Nursing Grand Rounds: Procedural Sedation

12-06-2018

Elaine Beardsley ACCNS-P MN CPEN
Disclosure Statement

• I do not have any conflict of interest, nor will I be discussing any off-label product use.

• This class has no commercial support or sponsorship, nor is it co-sponsored.

• We do not have any conflict of interest, nor will we be discussing any off-label product use.

• This class has no commercial support or sponsorship, nor is it co-sponsored.
Learning Objectives

1. Distinguish between various levels of procedural sedation in acute and ambulatory care settings.

2. Summarize common medications and methods that provide various levels of sedation.

3. Describe comprehensive monitoring for patients undergoing any level of procedural sedation.

Procedural Sedation and Analgesia (PSA) has continued to evolve since early 1990’s because:

- Access and costs related to taking a patient to the operating room for a simple procedure have continued to rise.
- The science of Neuropsychology and Neurobiology have shown that repeated instances of undertreated pain and anxiety in pediatric patients for procedures has contributed to some patients to long term effects such as stress disorders, change in perception of pain (nociception) and traumatic memories.

Mahajan & Dash, 2014
What is Procedural Sedation

Procedural sedation may be defined as the administration of sedative or dissociative agents, with or without analgesics, to induce a state that allows the patient to tolerate unpleasant procedures while maintaining cardiorespiratory function.

Specifically, the drugs, doses, and techniques used are not likely to produce a loss of protective airway reflexes.

Chang, 2018
Indications

Non-invasive procedure or imaging study
1. CT
2. MRI
3. Radiation

Invasive /Painful procedures
1. Laceration repair
2. Fracture reduction
3. Burn care or other dressing changes
4. Chest tube insertion
5. Abscess drainage
6. PIV placement
7. PICC placement
8. Many others ….

Given to prevent pain, anxiety, movement, memory of procedure (in some cases)
Validate in CHILD what level of sedation that the Provider can order and provide
RN Training

From the Sedation policy at SCH, Nurses who care for patients receiving procedural sedation need to have baseline certification requirements:

- Minimal and Moderate - Basic Life support certification
- Deep - Pediatric Life Support (PALS) certification
- **in addition to orientation with competency validation**
Levels of Sedation

Medications are chosen based on the desired sedation level (intent) based on the procedure and patient specifics.

SAFETY NOTE: A patient can progress into a deeper sedation level regardless of the medication given, and sedation levels are always on a continuum.

- Minimal (anxiolysis)
- Moderate (formerly called conscious sedation)
- Deep
- General anesthesia

CONTINUUM
Non–pharmacological methods

Prior to medication assessment and ordering from Sedation Provider, it is essential to consider if non-pharmacologic methods could be used instead based on procedure, patient assessment, and patient and family preferences:

• Distraction (Child Life)
• Oral sucrose

***these methods can also be combined with Procedural sedation prior
When Sedation Provider is ordering medication for Procedural sedation, certain factors are assessed prior:

Procedure:
- Length of procedure
- How much movement can be tolerated (face laceration repair for example)
- How invasive
- Who can provide medications and assess during sedation

Patient:
- NPO status
- Past Medical History
- ASA status (1 or 2 – no or mild systemic disease)
- Current physical assessment- signs of URI, etc
Minimal Sedation (Anxiolysis)

- Minimal sedation is used to treat anxiety associated with procedure.
- Medications most commonly used are Midazolam (intranasal or oral), and oral Lorazepam or Nitrous oxide as single agent.
- Cognitive function may be altered, but generally respiratory and cardiovascular function are not affected.

Care specifics:
- Given usually for 6 months or older.
- Pre-medication administration vital signs.
- Pre and post sedation nursing checklist.
- Universal Protocol completed prior to procedure.
- Oximetry (in some places).
- Post procedure vital signs.
Moderate Sedation

• Moderate sedation is used to depress consciousness during a procedure, but the patient can still respond to verbal or tactile stimuli. Respiratory and cardiovascular functions are usually easily maintained. Both pain and sedation medications combined can be given to induce moderate sedation.
  
  o Medications most commonly used are IV midazolam & morphine or fentanyl or combination Midazolam IN and Nitrous Oxide

