of 3-5 are not candidates for moderate sedation/PSA. The physician will classify the airway as:

Adequate – no significant risk factors identified. **At Risk –**a receding chin, history of cervical, neck problems/craniofacial abnormality or the inability to fully open mouth or flex the neck. **High Risk –** for example, history of head or neck surgery, head or neck deformity, morbid obesity, history of difficult airway problems. This also includes a history of sleep apnea. In addition, there are other factors that may increase the risk for adverse reactions and/or complications from sedation and may require consultation with an anesthesia provider. These include but are not limited to:

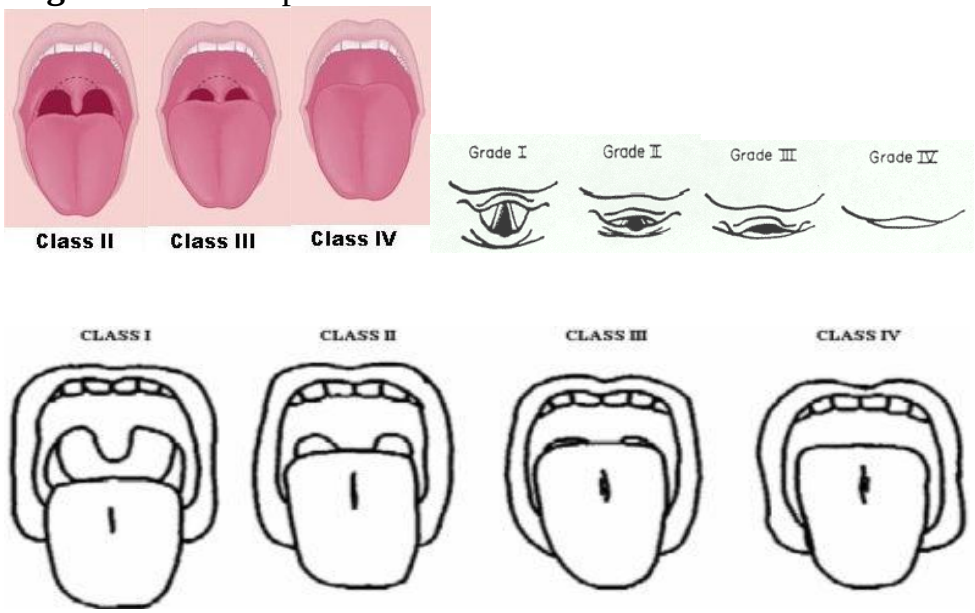
- Cardiovascular History
- Pregnancy
- Kidney or Liver Disease
- Snoring/Sleep Apnea
- Seizure Disorders
- Diabetes
- Full stomach
- Thyroid Dysfunction
- Patient/family history of malignant hyperthermia
- Congenital abnormalities: Down's Syndrome, Pierre Robin

Pre-Procedural preparation:

Once it's determined that the patient is an appropriate candidate for PSA, both the patient and the setting must be prepared. The assessment of the patient includes:

1. Baseline physical status, ASA
2. Baseline vital signs
3. Allergy
4. Current medications
5. NPO status
6. Medical/surgical history
7. Patent IV access
8. Informed consent/patient education
9. Current History and Physical
10. Review most recent lab results
11. Airway assessment using Mallampati classification (Figure 3)

Figure 3. Mallampati classes



12. **Equipment and accessories pre-procedural** (Figure 4)

1. Oxygen/nasal cannula/face mask
2. Suction device
3. Cardiac monitor
4. Pulse oximeter
5. ETCO2
6. Blood pressure
7. IV solutions/emergency drugs
8. Reversal agents
9. Ambu bag

Figure 4. Equipment and accessories pre-procedural

Nasal cannula

Ambu Bag and face mask

pulse oximeter

Suction device

Capnography

Personnel responsibilities:

During the procedure and course of sedation, the learner is responsible for:

- Airway assessment
- Oxygen delivery
- IV site assessment
- Response to medication
- Emotional support to the patient
- Vital signs
- ECG monitoring
- Pulse oximetry
- Report any changes to the physician

Children and PSA:

At any given time it is possible to find a pediatric patient who is undergoing CT scan in the Radiology You must remember that children are not small adults! Their vital sign numbers can be higher than in the adult population and their reaction to medication differs greatly. Fear, anxiety, temperament, age, and developmental stage of the child contribute to his or her ability to cooperate during necessary procedures such as these. To ensure cooperation, it is important to take the time to prepare an anxious child prior to a procedure:

- Approach the child in a friendly manner
- Attempt to build trust with the child
- Encourage parental participation
- Allow the child to bring a small toy
- Keep pain to a minimum

Medications (Table 2)

I. Benzodiazepines

They produce sedation, amnesia, diminished anxiety, skeletal muscle relaxation and anti-convulsing effects. Adverse effects include respiratory depression, laryngospasm, cardiac arrhythmia, bradycardia, hypotension, and CNS excitement. Reversal with **Flumazenil**.

