PROCEDURAL SEDATION COURSE
PRE•COURSE MATERIAL

SECTION I: DEFINITION AND INDICATIONS

1) DEFINITION

Ann Emerg Med. 2005;45(2);177-196

Procedural sedation and analgesia (previously known as conscious sedation) consists of the following:

- A technique of administering sedative or dissociative agents with orwithout analgesic agents (i.e. opioids).
- The goal is to induce a state of altered awareness, which allows the patient to tolerate a painful or unpleasant procedure while maintaining cardiorespiratory function, oxygenation, and airway control independently.

a) Spectrum of Sedation:

The spectrum of sedation ranges from light sedation (or simply anxiolysis) to a general anesthetic.

i) Light Sedation
The patient has a slightly decreased awareness. However, they are still very alert and their eyes may be spontaneously open. They will respond rapidly and appropriately to verbal commands and physical stimulation. This level of sedation is generally too light to permit invasive or painful procedures but may be appropriate for the extremely nervous or anxious patient who just needs the edge taken off before a routine procedure (such as suturing a standard laceration or performing an LP).

ii) Moderate Sedation
The patient has a significantly depressed LOC but responds purposefully with verbal or tactile stimulation. They are maintaining their airway and cardio-respiratory status independently.

iii) Deep Sedation
The patient has a profoundly depressed LOC and only responds to deep, painful stimulation (does not respond to voice or touch). At this level of sedation the patient is on the verge of losing their protective airway reflexes and may also have depressed respiratory status (or even a brief period of apnea).

iv) General Anesthesia
This is what we want to avoid! The patient will be completely non-responsive to any stimuli. They will have total loss of their protective airway reflexes and will have profoundly depressed respiratory status (with sustained apnea).

Two other modalities of procedural sedation that need to be considered are as follows:

v) Dissociative state
This involves the administration of an agent (typically Ketamine) that causes thalamo-cortical and limbic dissociation. It produces are trance-like state in which the patient appears alert and maintains spontaneous respiration and airway protection but does not respond to stimulation. Sedation, Analgesia, and amnesia are reliably provided by ketamine.

vi) Neurolepsis
This is a state of quiescence. The patient has decreased anxiety and a sense of indifference to what is occurring in their surroundings and to them. Typically, this is achieved with the typical antipsychotic medications (haldol, droperidol etc). If you add an opioid, you have what is called neuroleptoanalgesia. This is used sometimes during certain neurosurgical procedures in which it is important that the patient be able to respond to stimuli.

For the type of procedures that are performed in the non•OR environment, the ideal level of sedation is typically in the moderate to deep spectrum. Remember, our goal is to allow the patient to tolerate a specific procedure while they maintain independent cardio•respiratory function and airway protective reflexes.

2) INDICATIONS

There are multiple potential indications for procedural sedation.

- Obs/Gyne
  - D&C, endometrial ablation, cervical procedures
- Dental
  - Extractions, restorations, pediatrics
- Respiratory
  - Bronchoscopy
- Cardiology
  - Cardiac catheterization, PPM placement, EP studies
- Oncology
  - During line placement (port-a-cath)
- Radiology
  - During biopsies, line placements, other interventional procedures
- Emergency Medicine
  - Reductions, suturing complex lacerations, pediatrics, cardioversion, imaging uncooperative patients, abscess I&D

3) CONTRAINDICATIONS

There are multiple relative contraindications that will depend on the patient's physical status, the type of procedure and degree of sedation required, and the urgency of the procedure.

i. Lack of provider familiarity with the procedure, medications, monitoring
ii. Lack of the necessary monitoring equipment or personnel
iii. Unstable patient (hemodynamically or neurologically)
    a. This is the patient who should have their procedure delayed until stabilized or performed in the OR.
iv. The patient has allergies or sensitivities to the medications
v. The patient is assessed to have a potentially difficult airway or bag-mask ventilation

SECTION II: PREPARATION AND PLANNNING

There is no evidence in the current medical literature to support an extensive evaluation beyond vital signs, mental status, and an exam of the airway and the cardiopulmonary systems. There is also no evidence to support routine diagnostic testing prior to procedural sedation. Any diagnostic testing should be dependent on the patient's status (Ann Emerg Med. 2005;45(2);177-196).

