ITEMS TO CONSIDER:

- Conscious Sedation = oxymoron in Pediatrics!! Is a myth!
  - Up to late 1980’s ➔ there were NO formal guidelines or standards for procedural sedation and analgesia. In 1985, both NIH and AAP published 2 similar consensus documents, with concept of sedation as a “continuum” along which progressive sedation depth implied an increasing of cardiovascular depression (Green, Mason: 2011).
  - Is a term often/more frequently being abandoned d/t “ambiguity” of what it really means
  - Procedural sedation and analgesia newer terminology and consideration. Are currently 9 drugs by 6 routes commonly used (Sahyoun, 2012).
- Kids are at a MUCH greater risk for problems than adults
- All patients have different “endpoints”
- JCAHO: indicates that Dept. of Anesthesia of hospital has ultimate regulation of overseeing & organizing guidelines & protocols (www.jcaho.org/standard)
- Historical perspective:
  - 1992: Committee of Drugs (AAP) first set national standards ➔ intent was to define conscious sedation as a minimal amount of sedation when the child would make an appropriate response to painful stimuli
  - 1995, 1998: redefined by several organization, including ASA
  - 1998: JACHO established guidelines
  - 2/2001: ASA with new guidelines and focus on clarifying definitions
  - 10/2002: AAP with revision of 1992 standards, and included updated guidelines and rationale for process minimal/mild sedation ➔ anxiolytic and moderate ➔ conscious or sedation/analgesia
  - 10/2009: amended definitions of continuum with FOUR levels.
  - 2013: demand for pediatric procedural sedation OUTSIDE the OR has increased 10% annually (Doctor, 2013)
- 1992 AAP terms “confusing”
  - New terms should indicate “mild sedation” = anxiolysis, moderate = “conscious sedation” or the other side of the fence with DEEP and then general.
  - Do I want sedation ↔ analgesia ↔ BOTH sedation/analgesia?
    - Conscious sedation for minimally invasive ↔ sedation/analgesia for more invasive

QUESTION # 1: WHAT IS CONSCIOUS SEDATION?

- Is NOT unconscious sedation !!
- Perhaps better terms = “PROCEDURAL SEDATION” or “SEDATION ANALGESIA”
- Most sedation used in children is to gain COOPERATION, and anxiolysis in conjunction with local +/or regional anesthesia.
- Procedural Sedation levels: minimum, moderate & deep
  - ‘IDEAL” sedative provides sedation, anxiolysis, analgesia with a degree of amnesia
- Goals of sedation: Historical perspective
  - (Rodriquez et al, 2002): to match the patient and procedure with the most appropriate technique & agent to provide the most humane & compassionate environment safety possible.
  - (Poloner, 2001): anxiolysis, cooperation, amnesia, immobility, lack of awareness ➔ behavioral & emotional parameters. 😊
  - Minimize physical discomfort, control behaviors, decrease negative psychological responses to therapy
  - Analgesia, anxiety alleviation
- Sedation can not be quantified easily into 3 or 4 distinct & unique categories in clinical practice ➔ is a CONTINUUM!
  - Practitioner should be able to RESCUE patients from a higher level
  - Is NOT a one time administration of analgesic or sedative agent—> rather, a PROCESS by which analgesia & sedation are TITRATED to reach a desired effect.

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Definitions:

- **AWHONN (endorsed by American Association of Critical Care Nurses) 1996:**
  - Intravenous conscious sedation is produced by the administration of pharmacologic agents. A patient under conscious sedation has a depressed level of consciousness, but retains the ability to independently and continuously maintain a patent airway and respond appropriately to physical stimulation and/or verbal command.

- **American Association of Nurse Anesthetists (9/2002):**
  - This type of sedation induces an altered state of consciousness that minimizes pain and discomfort through the use of pain relievers and sedatives. Patients, who receive conscious sedation usually are able to speak and respond to verbal cues throughout the procedure, communicating any discomfort they experience to the provider. A brief period of amnesia may erase any memory of the procedure.

- **American College of Emergency Physicians: procedural sedation (@ 2000):**
  - A technique of administering sedatives or dissociative agents with/without analgesics to induce a state that allows the patient to tolerate unpleasant procedures while maintaining cardio respiratory function. Specifically, the drugs, doses and techniques used are not likely to produce a loss of productive airway reflexes.

- **American Society of Anesthesiologists (@ 2001 and updated 2009):**
  - “Sedation & analgesia” comprise a continuum of states ranging from Minimal Sedation (Anxiolysis) through general Anesthesia.
  - Guidelines designed to be applicable to procedures in a variety of settings by practitioners who are not specialists in anesthesiology. Minimal sedation entails “minimal risk” and guidelines specifically exclude it! Some examples: peripheral nerve blocks, local/topical anesthesia, less than 50% N2O in O2, or a single oral sedative or analgesic in doses appropriate for unsupervised treatment of anxiety or pain.