Care Specifics:
• Generally is used for children 6 months or older
• Pre-medication administration vital signs
• Pre and post sedation nursing checklist
• Universal Protocol completed prior to procedure
• Cardiac monitoring with heart rate, blood pressure and oximetry documented every 5 min until end of procedure, then every 15min until patient returns to baseline
Deep Sedation

- Deep sedation is used to induce general anesthesia where the patient may not verbally respond and cardiovascular and respiratory functions may be temporarily altered. *Deep sedation can only be given outside the OR by ED and ICU Attending/ Fellow as per Seattle Children’s credentialing*

  - Medications most commonly used are Ketamine, Ketamine-Propofol or Propofol
  - In general, the Provider performing the procedure *IS NOT* the same Provider monitoring and performing the sedation
Ketamine

- Ketamine is a dissociative anesthetic and is a phencyclidine (PCP) derivative
- Inhibits catecholamine uptake which results in a sympathomimetic effect
- Provides sedation, amnesia and analgesia
- Can have respiratory depression in higher or rapidly administered doses
- Onset = 1 - 2 minutes
- Duration of anesthesia = 10 min
- Recovery to baseline = can be up to 1.5 hours post

### Side Effects:
- ↑ heart rate, ↑ blood pressure, ↑ secretions, bronchodilation
- Nystagmus
- Flushing or blotchiness of extremities

### Adverse Effects:
- Prolonged vomiting,
- Laryngospasm,
- Emergence reaction (more common in older teens)

### Reversal:
There is no reversal agent
# Ketamine Care Specifics

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPO status</td>
<td>3 hours</td>
</tr>
<tr>
<td>Age inclusion</td>
<td>Generally used for children 1 year or older</td>
</tr>
<tr>
<td>Indications</td>
<td>Use for longer procedures and when propofol is contraindicated</td>
</tr>
<tr>
<td>Contraindications</td>
<td>American Society of Anesthesiologists Airway Classification (ASA) 3 or higher</td>
</tr>
<tr>
<td>Pre-medications</td>
<td>Often ondansetron is given 30 min prior to the procedure to prevent post sedation nausea and vomiting</td>
</tr>
<tr>
<td>Pre-sedation Provider Assessment</td>
<td>Complete prior to sedation</td>
</tr>
<tr>
<td>Respiratory Therapy presence</td>
<td>Optional</td>
</tr>
<tr>
<td>Medication Administration</td>
<td>Ketamine doses are administered over 1 minute</td>
</tr>
<tr>
<td>Dose</td>
<td>1-2 mg/kg with a half dose for repeat</td>
</tr>
</tbody>
</table>
Propofol Care Specifics

• Propofol is an alkphenol and is unlike any opioid or benzodiazepine
  • It provides sedation, amnesia but has *no analgesic* properties
  • It appears to work by enhancing the GABA neurotransmitters
  • Propofol reaches rapid equilibrium between plasma and brain tissue
  • Brain tissue propofol levels remain saturated longer than plasma, so subsequent doses may result in more side effects (stair stepping effect)
  • Propofol is made up a fat based emulsion from soy and egg
  • Chemically, propofol is highly attracted to the fats in the cells (lipophilic) and is metabolized in the liver and excreted by the kidneys
  • Propofol causes vasodilation resulting in transient mild hypotension but does generally not cause hypoperfusion
  • It has a beneficial antiemetic effect
Propofol Care Specifics

- Onset = 10-60 seconds
- Duration of anesthesia = 5-9 minutes
- Recovery to baseline = 10 min (total plasma clearance can take up to 1.5 hours)

| Side Effects       | • Stinging at injection site,  
|                    | • Transient hypotension,  
|                    | • Decreased respiratory drive and  
|                    | • Relaxation of respiratory support muscles |
| Adverse Effects    | • Airway obstruction related to relaxation of respiratory muscles and  
|                    | • Anaphylaxis (from egg and soy) |
**Propofol Care Specifics (Cont’d)**