Section 4.4.2 of the WRHA Policy on Conscious Sedation/Procedural Sedation (Adult) states that a pre-procedure assessment must include a detailed history and physical exam as well as a variety of other features including emotional state, communication ability, perceptions regarding the procedure and sedation etc. There is no evidence to support this.

1) PATIENT ASSESSMENT

Basic assessment should include the 4 following components:

a. History
    a. Current health
    b. Past medical conditions
    c. Medications
        i. Focusing on medications with CNS depressant effects such as benzodiazepine or opioids
    d. Allergies
    e. Last oral intake
    f. Substance use (ETOH, Tobacco & recreational drugs)
    g. Previous sedation/anesthesia
    h. Family history of complications with anesthetic agents
    i. Risk for rapid oxyhemoglobin desaturation
        i. Those at increased risk are:
            1. Pregnant women
            2. Infants and young children
            3. Obese patients
            4. Patients with critical illness
            5. Patients with significant underlying lung disease
    j. Increased risk of developing apnea (central or obstructive).
        i. Historical factors that help to identify these patients include:
            1. Sleep apnea (may be on CPAP at night)
            2. Snoring at night
            3. Obesity

b. Focused Physical Exam

i. Vitals

- Any patient who is hemodynamically unstable is <u>not</u> a candidate for procedural sedation. They require resuscitation and stabilization. If the procedure is emergently required, they should have the procedure done in the controlled environment of the OR under the care of an Anesthetist.

ii. Cardio-respiratory exam

iii. ASA Physical Status

- The WRHA Policy on Conscious Sedation/Procedural Sedation (Adult) May 2005 states that the ASA (American Society of Anesthesiology) status can be applied to patients and used to determine who should undergo procedural sedation.
- ASA Class

I – Healthy Patient
II – Mild Systemic Disease with no functional limitations
III – Severe Systemic Disease with functional limitation
IV – Severe systemic Disease that is a constant threat to life
V – Acutely ill patient, not expected to survive the operation/procedure

- Class I and II are the patients you should be performing procedural sedation on. However, in certain circumstances (emergent procedures) you can perform sedation on patients in Class III or IV

2) <u>DETAILED AIRWAY ASSESSMENT</u>

Walls. Manual of Emergency Airway Management. 2008 3rd ed

The 2 most important questions we want answered are:

1) If this patient hypoventilates or becomes apneic, will we be able to support her ventilation with a bag-valve mask?
2) If this patient requires intubation, do we anticipate any difficulty?

a) Predictors of Difficult Bag-Valve Mask Ventilation (MOANS)

In general, anything that would cause obstruction to airflow or would require extremely high pressures to ventilate could cause difficulty with bag mask ventilation.
A helpful mneumonic to determine if the patient would potentially be difficult to bag is MOANS.

M – Mask Seal (anything that affects it, such as facial abnormalities, beard, facial #s)
O – Obesity/Obstruction (both upper and lower airway obstructions)
A – Advanced Age (typically > 55 years)
N – No teeth (the oral tissues collapse)
S – Sleep Apnea/Stiff Lungs (restrictive chest wall or lung parenchyma)

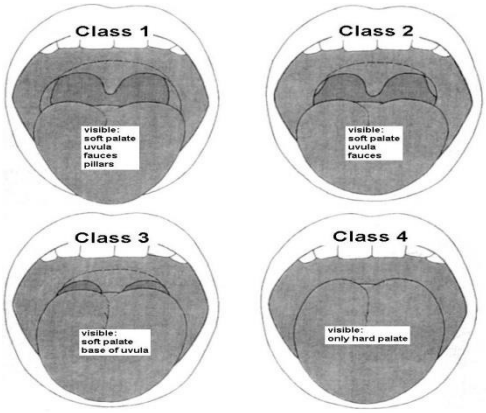
b) Predictors of a Difficult Intubation (LEMON)

Sometimes it is easy to predict if the patient could potentially be a difficult airway (they have airway edema or have a gunshot wound to the neck). In other situations, the findings

are much more subtle. There are certain features of the anatomy of the airway that predispose to a difficult laryngoscopy and intubation.
There a helpful mneumonic, LEMON to predict a difficult intubation.