**SEDATION CONTINUUM** (Innes et al, 1999)

| Alert anxious | Drowsy but clear mentation (sedation) | * EACH PATIENT WITH DIFFERENT ENDPOINT |
| | Eyes open: speech slurred | | |
| | Eyes closed but answers | | |
| | Opens eyes to voice: is confused | * SEDATION <-> ANALGESIA? |
| | O2 desat’s in room air | | |
| | Open eyes to pain; responds to stimuli | * BEWARE OF RAPID DRUG ADMINISTRATION |
| | Eyes closed: moans/withdraws from pain | * WHAT ARE MY GOALS? |
| | CO2 retention | | |
| | O2 desat’s in oxygen | | |
| | No pain response | | |
| | Bradycardia: poor gag | * NEED FOR APPROPRIATE MONITORING! |
| | Apnea and hypotension | | |
| | Death | | |

**CONTINUUM “Philosophy”: with amended **2009 guidelines** ➔ MINIMAL/Anxiolysis ➔ MODERATE/"Conscious Sedation" ➔ DEEP ➔ GENERAL** (see back of handout).

- Concern about respiratory depression ➔ cardiovascular collapse.
- “ZONE” between conscious & deep ➔ potential loss of protective reflexes
- Remember: “primum non nocere” ➔ FIRST DO NO HARM!! 😊

**AAP 2002 Addendum Guidelines**: highlights from Committee on Drugs

- Guidelines apply regardless of the settings in which sedatives are administered or specific training of personnel
- Sedative or anxiolytic meds should not be administered at home as part of preprocedural plan, nor administered by anyone who is not medically skilled or supervised.
- Crucial that age & size appropriate resuscitation equipment & meds be immediately available.
- Children who receive sedative meds with a long ½ life may require an extended observation.

**APA: 2002 updated highlights** (from website, Newsletter: May and December 2002)

- Concept of “RESCUE”: i.e., practitioner skills necessary to bring child back from inadvertent deeper anesthesia
- Exclusion of “minimal” (anxiolysis) has been expanded/clarified ➔ “guidelines do not apply to nitrous oxide alone or a single oral sedative or analgesic in doses appropriate for unsupervised management of anxiety, insomnia and pain.” (Chloral hydrate not excluded).
- Preprocedure evaluation be reconfirmed just before procedure begins to ensure patient is truly suitable
- Appropriate NPO status (though in emergency situation ➔ consider potential for aspiration versus need).
Patients receiving propofol, thiopental or methohexital = care consistent with DEEP sedation regardless of level of sedation actually intended.

**QUESTION #2: WHEN/WHERE SHOULD “CONSCIOUS SEDATION” BE ADMINISTERED?**

**SEDATION PLAN:**
- What are my goals? => anxiolysis, cooperation, amnesia, immobility, lack of awareness OR “out of it”?  
- Sedation <-> Analgesia differentiation. Remember: not all procedures need both & some need more of one!  
- CONTINUUM 😊  
- There is no mandate for IV access with patients receiving IM, PO, nasal, PR, inhaled or topical meds => BEWARE!

**Suggested Sedation/Analgesia Choices for Selected Procedures**

<table>
<thead>
<tr>
<th>PROCEDURE</th>
<th>CHOICES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phlebotomy</td>
<td>EMLA/ELAMAX, lidocaine -</td>
</tr>
<tr>
<td>PICC</td>
<td>EMLA/ELAMAX -&gt; Midazolam - Fentanyl, morphine, Ketamine</td>
</tr>
<tr>
<td>CT, EEG</td>
<td>Midazolam -&gt; chloral hydrate, pentobarb</td>
</tr>
<tr>
<td>MRI</td>
<td>Midazolam, propofol -&gt; pentobarb</td>
</tr>
<tr>
<td>Minor lacerations</td>
<td>LET, lidocaine -&gt; nitrous oxide -&gt; midazolam</td>
</tr>
<tr>
<td>Dislocation reduction</td>
<td>Midazolam + fentanyl, nitrous -&gt; moderate sedation</td>
</tr>
<tr>
<td>Fracture reduction</td>
<td>Midazolam + fentanyl/morphine =&gt; add Ketamine/atropine</td>
</tr>
<tr>
<td>Burn debridement</td>
<td>Ketamine/atropine + midazolam =&gt; add morphine</td>
</tr>
<tr>
<td>BM aspiration</td>
<td>EMLA/ELAMAX + midazolam =&gt; Fentanyl ⇔ nitrous</td>
</tr>
</tbody>
</table>