<table>
<thead>
<tr>
<th>NPO status:</th>
<th>3 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age inclusion:</td>
<td>Generally used for children 1 year or older</td>
</tr>
<tr>
<td>Indications:</td>
<td>Use for shorter procedures and when ketamine is contraindicated</td>
</tr>
<tr>
<td>Contraindications:</td>
<td>Patients with egg or soy allergies, obstructive sleep apnea, ASA 3 or higher, volume depletion, procedure expected to last longer than 30-40 minutes</td>
</tr>
<tr>
<td>Pre-medications:</td>
<td>If it is a painful procedure, administer a dose of fentanyl or morphine 15 minutes prior</td>
</tr>
<tr>
<td>Pre-sedation Provider Assessment:</td>
<td>Complete prior to sedation</td>
</tr>
<tr>
<td>Respiratory Therapy presence:</td>
<td>Optional but should be strongly considered</td>
</tr>
<tr>
<td>Medication Administration:</td>
<td>Propofol doses are administered over 30 seconds (count out loud)</td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Dose:                     | 1 mg/kg with repeat doses of 0.5 mg/kg (give no more frequently than q 3 min)  
***children under 5 years may need higher doses due to the water/fat ratio and may need induction doses of 2 mg/kg |
| Reversal:                 | None                                                          |
Propofol contains eggs and soy ingredients.

**SAFETY NOTE:** The CIS allergy profile (Multum) does NOT do ingredient checking, so no alert will fire if propofol is ordered despite an allergy to eggs or soy

- Prior to ordering propofol, review CIS for allergies and verify with family
- During the Universal Protocol, follow the checklist and specifically do a final verification prior to procedure that there are no allergies to egg or soy products
Ketamine-Propofol

- Due to the side effect profiles of Ketamine and Propofol, it is thought that giving these medications in combination may produce a superior sedation effect, that combines the rapid duration and antiemetic effects of propofol, with the analgesic, hemodynamic, and airway protective properties of ketamine.
- Ketamine given prior to propofol has been shown to diminish the pain at injection site
- Although other hospitals may give ketamine-propofol combined called “ketofol”, the Institute for Safe Medication Practices does not recommend this practice as it is has led to medication errors and adverse events

SAFETY TIP: Do not call it Ketofol and administer in separate syringes
Dexmedetomidine (precedex) – analgesic, sedative, anxiolytic

- Does not cause respiratory depression
- Can cause bradycardia and hypertension
- Extensively used in ICU for invasive and non-invasive positive pressure sedation
- Studies being done to show use as solo or combination agent for procedural sedation when given as a drip or IN
Nursing Care Prior to Procedure

- Patient/Family preparation of procedure—education, coping strategies
- Monitoring equipment (depending on level of sedation)
- Pre-sedation assessment including baseline vital signs, RASS
- Medications verified
Richmond Agitation Sedation Scale (RASS)

**NOTE:** The goal is for the RASS score to match the intended level of sedation. If the patient is outside the range, nursing care depends on helping patient reach desired level.

- For example, if the intent of sedation is minimal and the patient has received midazolam intranasally, the sedation score should be 0 ranging to -2. If the score is above (2-4), additional medication or distraction may need to be used. If the score is -3 through -5, they have progressed into a deeper sedation and needs much more frequent assessment and interventions to assure the airway is maintainable.
- If the intent is moderate sedation and the patient has received IV midazolam, the sedation score should range from -2 to -3.
- If the intent is deep sedation and the patient has received ketamine or propofol, the sedation score should range from -3 to -4, but may briefly be at -5.
## RASS Score

<table>
<thead>
<tr>
<th>Score</th>
<th>Classification</th>
<th>(RASS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Combative</td>
<td>Overtly combative or violent; immediate danger to staff</td>
</tr>
<tr>
<td>3</td>
<td>Very agitated</td>
<td>Pulls on or removes tube(s) or catheter(s) or has aggressive behavior toward staff</td>
</tr>
<tr>
<td>2</td>
<td>Agitated</td>
<td>Frequent nonpurposeful movement or patient–ventilator dyssynchrony</td>
</tr>
<tr>
<td>1</td>
<td>Restless</td>
<td>Anxious or apprehensive but movements not aggressive or vigorous</td>
</tr>
<tr>
<td>0</td>
<td>Alert and calm</td>
<td></td>
</tr>
<tr>
<td>-1</td>
<td>Drowsy</td>
<td>Not fully alert, but has sustained (more than 10 seconds) awakening, with eye contact, to voice</td>
</tr>
<tr>
<td>-2</td>
<td>Light sedation</td>
<td>Briefly (less than 10 seconds) awakens with eye contact to voice</td>
</tr>
<tr>
<td>-3</td>
<td>Moderate sedation</td>
<td>Any movement (but no eye contact) to voice</td>
</tr>
<tr>
<td>-4</td>
<td>Deep sedation</td>
<td>No response to voice, but any movement to physical stimulation</td>
</tr>
<tr>
<td>-5</td>
<td>Unarousable</td>
<td>No response to voice or physical stimulation</td>
</tr>
</tbody>
</table>
Roles Established