L – Look Externally (facial fractures, deformity, burns, edema, congenital anomalies)
E – Examine 3-3-2 (see left)
M – Mallampati (see below)
O – Obesity/Obstruction (upper airway obstruction such as edema, hematoma, FB)
N – Neck mobility (impaired neck mobility from Rheumatoid Arthritis, C-spine immobilization etc)

Mallampati Score:



3) <u>FASTING STATUS</u>

This is an area of significant research and development. Much of what we considered the gold standard for fasting prior to procedural sedation was derived from the general anesthesia literature. This addressed fasting prior to elective procedures in the setting of a general anesthetic, with airway manipulation and intubation, as well as a significantly invasive procedure being performed on the patient.

In this context, the aspiration risk was 1/3,500 and the mortality as a result was 1/125,000 (Ann Emerg Med. 2007;49:454-461).

In the Setting of procedural sedation in an emergency department, there is NO EVIDENCE that fasting prior to the procedure has any impact on the incidence of complications or patient outcomes (Ann Emerg Med. 2007;49:454-461).

In a prospective observational study of 1,014 children, grouped according to fasting status, who underwent procedural sedation in an emergency department setting, the adverse event rate was the same between groups (Ann Emerg Med. 2003;42:636-646).

After a detailed review of the available literature, a recent clinical policy by the American College of Emergency Physicians concluded that "…There is no evidence suggesting a

correlation between fasting, emesis, and pulmonary aspiration in healthy pediatric patients undergoing procedural sedation in the ED." (Ann Emerg Med.2008;51(4): 378-399)

In fact, even the belief regarding preoperative fasting is beginning to change.

A 2003 Cochrane Review looked at healthy adults undergoing general anesthesia. The review evaluated 22 randomized controlled trials of patients deemed to be at standard risk of aspiration. They found no differences in outcomes between participants who followed a standard fast versus those who drank clear fluids in the pre-op period. In fact, patients who were given a drink of water preoperatively were found to have a significantly lower volume of gastric contents than those patients who fasted!!! (*Cochrane Database of Systematic Reviews* 2003, Issue 4. Art. No.: CD004423)

A 2009 Cochrane Review evaluated preoperative fasting in children undergoing general anesthesia. The reviewed 25 studies that included 2,543 "normal aspiration risk" children. They found no difference between the standard 6 hour fast and children who had clear fluids up to 120 minutes prior to the procedure. (*Cochrane Database of Systematic Reviews* 2009, Issue 4. Art. No.: CD005285)

So is it as simple as there are no fasting Guidelines for procedural sedation and that someone who just ate a pizza 15 minutes prior can have procedural sedation? Ultimately, the decision will come down to the urgency of the procedure and how deep you will be taking the patient. Below is a guideline from ACEP.

Standard-risk patient[a]

Oral intake in the prior 3 hours	Procedural Urgency[b]			
	Emergent Procedure	*Urgent Procedure*	*Semi-Urgent*	*Non-Urgent*
Nothing	All levels of sedation	All levels of sedation	All levels of sedation	All levels of sedation
Clear liquids only	All levels of sedation	All levels of sedation	Up to and including brief deep sedation	Up to and including extended moderate sedation
Light snack	All levels of sedation	Up to and including brief deep sedation	Up to and including dissociative sedation; non-extended moderate sedation	Minimal sedation only
Heavier snack or meal	All levels of sedation	Up to and including extended moderate sedation	Minimal sedation only	Minimal sedation only

Higher-risk patient[a]