- Adapted from: Brent, @ 2000 and Kennedy & Luhmann, @ 1999

**PATIENT EVALUATION:**
- Are there any allergies, past reactions to meds?  
- INFORMED CONSENT  
- Identify possible risk factors: age, alteration in: respiratory, CV, neuro, hepatic or renal systems.  
- Baseline ASA physical status classification “scale”:
  - I Healthy, no underlying organic disease  
  - II Mild or moderate systemic disease that does not interfere with daily routines  
  - III Organic disease with definite functional impairment  
  - IV Severe Disease that is life threatening  
  - V Moribund patient, not expected to survive  
  - E (suffix) Physical status appended with E connotes a procedure undertaken as an emergency

- Possible examples of children in each classification status:
  - II child with asthma who does not require continual therapy & asymptomatic between exacerbations  
  - III child with cyanotic congenital heart disease, stable but who has continued cyanosis & mild S/S  
  - IV child as in II, but requiring ventilatory support but hemodynamically stable  
  - V child with septic shock and multisystem failure; unstable hemodynamics; responding poorly to meds

**MONITORING EQUIPMENT:**
- “Crash cart”, oxygen, suctioning, pulse oximeter, BP ( q 5 minutes), ECG possibly  
- Remember SOAP ME:  
  - Suction, Oxygen, Airway (bag-mask for Positive pressure ventilation (age appropriate); Pharmaceuticals (meds); Monitoring equipment; Emergency cart  
- Documentation form: well developed, organized and simple to use  
- Baseline vital signs -> start of procedure -> throughout procedure  
- Items on form should include: ALL scales (Ramsey, ASA, Aldrete; baseline patient information; reason for needed sedation; “FLOW chart” for vital signs, meds, etc; signature;

**HOSPITAL PERSONNEL:** qualified practitioners
- Minimum of TWO for sedation -> THREE when doing deep  
- Need to be excellent at airway management, understanding of meds, etc.
FASTING GUIDELINES: Summary of ASA Pre-Procedure Guidelines (@ 2002; updated 2011)

- Intent was to minimize risk of aspiration in sedated patients for GENERAL anesthesia originally based on expert opinion but nothing really re: procedural sedation.
  - Studies now suggest that risk of clinically important aspiration lower than during general d/t risk factors are not present.

<table>
<thead>
<tr>
<th>Ingested Material</th>
<th>Minimum Fasting Period (all ages)</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Clear liquids</td>
<td>2 hours</td>
</tr>
<tr>
<td>* Breast milk</td>
<td>4 hours</td>
</tr>
<tr>
<td>* Infant formula</td>
<td>6 hours</td>
</tr>
<tr>
<td>* Non-human milk</td>
<td>6 hours</td>
</tr>
<tr>
<td>* Light meal</td>
<td>6 hours</td>
</tr>
</tbody>
</table>

- Apply to healthy patients undergoing elective procedures.
- Both amount & type of foods ingested must be considered re: what is appropriate

QUESTION #3: HOW SHOULD SEDATION BE ADMINISTERED? WHICH ROUTES?

- Sedation <-> Sedation & Analgesia? Which do I want?
  - Depth of sedation has been correlated with risk of adverse events (Doctor, 2013).
- Remember: LIGHTEST degree of sedation & MATCH the patient & procedure to technique & meds!!
- Possible routes include: IV, IM, Intranasal, PR, PO, topical
  - Do I really need a medication? Can I do this procedure non-pharmacologically?
  - How quickly do I need to do the procedure?
  - Is there a family member present?
  - What is the child’s underlying condition? Is he/she vomiting, having diarrhea, runny nose?
  - What is my “goal”?
  - What meds do I need to have available?
  - Do I have an IV in place?
  - Do I need to give continually or just once?
- Flavoring of oral medications: (Isik, et al. 2008)
  - pH values can affect taste as well as absorption time med in contact with mucosa, local pH, quantity and flow of saliva, features of the drug as well as site.
  - Products used in study were: midoxolam pepsi, 10% sodium citrate (salty), fresh pomegranate juice, fresh grapefruit juice. The Sodium citrate won!!
- There are PRO’s and CON’s of each route -> decide which is best for the desired procedure. 😊

QUESTION #4: WHO CAN ADMINISTER SEDATION?