Verify roles in the Universal Protocol:
• Sedation Provider** depending on level of sedation
• Proceduralist
• RN
• Others as needed (additional holding help, etc)
## Universal Protocol

### Pre-Procedure

<table>
<thead>
<tr>
<th>WHO</th>
<th>Challenge</th>
<th>Done By</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proceduralist</td>
<td>Introductions</td>
<td>Team</td>
<td>First and last name, role</td>
</tr>
<tr>
<td>Proceduralist</td>
<td>“Patient ID”. Reads name and MR of ID band</td>
<td>RN/tech</td>
<td>Compares it to CIS</td>
</tr>
<tr>
<td>RN/tech</td>
<td>“Procedure?”</td>
<td>Proceduralist</td>
<td>States Procedure</td>
</tr>
<tr>
<td>RN/tech</td>
<td>“Sedation?”</td>
<td>Proceduralist</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>RN/tech</td>
<td>“Sedation Form completed?”</td>
<td>Proceduralist</td>
<td>Completed/NA</td>
</tr>
<tr>
<td>RN/tech</td>
<td>“Site?”</td>
<td>Proceduralist</td>
<td>Verifies Site/NA</td>
</tr>
<tr>
<td>Proceduralist</td>
<td>“Suction, oxygen, supplies Ready?”</td>
<td>RN/tech</td>
<td>Yes/Hold</td>
</tr>
<tr>
<td>Proceduralist</td>
<td>“Allergies?”</td>
<td>RN/tech</td>
<td>No/Yes Specify</td>
</tr>
<tr>
<td>Family</td>
<td>Family Questions?</td>
<td>Family</td>
<td>No/Yes Specify</td>
</tr>
<tr>
<td>Team</td>
<td>Team Concerns?</td>
<td>Team</td>
<td>No/Yes Specify</td>
</tr>
</tbody>
</table>
Airway Assessment and Management

Given that we anticipate patients to have some respiratory depression and relaxation of support muscles, there are some essential care techniques that must be utilized when necessary:

1. Capnography
2. Maintenance of proper airway alignment
3. Assessment of airway status and ventilation
4. Jaw thrust
5. Insertion of an airway adjunct
6. Ventilation support using bag valve mask
Capnography – the 7th vital sign (after pain)
Capnography

- Measures end tidal carbon dioxide exhalation
- Provides very early detection in changes in ventilation, long before oximetry changes
- Oximetry measures oxygenation; capnography measures ventilation
Capnography Waveforms

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Waveform</th>
<th>Features</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td><img src="image" alt="Graph" /></td>
<td>SpO2 Normal, EtCO2 Normal, Waveform Normal, RR Normal</td>
<td>No intervention required</td>
</tr>
<tr>
<td>Hyper-ventilation</td>
<td><img src="image" alt="Graph" /></td>
<td>SpO2 Normal, EtCO2 ↓, Waveform Decreased amplitude and width, RR ↑</td>
<td>Continue sedation</td>
</tr>
<tr>
<td>Bradypneic Hypo-ventilation (Type 1)</td>
<td><img src="image" alt="Graph" /></td>
<td>SpO2 ↓, EtCO2 ↑, Waveform Increased amplitude and width, RR ↓↓</td>
<td>Reassess patient, Continue sedation</td>
</tr>
<tr>
<td>Hypopneic Hypo-ventilation (Type 2)</td>
<td><img src="image" alt="Graph" /></td>
<td>SpO2 ↓, EtCO2 ↓, Waveform Decreased amplitude, RR ↓</td>
<td>Reassess patient, Continue sedation</td>
</tr>
<tr>
<td>Hypopneic Hypo-ventilation with periodic breathing</td>
<td><img src="image" alt="Graph" /></td>
<td>SpO2 Normal or ↓, EtCO2 ↓, Waveform Decreased amplitude, RR ↓, Other Apneic pauses</td>
<td>Reassess patient, Assess for airway obstruction, Supplemental oxygen, Cease drug administration or reduce dosing</td>
</tr>
</tbody>
</table>
1. Use capnography to assess ventilation status
   a. Pre-oxygenation is going decrease the chance of desaturation if hypoventilating, but capnography waveforms will rapidly detect changes in ventilatory status
   b. ETCO2 measures end tidal pulmonary exhaled CO2
      i. If a patient is taking shallow breaths, they may be rebreathing the CO2 so their reading may appear low ex. 15 mmHg
      ii. ** to detect hypoventilation, waveforms must be interpreted
1. Verify that the patient is positioned in “sniffing position”
   a. Depending on the size of child, this may mean that a roll be placed under the shoulders (in a younger child), or under the head (in an older child) to assist with proper alignment which places the external ear canal anterior to the shoulder