Oral intake in the prior 3 hours	Procedural Urgency[b]			
	Emergent Procedure	*Urgent Procedure*	*Semi-Urgent*	*Non-Urgent*
Nothing	All levels of sedation	All levels of sedation	All levels of sedation	All levels of sedation
Clear liquids only	All levels of sedation	Up to and including brief deep sedation	Up to and including extended moderate sedation	Minimal sedation only
Light snack	All levels of sedation	Up to and including dissociative sedation; non-extended moderate sedation	Minimal sedation only	Minimal sedation only
Heavier snack or meal	All levels of sedation	Up to and including dissociative sedation; non-extended moderate sedation	Minimal sedation only	Minimal sedation only

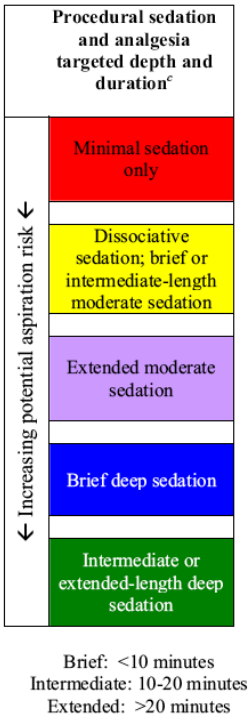


Figure. Prudent limits of targeted depth and length of ED procedural sedation and analgesia according to presedation assessment of aspiration risk

(Ann Emerg Med. 2007;49:454-461)

4) MONITORING

a. Equipment Required
Ann Emerg Med. 2005;45(2);177-196
WRHA Policy on Conscious Sedation/Procedural Sedation (Adult) May 2005

- IV access
- Oxygen
- Suction
- Reversal Agents
    - Flumazenil for benzodiazepines
    - Naloxone for opioids
- Advanced Life Support medications and defibrillator
    - Need to be available in the department
- Airway Equipment
    - BVM and oral airways at patient's bedside
    - Advanced equipment should be available in the department.
- Appropriate monitoring equipment must be available (will be discussed later)

b. Personnel Required
Ann Emerg Med. 2005;45(2);177-196
WRHA Policy on Conscious Sedation/Procedural Sedation (Adult) May 2005

How many people are required to safely perform procedural sedation?

- The literature does not provide clear evidence as to the number of personnel necessary to perform procedural sedation.

What training is required to administer procedural sedation safely?
- Individuals performing moderate to deep sedation need to be trained in the following areas

1) Administration of the pharmacologic agents
2) Monitoring patients during sedation
3) Management of complications (respiratory, airway, hemodynamic) that may arise during procedural sedation.

c. How to Monitor during procedural sedation

What monitors are required? (Ann Emerg Med. 2005;45(2);177-196)

1) Pulse oximetry
2) BP monitoring
3) Continuous EKG monitoring
4) End Tidal CO_2 (if available).

Who monitors the patient?

- There must be one person (usually an RN) dedicated to monitoring the patient (with no other responsibilities).
- An addition person should be performing the procedure. At least one of these should be a physician or otherwise specially trained individual. (WRHA Policy on Conscious Sedation/Procedural Sedation (Adult) May 2005)

5) DISCHARGE CRITERIA

WRHA Policy on Conscious Sedation/Procedural Sedation (Adult) May 2005

- Recovery time will vary depending on the depth and duration of the procedure and on the patient response.
- Outpatients must be able to ambulate without dizziness and tolerate sips of clear fluids without nausea or vomiting.
- They must be discharged to the care of a responsible adult who will escort the patient home by either car or taxi.
- The physician must also provide and review written procedural sedation discharge instructions and ensure that the patient understands them.

SECTION III: PHARMACOLOGY

1) GOALS OF MEDICATION CHOICES

a. Provide Analgesia
    a. There will be pain and discomfort for to varying degrees and for varying amounts of time depending on the procedure.
    b. Pain and discomfort should be kept to a minimum both during and immediately after the procedure.
b. Provide Sedation
    a. These are procedures that a conscious person would resist or not tolerate.
    b. The patient needs to be unaware and thus cooperative.
    c. Thus the patient needs to be sedated which means sleepy not comatose!