▪ Lorazepam (Ativan)

Adult Dose: 1-2 mg IV or 0.5 – 2 mg PO
Pediatric Dose: 0.05 – 0.1 mg/kg IV
Contraindications: Hypersensitivity, depressive disorder/psychosis
Peak: 15 – 20 min
Duration: Amnesic effect: 6 – 8 h

▪ Midazolam (Dormicum)

Adult Dose: 0.5 – 2.5 mg IV
Pediatric Dose: 0.05 – 0.2 mg/kg b.w IV.
Contraindications: Hypersensitivity, existing CNS depression
Onset: 1 – 5 min
Duration: 30 min to 2 h
Requires direct physician supervision during administration to pediatric patients*****
Oral route: 0.25 – 0.7 mg/kg b.w
Intra-nasal route: dose of 0.1 -0.2mg/kg b.w

II. Narcotics

Opioids produce analgesia and sedation. Adverse effects include respiratory depression, hypotension, airway obstruction, bradycardia, cardiac arrest, and seizures. Reversal may be obtained with Naloxone

- **Morphine Sulfate**

Adult Dose: 2-5 mg IV
Pediatric Dose: 0.05 – 0.1 mg/kg b.w IV
Contraindications: Hypersensitivity, increased ICP, severe respiratory depression, liver or renal insufficiency
Onset: 1-3 min
Peak: 20 min
Duration: 1 – 2 h

- **Pethidine (Meperidine hydrochloride)**

-Given in combination with benzodiazepine for endoscopies
-Largely replaced by fentanyl
-Adult dose 50mg IV or IM

- **Fentanyl**

Adult Dose: IV 25-50 µ0g
Pediatric Dose: 1 – 2 µg/kg b.w as a slow IV bolus
Contraindications: Hypersensitivity to the drug, increased ICP, severe respiratory depression
Onset: 1 – 3 min
Peak: 3 – 5 min
Duration: 30 min to 1 h
Requires direct physician supervision during administration to pediatric patients. *****

Remifentanil (Ultiva) *

I.V bolus 0.75 -1.5 µg/kg b.w. Continuous infusion of 0.075-0.15 µg /kg b.w/min
Adverse effects: bradycardia and hypotension

III. Anesthetic drugs:

Anesthetic agents act upon the brain to produce general anesthesia, which is partial or complete loss of sensation with loss of consciousness. Since anesthesia may result in partial or complete loss of protective reflexes, therefore anesthetist must be present to continuously monitor the patient's status.

- **Ketamine (Ketalar)**

Dose: Oral route: 3 mg - 6 mg/kg "mixed with juice"
IV: 0.5 – 2 mg/kg
IM: 3 – 4 mg/kg
Do not exceed 2 mg/kg – may produce anesthesia
Contraindications: Increased ICP, hypertension, patients with psychotic disorders, hypersensitivity
Adverse effects: Hypertension, tachycardia, muscle hyperactivity, increased airway resistance, depressed cough reflex, vivid dreams, nausea/vomiting
Onset: IV 40 sec, IM 3 – 4 min
Duration: 1 – 2 h

- **Propofol***

Dose: Bolus1-2 mg/kg b.w IV
Adequate sedation infusion rate=25-100 ug/kg b.w/min
Adverse effects:

- Hypoventilation
- Low therapeutic margin
- Referred to as anaesthetic agent and is not recommended for sedation by non-anesthesiologists.

- **Etomidate**

Dose: 0.3mg/kg b.w.i.v.

Etomidate is an ultra–short-acting nonbarbiturate hypnotic used for anesthesia. It produces rapid induction without histamine release and with minimal cardiovascular and respiratory effects. Onset of action is 5-30 seconds with peak action at 1 minute. Etomidate has a duration of 2-10 minutes depending on the dose. The major adverse effect is transient adrenal suppression secondary to inhibition of 11-ß-hydroxylase and 17-alpha-hydroxylase enzymes which are important in cortisol synthesis. There is also a high incidence of pain on injection and nausea and vomiting associated with bolus administration.