- 2013: numbers indicate increasing need/demand for sedation in pediatrics
  - Children require sedation for more procedures than adults therefore, more common place for advanced care providers in various locations (Hospitalist and Intensivist MD’s, CRNA’s, NP’s) in ED, PICU, etc.
  - The (+) advantages of various “sedationists” include convenience, more efficient patient management, conservation of limited resources (ie, OR and anesthesiologists).
- Pre printed order sets/sheets:
  - Studies and guidelines indicate that implementing preprinted orders are essential in minimizing errors
  - Takes away issues of legibility & completeness of order
- ASA, AAP guidelines: MD, advanced practice nurse, RN’s ( in some situations)
- AWOHN position statement ( 1996: endorsed by America Association of Critical Care Nurses)
  - Administration of IV conscious sedation medications by non-anesthetist RNs is allowed by state laws and institutional policy, procedures, and protocol.
  - A qualified anesthesia provider or attending physician selects and orders the medications
  - Certified Registered Nurse Anesthetists ( CRNA’s), anesthesiologists, other physicians, dentists, oral MD
  - Specially trained RN’s may assist in the administration
QUESTION #5: WHO CAN “MONITOR” SEDATION? WHAT CONSTITUTES MONITORING?

- RNs: specially trained, credentialed/certified by institution -> program based on JCAHO and other guidelines
  - Pre-sedation, intra-sedation, post-sedation are PARAMOUNT to successful sedation!
  - History taking, allergy seeking (meds, foods, environment).
  - Monitoring equipment but also the patient ➔ physiological and behavioral responses
- MD’s too!!
- AWHONN: 1996
  - The RN managing the care of the patient receiving IV conscious sedation shall have no other responsibilities that would leave the patient unattended or compromise continuous monitoring.
  - Assess total patient care requirements during IV conscious sedation & recovery. Physiologic measurements should include…respiratory rate, O2 sats, BP, HR/rhythm, LOC.
  - Anticipate & recognize potential complications of IV conscious sedation in relation to the type of medications being administered.
  - Possess the requisite knowledge & skills to assess, Dx and intervene in the event of complications…
  - Demonstrate skill in airway management resuscitation.
- AANA: 2002
  - The provider who monitors the patient receiving conscious sedation should have no other responsibilities during the procedure & should remain with the patient at all times during the procedure.

- What constitutes “monitoring”?
  - Vital signs
  - Skin
  - Level of orientation & pain
  - IV site: intact and patent
  - Sedation Continuum
  - Technology available and working!! ➔ DON’T forget a watch or clock!! 😊

QUESTION #6: WHAT SCORES SHOULD BE UTILIZED?

- Current thoughts: need of objective tool that would be rapidly responsive to changes in patient condition + able to integrate data from multiple sources.
  - Use of physiological monitoring, vital signs, capnography, etc.
  - Implementation of sedation scales has been associated with improved outcomes (Sessler, 2013).
- Baseline: pain scale (age & developmentally appropriate: faces, FLACC, CRIES, visual analogue, etc)
- Modified Ramsey score:

  1. Patient anxious, agitated or restless ➔ AWAKE
  2. Patient cooperative, oriented and tranquil ➔ COMFORTABLE
  3. Patient responds to voice and commands only
  4. Patient responds to gentle shaking
  5. Patient responds to noxious stimulus
  6. Patient has no response to firm nail bed pressure or other noxious stimuli

- Post anesthesia scale: Aldrete (see later)
- Other scores to consider: COMFORT behavior, Hartwig sedation, Richmond Agitation Sedation Scale (RASS), State Behavior Scale (SBS), and U Michigan Sedation Scale (UMSS).

QUESTION #7: WHICH MEDS SHOULD BE USED? AND WHY?

- Many options for Procedural sedation and Analgesia:
  - Oftentimes BEST combination is SHORT acting benzodiazepine (e.g.: midazolam) either alone or in combination with opioid analgesic (eg: fentanyl, morphine).
  - It is essential that meds/sedatives be titrated to effect as either over or under sedation with (-) outcomes
    - Over sedation: may delay recovery, may also induces tolerance and withdrawal syndrome.
    - Under sedation: may lead to increased distress and other adverse events.
- Chloral hydrate ➔ midazolam for diagnostic imaging ➔ ? better.
  - Evidence tends to indicate that for young children, chloral hydrate more effective in facilitating completion of painless studies despite longer onset and duration (Hare, 2012).
- ANALGESIA: MANY options to choose from
  - Defined as the alleviation of pain without intentionally producing a sedated state.
  - NON-OPIOIDS: aspirin, ibuprofen, ketorolac, acetaminophen
• **OPIOIDS:** several categories  
  o Provide analgesia and sedation during painful procedures ➔ dose dependent with INCREASED range of effects  
  o **OPIATES:** natural derivatives of opium poppy, such as morphine, codeine  
    ▪ **SEMI-SYNTHETIC:** hydrocodone, oxycodone  
    ▪ **SYNTHETIC:** fentanyl, sufentanil (first synthesized 1974, and 5-10x more potent than fentenyl yet shorter duration of action).  
      • Fentanyl: potent analgesic with NO enxiolytic or amnestic properties  
        o NO sedation at low doses; short duration of action.  
        o Routes: IV, nasal.  
        o BEWARE rigid chest syndrome: not seen in procedural sedation but usually in larger and RAPID given bolus.