2. Extend the atlanto-occipital joint to align the 3 planes: oral axis, nasopharyngeal axis, and tracheal axis
Figure 7. Correct positioning of the child more than 2 years of age for ventilation and tracheal intubation. **A,** With the patient on a flat surface (eg, bed or table), the oral (O), pharyngeal (P) and tracheal (T) axes pass through three divergent planes. **B,** A folded sheet or towel placed under the occiput aligns the pharyngeal and tracheal axes. **C,** Extension of the atlanto-occipital joint results in the alignment of the oral, pharyngeal, and tracheal axes. Note that proper positioning places the external ear canal anterior to the shoulder. **D,** Incorrect position with neck flexion. **E,** Correct positions for infant. Note that the external ear canal is anterior to the shoulder. Reproduced with permission from Coté and Todres.
Assess Patency of Airway and Adequacy of Ventilation

Throughout the procedural sedation, assess:

- Visible chest rise with each breath
- Capnography waveform and reading
- Presence of audible airway sounds (snoring or obstructive noises)
- Oxygen saturation (may be sustained with mild hypoventilation or obstruction due to pre-oxygenation)
- Respiratory rate and depth
- Presence of retractions
- Heart rate, Blood pressure
Jaw Thrust

• If an airway obstruction is suspected, use a jaw thrust to open the airway and lift the tongue from occluding the airway
• To effectively perform a jaw thrust, use the fingers to lift the mandible and the thumbs to open the mouth
Oral Pharyngeal Airway (OPA)

- Only for use in UNCONSCIOUS patient with no intact cough/gag reflex

**SAFETY NOTE:** Given that patients will arouse promptly, they are at risk for vomiting and aspiration if an OPA is used

- Holds tongue and soft hypopharyngeal structures away from posterior pharynx
- Measure from tip of mouth to base of mandible
- Place using a tongue depressor
- Never tape in place
Nasal Pharyngeal Airway (NPA)

- Provides unobstructed path for airflow between nares and pharynx
- Can use in conscious/semi-conscious patient
- Small internal diameter so must be evaluated frequently and suctioned prn to maintain patency
- Measure from nares to tragus of external ear
- Insert using water soluble lubricant with bevel facing towards nasal septum
Bag Valve Mask Ventilation

- If patient becomes hypoxemic below 90% despite adequate airway patency and providing tactile stimulation, provide bag valve mask ventilation
  - Open airway and seal mask to face using E-C technique
  - Assess quality of ventilation as you may need an NPA or OPA
  - If it is difficult to get a seal, use 2 people to assist:
    - Ventilate at a rate of 1 ventilation per 5 seconds
Post Procedure Monitoring

- Prior to the Provider leaving the room, a post procedure Universal Protocol will be done to determine the next steps in the plan of care.
- Upon completion of the procedure, vital signs will be completed every 15 minutes until patient returns to baseline.