- **Ketamine + propofol (Ketofol)***

  -Ketofol (1:1 mixture of ketamine 10 mg/ml and propofol 10 mg/ml)
  -Commonly used for procedural sedation in Emergency Department

IV. Inhalation sedation:

-Nitrous oxide
-Inhalation anesthetic

V. Anti-Histamine drugs

- Hydroxyzine (Vistaril)
- Promathezine (Phenergan)
- Trimeprazine (Vallergan)
- Diphenhydramine (Benadryl)
- Chlorpromazine

VI. Alpha-2 adrenoreceptor agonists:

Alpha-2 adrenoreceptor agonists have both sedative and analgesic effects. It induces sedation characterized by an easy and quick arousal, resembling natural sleep

- **Dexmedetomidine (Precedex) ***

Dexmedetomidine is alpha-2 adrenoreceptor agonist that has both sedative/analgesic effects.
Side effects: bradycardia and hypotension

- IV infusion: Loading dose: 0.5 -1ug/kg b.w. over 10 min.
- Maintenance dose: 0.2-0.6ug/kg b.w/hr
- Intra-nasal dose 1-1.5 ug/kg b.w.

- **Clonidine**

The essential difference between clonidine and dexmedetomidine is their elimination half-life, which is nearly four times longer for clonidine than for dexmedetomidine.

VII: Reversal Agents:

- **Naloxone (Narcan)**

Dose: 0.01 – 0.1 mg/kg b.w IV
Indication: Reverses respiratory and CNS depression after narcotic use
Contraindications: Hypersensitivity
Adverse effects: surge of pain, Hyper- or hypotension, tachycardia, nausea/vomiting

- **Flumazenil (Anexate)**

Adult Dose: 0.2 mg over 30 sec IV
Pediatric Dose: 0.01 mg/kg b.w IV
Indication: Benzodiazepine antagonist
Contraindications: Hypersensitivity, seizures/patient on routine benzodiazepines
Adverse effects: Seizures, arrhythmia, dizziness, headache.

VIII: Emergency Medications

- Drugs to treat Allergy
- Benzodiazepine Antagonist
- Anticonvulsants
- Narcotic Antagonists
- Steroids
- Antihypoglycemic
- Vasopressors
- Analgesics
- Emergency drugs

N.B.*those drugs have a narrow therapeutic margin. Patients can be easily shifted to deep sedation or even GA. It should not be administered except with experienced personnel and an anesthesiologist should be at the vicinity of the procedure place.

Table 2. Medications and dosages

Medication	Dose	Comments
Sedatives		
Chloral Hydrate	50-100 mg/ kg p.o. or p.r.	Up to 1 gram/ single dose Max dose = 2 grams
Diazepam	0.1 mg/ kg IV slowly (over 3 min.) 0.15-0.3 mg/ kg p.o.	
Droperidol	0.02-0.05 mg/ kg IV slowly (over 3 min.)	Onset: 3-10 min. Peak: 30 min. Duration: 2-4 hrs.
Midazolam	0.05 mg/ kg slowly (over 3 min.) 0.1-0.3 mg/ kg IM 0.5-0.7 mg/ kg p.o.	
Narcotics - (not in infants less than 3 mos.)		
Meperidine	1 mg/ kg IM, SQ, or IV (slowly)	
Morphine	0.1 mg/ kg IM, SQ, or IV (slowly)	
Butorphanol	0.01-0.02 mg/ kg IV (slowly)	
Fentanyl	1-3 mcg/ kg (0.001-0.003 mg/ kg)	Diminished sensitivity to C02 stimulation may persist longer than depression of resp. rate
Antagonists		
Naloxone (for narcotics)	0.01-0.10 mg/ kg IV to desired effect	Brief duration of action (30 to 45 min.)
Physostigmine (for anticholinergic syndrome)	0.015-0.025 mg/ kg to desired effect	Watch for cholinergic side effects (bradycardia, emesis, cramping, salivation)
Flumazenil (for benzodiazepines)	0.1-0.2 mg (partial antagonism) 0.4-1.0 mg (complete antagonism)	Benzodiazepine withdrawl-induced seizures; residual sedation/ hypoventilation

PSA/Moderate Sedation "CHAIN OF SURVIVAL"

References

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