• **NITROUS OXIDE:**  
  o One of the oldest agents (discovered in 1772-> in use since 1844).  
  o Odorless, tasteless gas ➔ effective for mild to moderately painful procedures.  
  o Inhaled ➔ anxiolysis, amnesia. “Dissociative euphoria”  
    ▪ 50/50 mixture (with oxygen) usual ➔ with use of distraction & story telling!  
    ▪ Onset of action: 1-3 minutes -> wears off quickly (within 5 minutes)  
  o Used in children > 8 years old. Can follow commands, “floating” description, common laugh 😊  
  o Little effect on CV or respiratory systems, as well as airway reflexes.  
  o Give 100% O2 for 3-5 minutes when finishing

• **SEDATION:** desire to decrease movement, gain cooperation ➔ MANY categories to choose from  
  o **PROPOFOL** (Diprivan): creates NO analgesia or amnesia ➔ purely a SEDATIVE  
    ▪ Induction & maintenance of anesthesia  
    ▪ Rapid, dose dependent levels of sedation with rapid return to consciousness!  
      • Usual dose: loading dose of 2 mg/kg in infants/toddler ➔ 1 mg/kg older and then bolus of 1 mg/kg younger and 0.5 mg/kg older until targeted sedation endpoint reached.  
      • Narrow therapeutic range  
      • Excellent efficacy when used in conjunction with opiates or ketamine for short painful procedures.  
      • Contraindication: allergy to eggs or soy.  
        ▪ Increasing use of med Outside operating room ➔ ED’s  
          • This should be administered ONLY BY persons trained in the administration of general anesthesia and who are NOT simultaneously involved in surgical or diagnostic procedures ➔ FULL VIGALENCE devoted to sedated patient!  
          • There is NO reversal agent.  
  o DPT: get rid of it!!  
  o **CHLORAL HYDRATE:** "sedative hypnotic" ➔ NO analgesia  
    ▪ Has been used since 1894: while safe, recent concerns potential carcinogenicity.  
    ▪ Dosing: 50-75 mg/kg not to exceed 100 mg/kg or 2 GM (some recommend 3 GM upper limit)  
    ▪ VERY unpredictable ➔ Has a LONG onset of action (> 40 minutes) and a LONG duration (> 2-3 hours). Upper limit about 20 KG if using this by itself.  
    ▪ Tastes lousy!! 😕  
  o ETOMIDATE: (Amidate) is an ultra short acting NONbarbiturate hypnotic, with rapid induction without histamine release and minimal CV and RESP effects.  
    ▪ NO analgesia; onset of action = 5-30 seconds and duration of 2-10 minutes depending on dose.

  o **BARBITURATES:** “SEDATIVE-HYPNOTICS” ➔ NO analgesia  
    ▪ Examples: pentobarb (Nembutal), methohexital (brevital), thiopental  
    ▪ Pentobarb: #1 used, with sedation onset 1-3 minutes and duration of 45-60 minutes but long ½ life of 26+ hours.  
      ▪ Many different routes: IV, IM, PO, PR

  o **BENZODIAZAPINES:** 😊  
    ▪ Sedative-hypnotics with excellent anxiolytic, amnesia, skeletal muscle relaxation properties  
    ▪ NO analgesia  
      ▪ Examples: midazolam (Versed), lorazepam (Ativan), diazepam (Valium)  
      ▪ Midazolam #1 used ➔ many different routes (IV, IM, PO, intranasal), with minimal hemodynamic effects. Quick onset, short duration.  
      ▪ Intranasal midazolam more effective than intranasal ketamine  
      ▪ Reversal agent: Flumazenil
KETAMINE: dissociative & anesthetic agent -> sedation, analgesia, amnesia RAPIDLY!!  
- Related to PCP, and different than all other sedatives/hypnotics. First made in 1962 and approved for clinical use in 1970.  
- Preserves airway reflexes and decreased effects on respiratory drive in typical doses  
  - Onset of action = 1 minute IV with duration of action = 10-15 minutes  
  - Subdissociative doses (0.25-.05 mg/kg) preprocedural analgesia and often as adjunct to propofol for painful procedures.  
  - Dissociative doses (1-2 mg/kg) used for painful procedures when ketamine is ONLY agent.  
- Need to give atropine (anti cholinergic effects) simultaneously to prevent issues  
- Studies tend to suggest that increased BMI are at greater risk for nausea/emesis consider use of ondansetron before sedation.  
- Beware of “emergence reactions”  
  - The incidence may be reduced by decreasing dose + using in conjunction with benzodiazepine.