2) THE IDEAL DRUG

i) short half life
ii) predictable effects
iii) easily titratable
iv) reversible
v) no side effects
vi) low cost

Sadly, there is no one ideal drug so we have to choose from the best available based on the "3Ps".

1) The Patient
    a. Adult or pediatric
    b. Co-morbidities
        i. Cardiac, chronic pain, substance abuse
    c. Check to see if they have had prior procedural sedations
        i. This can give you good clues to dosing and response to drugs
    d. Assess the patient to see if they are at risk for respiratory depression and/or hypotension
    e. Other factors e.g. allergies, tolerance, hemodynamics
2) The Practitioner
    a. Your comfort level and experience with the drug.

b. Pick an agent and use it a few times in different situations
c. When using an agent for the first time start with low doses and titrate to effect but don't be too cautious, or the plane of sedation will not be achieved.
    i. e.g. giving small propofol boluses every 5 minutes is too long an interval
d. Spend some time with others with more experience
e. Review the literature

3) The Procedure
    a. What are you trying to accomplish?
        i. Consider the length of the procedure and the amount of anticipated discomfort
    b. Types of Procedures:
        i. Noninvasive
            1. These types of procedures are unlikely to cause pain or discomfort but do require the cooperation of the patient.
                a. Taking a young child to CT
                b. The agitated elderly patient
                c. The combative adult
            2. The Drug to Consider:
                a. Benzodiazepine – Midazolam
                    i. Can be used as a single agent for its sedative, amnestic and anxiolytic properties
        ii. Low Pain, High Anxiety
            1. These types of procedures will likely cause some discomfort that can be controlled with a local anesthetic but are causing the patient a great deal of anxiety preventing full cooperation
                a. Laceration repair
                b. Lumbar puncture
            2. Need minimal sedation
            3. The Drug to Consider:
                a. Benzodiazepine
                    i. Midazolam or Lorazepam
                b. Ketamine
                c. Analgesia with local anesthetic
        iii. High Pain, High Anxiety
            1. These types of procedures are expected to cause a great deal of pain and discomfort and thus a high degree of anxiety
                a. Fracture reduction
                    i. Require a deep plane of sedation so that the muscles are relaxed enough to allow the manipulation to occur the duration of which depends on the difficulty of the reduction
                b. Electrical cardioversion
                    i. Requires a plane of sedation and a level of amnesia so that the shock can be delivered the duration of which is incredibly short.
            2. The Drug to consider:

a. Depends on the anticipated length of procedure and the depth of sedation required
    i. Midazolam and Fentanyl combination
    ii. Propofol
    iii. Ketamine

3) <u>ADMINISTRATION CONSIDERATIONS</u>

- Intravenous administration is the ideal route for procedural sedation
    - It provides rapid, predictable and titratable effects.
    - Also allows access for fluids and reversal agents.
- PO/IM routes are erratic and tend to result in prolonged sedation

4) <u>MEDICATION CHOICES</u>

a) Fentanyl
    a. Potent, rapid acting opioid (~100x more potent than IV morphine)
    b. Binds to opiate receptors in the brain and spinal cord
    c. Pharmacokinetics:
        i. Onset of action: ~90 seconds
        ii. Clinical duration: 20-30 minutes
        iii. Serum half life: ~90 minutes
    d. Dosing:
        i. 1-3 mcg/kg IV
        ii. generally titrate in 25-75 mcg aliquots every 2-3 minutes
        iii. Often combined with midazolam
    e. Adverse Effects:
        i. Respiratory depression
            1. Maximal effect usually seen in 5 minutes
            2. Depends on dose and co-administration of other agents
        ii. Pruritis
            1. Seldom causes allergic reaction
        iii. Nausea and vomiting
            1. But less than with other opioids
        iv. Muscular and glottic rigidity
            1. Usually only with dosing errors
    f. Ideal Procedures: (usually combined with midazolam)
        i. "high pain, high anxiety"
            1. Joint/fracture reductions
            2. Cardioversion