### POST-PROCEDURE

<table>
<thead>
<tr>
<th>WHO</th>
<th>CHALLENGE</th>
<th>DONE BY</th>
<th>RESPONSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proceduralist</td>
<td>“Ready for post-procedure checklist?”</td>
<td>Anyone not ready</td>
<td>Delay until ready</td>
</tr>
<tr>
<td></td>
<td>“Specimens labeled?”</td>
<td>RN/ tech</td>
<td>Label, sent, instructions/NA</td>
</tr>
<tr>
<td></td>
<td>“Plan for Family update”</td>
<td>RN/ tech</td>
<td>Location and will retrieve</td>
</tr>
<tr>
<td>RN/ tech</td>
<td>“Wound or Cast Care?”</td>
<td>Proceduralist</td>
<td>Not indicated/Yes Specify</td>
</tr>
<tr>
<td></td>
<td>“Immediate Care Plan?”</td>
<td></td>
<td>Specify next steps</td>
</tr>
</tbody>
</table>
Prior to discharge, the patient should be assessed that they have returned to baseline using these assessment criteria:

- Airway and cardiovascular status within normal limits
- Easily arousable
- Protective reflexes intact
- Baseline level of communication
- Age appropriate behaviors
- Can sit up unaided or at baseline
- Adequate hydration and can tolerate oral fluids
Nitrous Oxide Use in Pediatric Emergency Departments

- Usage in pediatric centers has continued to rise since early 2000
- Used primarily in Interventional Radiology and ED’s
- Has been used for procedural sedation for:
  - PIV placement
  - Bladder catheterization
  - Radiological studies
  - Laceration repair
  - Incision and drainage
  - Joint tap
  - Fracture reduction
  - LP

- Used as a solo agent for anxiolysis when intent is minimal sedation
- Combined with other agents when intent is moderate sedation
Physical Properties of Nitrous Oxide

- Mildly sweet smelling colorless gas
- Nonflammable, but can support combustion
- Oxygen does not separate from nitrogen so is not available as an oxygen source so must be given with 02
- When compressed into a cylinder, it becomes a liquid
- Will rapidly replace nitrogen in trapped air spaces in body if present and will expand 30 times the space that Nitrogen held

SAFETY POINT: Do not administer N2O with patients with trapped gas
Mechanism of Action of Nitrous Oxide

- Nitrous oxide is mostly insoluble and does not disassociate in blood.
- Nitrous oxide reaches equilibrium in the tissues relatively rapidly, but has a low potency compared to other inhaled gases like sevoflurane or isoflurane.
- Half life is 5 minutes.
- Onset of action is 2-5 minutes.
- N20 is not metabolized in the lungs so is excreted almost unchanged.
  - Very slight (less than 0.05%) is metabolized in the GI tract.

SAFETY POINT: N20 needs to be removed from air (scavenged) to prevent other’s from inhaling it while in the room.
Effects of Nitrous Oxide – Neurological, Cardiac and Respiratory System

N2O interaction with brain neurotransmitters is felt to result in minimal-moderate analgesia, sedation, amnesia, anxiolysis, euphoria, and spacial disorientation.

<table>
<thead>
<tr>
<th>Effects of Nitrous Oxide on Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neurological</td>
</tr>
<tr>
<td>• Headache, seizures (very infrequent)</td>
</tr>
<tr>
<td>Cardiac</td>
</tr>
<tr>
<td>• No effect on cardiac output but may decrease blood pressure if elevated from anxiety</td>
</tr>
<tr>
<td>Respiratory</td>
</tr>
<tr>
<td>• Silent aspiration if patient moved into unconscious deep state (rare), hypoventilation (when combined with other agents that depress ventilation)</td>
</tr>
<tr>
<td>o If nitrous oxide is stopped abruptly without giving oxygen, the patient can have diffusion hypoxia (rare)</td>
</tr>
</tbody>
</table>

**SAFETY POINT:** Oxygen will be given for 3-5 minutes following discontinuation of nitrous oxide
Fear and pain are very closely related, and often expressed as single emotion for children.

Children may not have the words to discern between pain and fear.

There is no validated tool to use of anxiety as a patient selection tool for nitrous oxide.

Although nitrous oxide can provide excellent anxiolytics, the administration via a mask can be fearful and not lend itself to a positive experience for the patient.

If the intended sedation level is moderate or deep, nitrous oxide as a solo agent will not provide those benefits.