REVERSAL AGENTS: ☺
- NALOXONE (Narcan): prompt reversal of opioid agonist narcotics  
  - 0.1 mg/Kg for under 20 Kg and 2 mg for over 20 Kg every 2-3 minutes  
- FLUMAZENIL (Mazicon): for benzodiazepines. Will antagonize sedation, amnesia, muscle relaxant and an anticonvulsant properties.  
  - 0.01-0.02 mg IV infused over 15 seconds; may repeat q60 seconds  
  - Duration of action is very short -> may need to repeat !

QUESTION #8: WHAT ARE THE POSSIBLE SIDE EFFECTS OF PROCEDURAL SEDATION?
- Know risk factors!  
  - Study with propofol: have shown predictors contributing to of adverse events ASA 3 status, hx of snoring (possible airway obstruction), patient > 12 years old, use of adjuvant midazolam prior (Srinivasan, 2011)  
- Post procedure evaluation: continues until the child is no longer @ risk for respiratory or CV complication, and vital signs are stable !  
- Statistics indicate that non hospital based facilities have increased adverse events & poorer outcomes.  
- A brief period of amnesia MAY follow the process  
- Need to consider pharmacological, clinical and cognitive issues!  
- PHARMACOLOGICAL:  
  - Side effects of medications: CONTINUUM, category of med utilized  
  - Opiates: nausea, vomiting, hypotension, respiratory depression, pruritis \( \Rightarrow \) chest wall rigidity fentanyl  
  - Ketamine: vomiting (use ondansetron oftentimes BEFORE sedation).  
  - Midazolam: respiratory depression, hypotension possible \( \Rightarrow \) paradoxical combativeness, agitation, restlessness, disorientation.  
  - If given with Opioids, increased risk of hypoxia and apnea.  
  - Propofol: respiratory (depression, apnea), hypotension.  
  - See chart later  
- CLINICAL:  
  - O2 desat's -> Stimulate patient, instruct to take deep breaths. Give O2  
  - Respiratory depression/apnea -> Breathe frequently, give 100% O2, REVERSAL AGENTS  
  - Symptomatic Bradycardia -> Give atropine (especially if fentanyl or morphine used)  
  - Hypotension -> Fluids  
  - Hemodynamic instability -> CALL A CODE!!  
  - Some examples of reported issues:  
    - Drug/Drug interaction: "the 6 week old infant received DPT for a circ, found dead 6 hrs later  
    - Drug OD: Child received 6000 mg Chloral hydrate  
    - Premature D/C: child became stridorous & cyanotic on the way back to his hometown.  
    - Prescription/transcription error: child received tablespoons instead of teaspoons  
    - Inadequate equipment: An O2 outlet was available but flow meter was not; only RA available  
    - Inadequate understanding of drug: child was given 175 ug of fentanyl IV push -> chest wall/glottic rigidity was followed by full cardiac arrest. Narcan or other meds not given.  
    - Inadequate fasting for elective procedure: child received bottle of formula prior to CT scan so baby could "sleep" through test.  
- COGNITIVE:  
  - Did the process produce desired goals?  
  - Not unusual for child/patient to have period of amnesia directly following, with increased anxiety
POST ANESTHESIA SCORE (ALDRETE)

<table>
<thead>
<tr>
<th>SCORE</th>
<th>CRITERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Dangerously agitated</td>
</tr>
<tr>
<td>6</td>
<td>Very agitated</td>
</tr>
<tr>
<td>5</td>
<td>Agitated</td>
</tr>
<tr>
<td>4</td>
<td>Calm and cooperative</td>
</tr>
<tr>
<td>3</td>
<td>Sedated</td>
</tr>
<tr>
<td>2</td>
<td>Very sedated</td>
</tr>
<tr>
<td>1</td>
<td>Unresponsive</td>
</tr>
</tbody>
</table>