b) Midazolam
    a. Rapid acting, easily titratable benzodiazepine
    b. Acts on GABA receptors resulting in **anxiolyic**, hypnotic and amnestic effects
    c. Pharmacokinetics
        i. Onset of action: ~1-3 minutes
        ii. Clinical duration: ~ 30 minutes
        iii. Serum half life: ~1.5-3 hours
    d. Dosing:
        i. 0.02-0.1 mg/kg IV total
        ii. Generally titrate in 1-2 mg aliquots every 2-3 minutes

iii. Often combined with fentanyl

e. Adverse Effects:
   i. Respiratory Depression
      1. Severity increased when used in combination with alcohol, barbituates and opioids
   ii. Hypotension
      1. When used with fentanyl in the "right" patient
f. Ideal Procedures:
   i. "non-invasive" (as a single agent)
      1. taking patients to CT or MRI
   ii. "high pain, high anxiety" (combined with Fentanyl)
      1. Joint/fracture reductions
      2. Cardioversion

c) Ketamine
   a. Dissociative agent which is a derivative of the street drug phencyclidine (PCP)
   b. Causes a dissociate between the thalamoneocortial and limbic systems preventing the higher order centres from perceiving visual, auditory or painful stimuli
   c. Also:
      i. Inhibits re-uptake of catecholamines Æ may cause tachycardia and hypertension
      ii. Relaxes bronchial smooth muscle
      iii. Stimulates salivary/tracheobronchial secretions
   d. Pharmacokinetics
      i. Onset of action: ~ 1 min IV
      ii. Clinical duration: ~15 minutes
      iii. Serum half life: usually complete recovery in 1-2 hours
   e. Dosing:
      i. Start with 0.5-1 mg/kg IV
      ii. Titrate with doses of 0.05-0.1 mg/kg IV every 3-4 minutes
   f. Adverse Effects:
      i. Respiratory depression
         1. Usually not a problem
            a. may occur with rapid, large dosing or in patients with CNS disorders or in sick infants
         2. usually muscle tone and airway protection is maintained
      ii. Laryngospasm
         1. Reported almost exclusively in infants < 3 months old
         2. Overall very rare in pediatrics
      iii. Muscle rigidity
      iv. Random movements
      v. Nystagmus
      vi. Emergence phenomenon
         1. Hallucinations and nightmares which may occur in up to 30% of adults and 10-17% of children
         2. Increased risk in patients:
            a. > 16 years of age
            b. female

c. psychiatric history
d. illicit drug use
e. large doses

3. can consider premedication with benzodiazepine in adults

g. Ideal Procedures:
   i. "low/brief pain, high anxiety"
      1. cardioversion
   ii. "high pain, high anxiety"
      1. Joint/fracture reductions

d) Propofol
   a. Ultra-short acting sedative hypnotic derived from the alkylphenols which provides a very dose dependant sedation that ranges from minimal sedation to general anesthesia
   b. Does NOT provide analgesia
   c. Pharmacokinetics:
      i. Onset of action: 15-30 seconds
      ii. Clinical duration: less than 10 minutes
      iii. Rapidly metabolized (does not accumulate in blood or tissues)
   d. Dosing:
      i. 0.25-0.5 mg/kg IV titrated every 3-5 minutes
   e. Adverse effects:
      i. Hypotension
         1. Generally rare in kids and healthy adults
         2. Rarely requires treatment
         3. Increased risk in the hypovolemic patient, the elderly patient or if given too rapidly
      ii. Respiratory depression
         1. Rare event
            a. Tends to be dose-related
         2. Risk increased if:
            a. Too much is given
            b. It is given too rapidly
            c. Patient has respiratory co-morbidities
      iii. Pain on injection
         1. Can consider mixing some lidocaine in the bottle or giving some lidocaine IV prior to injection
   f. Ideal Procedures:
      i. "low/brief pain, high anxiety"
         1. Cardioversion
      ii. "high pain/high anxiety" (combined with Fentanyl)
         1. Joint/fracture reductions