**KEY POINT:** N20 is not ideal for everyone and patient ideally needs to be able to cooperate and listen to a guided voice to respond; too anxious or too fearful of mask will not likely give good results.
Nitrous Oxide Availability

• Nitrous Oxide can be given in any room provided there is suction available for scavenging
• Rooms 24, 49, 50 have nitrous oxide plumbed into wall outlet; other rooms will use the nitrous supplied in the cylinders
• All rooms will use the oxygen and suction supplied in the wall
• The Nitrous Oxide administration cart can be utilized regardless of room the patient is in
Exclusions for Nitrous Oxide

Absolute:
- Trapped gas in enclosed spaces
- History of Bleomycin administration
- MTHFR gene
- First trimester pregnancy
- B12 deficiency (vegans not routinely excluded)
- Greater than ASA 2

Consider:
- Psychiatric disorders
- Under 3 years given mask may be very frightening
### Administration Processes: Roles

<table>
<thead>
<tr>
<th>Roles</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proceduralist</td>
<td>This is the person doing the procedure</td>
</tr>
<tr>
<td>Operator</td>
<td>This is the RN who delivers the N20</td>
</tr>
<tr>
<td>Sedationist</td>
<td>This is the person who assesses the patient for level of sedation, response, titration (includes side effects and overall assessments)</td>
</tr>
<tr>
<td></td>
<td>• For minimal sedation with N20 - this will also be operator</td>
</tr>
<tr>
<td></td>
<td>• For moderate sedation with N20 - this will be the Attending/Fellow</td>
</tr>
</tbody>
</table>
Nitrous Oxide Concentration

• The circuit is able to deliver 30-70% N20 with oxygen
• Generally, 30-50% is minimal sedation and 50-70% is moderate sedation but it is patient dependent
• Combination of other medications (opioids, benzodiapenes) with nitrous within active duration times will yield moderate sedation and will need an ED Attending/Fellow present in the room to assess patient
• For ED sedation, the Nitrous Oxide limit will be 45 minutes
Scavenging System

- Nitrous oxide is exhaled almost in its complete form
- The circuit will be connected to the vacuum outlets so all exhaled gas can be removed
- Masks will be used to ensure that complete scavenging is done
- When in use, ensure that there is a good mask seal to patient

**SAFETY POINT:** The whistling noise of scavenging system must be heard during the procedure to ensure effective scavenging
Optimal Sedation With Nitrous Oxide

Psychological signs:
• Patient appears relaxed and comfortable
• Emotions may appear as happy, content, not fearful

Physical signs:
• Arms and legs relax onto bed - they may say feel “heavy”
• Eyes look glassy and blink rate is slower
• Body appears more relaxed, shoulders drop
• May smile, be content, or laugh
• May describe tingling in fingers, toes, cheek, tongue but not always
• May describe warmth
• May describe like they are floating

**KEY POINT:** In general, 30-50% Nitrous oxide provides minimal sedation, 51-70% provides moderate sedation but could extend into deep
Over-sedation With Nitrous Oxide

- Patient becomes restless and moves frequently
- Relaxed state has disappeared
- Fearful of dreams - hallucinating
- Excessive sleepiness or unconscious
- Combative
- Vomiting
- Feeling too hot
- Difficulty hearing

**KEY POINT:** If patient reached optimal sedation but is now restless, consider over-sedation and lower N20 concentration
Workflow in ED

• WA state scope of practice allows RN to deliver N20
• In ED, Attending's or Fellows will review eligibility and order (assess and review exclusion criteria)
• Trained ED RN will administer N20 during procedure
• Monitoring for minimal (in ED) is oxygen saturation and pulse rate
• If intent is moderate sedation, ED Attending or Fellow needs to be present and full monitors are present
Future State!!

- Dr. Eliot Grigg is lead of Sedation Committee
- Actively working to develop options to provide more procedural sedation options for inpatients!!
Summary

- Procedural sedation should be considered for patients undergoing procedures where there is pain, emotional trauma, or excessive movement that could interfere with procedure.
- Sedation medications are chosen based on intended level of sedation.
- Credentialing, equipment and training need to be considered.
- Nursing care of a patient for procedural sedation requires the art and science of nursing!
References

https://emedicine.medscape.com/article/804045-overview