SEDATION AGITATION SCALE (Riker, 1993). Developed Maine Medical Center

<table>
<thead>
<tr>
<th>SCORE</th>
<th>TERM</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Dangerously agitated</td>
<td>Pulling at ETT; trying to remove tubes; thrashing side to side</td>
</tr>
<tr>
<td>6</td>
<td>Very agitated</td>
<td>Does not calm despite frequent verbal reminders of limits; requires physical restraints</td>
</tr>
<tr>
<td>5</td>
<td>Agitated</td>
<td>Anxious or mildly agitated; attempting to sleep; calms to verbal instructions</td>
</tr>
<tr>
<td>4</td>
<td>Calm and cooperative</td>
<td>Calm, awakens easily, follows commands</td>
</tr>
<tr>
<td>3</td>
<td>Sedated</td>
<td>Will awaken and follow commands; required loud verbal or physical stimuli</td>
</tr>
<tr>
<td>2</td>
<td>Very sedated</td>
<td>Aroused to physical stimuli but does not awaken, communicate or follow command</td>
</tr>
<tr>
<td>1</td>
<td>Unresponsive</td>
<td>Minimal/no response to stimuli, does not communicate or follow commands</td>
</tr>
</tbody>
</table>

**QUESTION #9: WHAT SHOULD BE EXPECTED FOLLOWING PROCEDURAL SEDATION?**

- Return to baseline!! 😊
- Discharge criteria should include:
  - Intact protective airway reflexes, stable vital signs, NO pain, parent/SO able to follow D/C instructions, child conscious and able to communicate/at baseline.
  - Aldrete Score of 10, ASA back to baseline and presedation mental status, pain scale normal
  - Tolerate fluids and voiding
**SOME FINAL THOUGHTS:**

- Let’s replace “CONSCIOUS SEDATION” with “PROCEDURAL SEDATION” terminology!
- Don’t be afraid to give a dose of Versed to “gain cooperation”!
- THE CONTINUUM!! 😊
- Good pre-procedure evaluation ➔ Match meds to procedure and child!
- Procedural sedation provides a SAFE and EFFECTIVE option for procedures, and the number & types of procedures that can be performed will continue to increase!!
- Procedural sedation allows the child to recover quickly and resume their normal daily activities in a relatively short period of time!!

**CONTINUUM OF DEPTH OF SEDATION:** as approved by ASA House of Delegates 10/13/1999 and amended 10/21/2009

<table>
<thead>
<tr>
<th>Responsiveness</th>
<th>Minimal sedation/anxiolysis</th>
<th>Moderate sedation/ “conscious sedation”</th>
<th>Deep sedation/ analgesia</th>
<th>General Anesthesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airway</td>
<td>Unaffected</td>
<td>No intervention required</td>
<td>Intervention may be required</td>
<td>Intervention often required</td>
</tr>
<tr>
<td>Spontaneous ventilation</td>
<td>Unaffected</td>
<td>Adequate</td>
<td>May be inadequate</td>
<td>Frequently inadequate</td>
</tr>
<tr>
<td>Cardiovascular function</td>
<td>Unaffected</td>
<td>Usually maintained</td>
<td>Usually maintained</td>
<td>May be impaired</td>
</tr>
</tbody>
</table>

**Popular meds used for Analgesia**

<table>
<thead>
<tr>
<th><strong>Morphine</strong> (Duramorph)</th>
<th><strong>Sublimaze</strong> (Fentanyl)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dosing</strong></td>
<td><strong>Rate</strong></td>
</tr>
<tr>
<td>0.05-0.2 mg/Kg IV</td>
<td>Over 2-3 minutes</td>
</tr>
<tr>
<td>1-3 mcg/Kg SLOWLY</td>
<td>Slowly: 3-5 minutes</td>
</tr>
<tr>
<td><strong>Onset of action</strong></td>
<td><strong>Duration</strong></td>
</tr>
<tr>
<td>1-3 minutes, peak 15-20 minutes</td>
<td>3-5 hours</td>
</tr>
<tr>
<td>1-2 minutes</td>
<td>30-60 minutes</td>
</tr>
<tr>
<td><strong>Contraindications</strong></td>
<td><strong>Precautions</strong></td>
</tr>
<tr>
<td>* hypersensitivity</td>
<td>* Rapid administration may cause RDS, hypotension</td>
</tr>
<tr>
<td>* ICP</td>
<td>* Use in caution in pts. With decreased RR or hepatic disease</td>
</tr>
<tr>
<td>* RDS</td>
<td><strong>Adverse Effects</strong></td>
</tr>
<tr>
<td><strong>Precautions</strong></td>
<td>* RDS, hypotension,</td>
</tr>
<tr>
<td></td>
<td>* N.V. D, rash, hives</td>
</tr>
<tr>
<td>* Chest wall rigidity, &amp; poor pulmonary compliance with rapid administration</td>
<td></td>
</tr>
<tr>
<td><strong>Adverse Effects</strong></td>
<td><strong>REVERSAL MEDS</strong></td>
</tr>
<tr>
<td>* RDS, hypotension,</td>
<td>Naloxone (Narcan)</td>
</tr>
<tr>
<td>* N.V. D, rash, hives</td>
<td>• For under 20 Kg: 0.01-0.02 mg/kg initially. If no response -&gt; may repeat in 2-3 minutes.</td>
</tr>
<tr>
<td></td>
<td>• For over 20 Kg: give 2 mg initially</td>
</tr>
<tr>
<td>* Chest wall rigidity</td>
<td>Naloxone</td>
</tr>
<tr>
<td>* nasal pruritis, apnea</td>
<td></td>
</tr>
</tbody>
</table>
### SOME MEDICATIONS USED FOR SEDATION!!