SECTION IV: COMPLICATIONS

1) COMPLICATIONS

a. When do they occur?
- Can occur at any point during the procedural sedation

- Often are seen after the procedure is done because the painful stimulus is gone but the effects of the sedating drugs are still present
- In a prospective trial of over 1,000 pediatric patients, the highest risk of adverse events was within 25 minutes of the last dose of medication being given (with the median time being 2 minutes from the final dose of medication). (Ann Emerg Med. 2003;42:177-196)

b. What are common complications?

1) Respiratory Depression
    a. Respiratory rate slows to a point that the patient is no longer adequately ventilating and oxygenating
        i. Resp rate < 10
        ii. O_2 saturation begins to drop
        iii. Patient appears to be taking ineffective breaths
    b. Propofol, fentanyl and midazolam combination
    c. Approach to Respiratory Depression
        i. "Stop, Stimulate, Start"
            1. Stop giving the drugs
            2. Stimulate the patient
            3. Start extra oxygen
        ii. If the above fails
            1. Perform a jaw thrust and wait…
        iii.iii. If the problem persists:
            1. Consider a reversal agent (see below)
2) Hypotension
    a. Generally this is a very transient phenomenon that can be countered with stimulation of the patient
    b. Approach to Hypotension during procedural sedation
        i. Stop giving the drugs
        ii. Attempt to rouse the patient and allow time for the drugs to wear off before giving fluids for mild hypotension
        iii. If it is a severe drop, give a bolus of Normal Saline (e.g. 500-1000cc)
3) Vomiting
    a. There is no established ideal "fasting period" for procedural sedation however vomiting is a very rare phenomenon.
    b. Approach to Vomiting during procedural sedation
        i. Stop the procedure
        ii. Clear the airway
            1. Roll the patient if possible
            2. Suction
        iii. Assess the situation
4) Emergence Reactions
    a. As the sedation wears off patients can experience wild hallucinations or nightmares that can be very frightening and may result in extremely agitated behaviour.
    b. This is mostly seen with Ketamine use.
        i. There is some role to suggest co-administration of a benzodiazepine with Ketamine in adults
            1. However this has not been proven to work in children

c. To prevent this phenomenon it is important to maintain a quiet, reassuring environment during the sedation.
d. Approach to emergence reactions:
    i. Maintain a calm reassuring environment
    ii. If symptoms are persistent and severe given a small dose of midazolam

2) <u>REVERSAL AGENTS</u>

These drugs are used to reverse the effects of two of the common medications used in procedural sedation. It is important to have them at the bedside and to have good knowledge and understanding regarding their use.

They should be used judiciously whenever acute complications arise that are not resolving in a timely manner. Remember that the drugs used in procedural sedation are chosen for their short half-life and duration of action so generally their effects will wear off before reversal agents are needed.

1) Narcan
    a. Pure opioid antagonist
    b. Indicated for reversal of opioid induced respiratory depression
    c. Pharmacokinetics
        i. Onset: 2-5 minutes
        ii. Clinical Duration: 15-30 minutes
            1. May require repeated doses
        iii. Dosing:
            1. Adults: 0.1-0.2 mg IV
                a. 2 mg total may be required for complete reversal
            2. Children: 0.005-0.05 mg/kg IV
        iv. Caution:
            1. Be careful in opioid addicted patients as Narcan may precipitate acute withdrawal

2) Flumazenil
    a. Competitively inhibits the activity at the benzodiazepine receptor site on the GABA/benzodiazepine receptor complex.
    b. Indicated for reversal of benzodiazepine induced respiratory depression
    c. Pharmacokinetics
        i. Onset: 1-3 minutes
        ii. Clinical Duration: ~1 hour
        iii. Dosing:
            1. 0.2 mg IV every 1 minute to a max of 1 mg
        iv. Caution:
            1. Avoid in patients chronically using benzodiazepines and with seizure disorders