<table>
<thead>
<tr>
<th></th>
<th>Midazolam (Versed)</th>
<th>Ketamine (Ketalac)</th>
<th>Propofol (Diprivan)</th>
<th>Pentobarb(Nembutal)</th>
</tr>
</thead>
</table>
| **Dosing**   | PO: 0.5-0.75 mg/Kg 30+ min prior  
              | IV: 0.05-0.1 mg/Kg and titrate up  
              | Nasal: 0.2-0.6 mg/Kg 10 min prior  
              | PR: 0.3-0.5 mg/kg/dose 30+ min before procedure  
              | IV: 1-1.5 mg/Kg, and then titrated bolus increments  
              | IM: 3-4 mg/kg  
              | 50-200ug/Kg/min, with aliquots of 0.5 mg/Kg titrated  
              | IV: 1-2mg/kg/dose and titrate up if needed to max 6 mg  
              | IM: 1-6 mg/kg  
              | PO: 4-6 mg/kg |
| **Rate**     | Slow: 2-4 minutes  
              | Over 1 minute  
              | Aliquots q 30-60 sec.  
              | Slowly 2-4 minutes |
| **Onset of Action** | PO: 15-20 minutes  
              | IV: 1-3 minutes  
              | IN: 5-10 minutes  
              | 30-60 seconds  
              | 30-60 seconds  
              | 30-60 seconds  
              | 30-60 seconds  
              | 30-60 seconds  
              | 30-60 seconds  
              | 30-60 seconds  |
| **Duration** | 30-60 minutes  
              | 10-35 minutes  
              | 3-5 minutes  
              | 15-45 minutes  
              | 15-45 minutes  
              | 15-45 minutes  
              | 15-45 minutes  
              | 15-45 minutes  
              | 15-45 minutes  |
| **Contraindications** | * Hypersensitivity, uncontrolled pain  
              | * Hypersensitivity, ICP, hypertension, Psych disorders, brain tumors  
              | * Alcohol abuse, pregnant/breast feeding,  
              | * Hypoventilation, risk factors  
              |
| **Precautions** | * NO analgesia, IN can be unpleasant  
              | * Administer atropine simultaneously, emergence reactions  
              | NO analgesia, young children  
              | NO analgesia  
              |
| **Adverse Effects** | * No analgesia, too fast infusions can cause hypotension & RDS/apnea  
              | * Emergence reaction, hypersalivation, tachy/brady cardia, increased CO, amnesia, bronchospasm  
              | * Pain at IV site, hypotension, apnea, Bradycardia  
              | * Can produce persistent drowsiness up to 24 hours; RDS, N/V, Laryngospasm, agitation, dizziness  
              |
| **REVERSAL MEDS:** | Dosing: 0.01-0.02 mg/kg q 1 minute up to 1 mg. May not reverse respiratory depression by itself!  
              | Adverse effects: dizzy, agitation, Sz, N/V, brady/tachy cardia  
              | Beware usage in young children  
              |

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## REFERENCES FOR PEDIATRIC SEDATION: FLOATING IN SPACE!!

- **Websites to utilize:**
  - American Society of Anesthesia
  - American Association of Nurse Anesthetists
  - American Academy of Anesthesiologist Assistants
  - American Association of Critical Care Nurses
  - American College of Emergency Physicians
  - National Institutes of Health
  - American Academy of Pediatrics
  - American Academy of Pediatric Dentistry
  - Medline and PubMed
  - The Center for Medicaid and Medicare (CMS)
  - The Joint Commission

- Albany Medical Center: Procedural Sedation protocol (Minimal/moderate sedation, Deep Sedation)

American Association of Nurse Anesthetists. (Website: www.aana.org) @ 2002.

American Society of Anesthesiologists. Guidelines, Newsletter. (Website: www.asahq.org)

American Association of Critical-Care Nurses; (website www.aacn.org)


Hare, M. Chloral hydrate or midazolam: which better for sedating for painless diagnostic imaging. Arch Dis Child. 2012. 97:750-752


Kinder, K et al. Do children with high body mass indices have a higher incidence of emesis when undergoing ketamine Sedation? Pediatric Emergency Care. 20912. 28:1203-1205


