

Procedural Sedation & Analgesia

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Levels of Sedation

- **Minimal sedation**

- Minimal anxiolysis or analgesia, airway reflexes and cardiovascular function maintained, respond normally to verbal commands
- Example: midazolam alone

- **Moderate sedation**

- Purposeful response to verbal commands or light touch, airway reflexes maintained, cardiovascular function usually maintained
- Example: nitrous oxide

- **Dissociative sedation**

- Ketamine

- **Deep sedation**

- Cannot be aroused easily but responds to repeated or painful stimuli, ventilation may be impaired, cardiovascular function usually maintained
- Example: propofol, opiate+benzo, etomidate

- **General anesthesia**

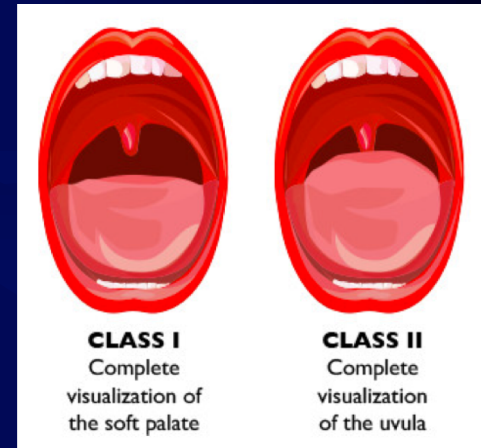
- Unconscious, patient not arousable, usually impaired ventilation, may have impaired cardiovascular function
- Example: too much propofol, opiate+benzo; inhaled anesthetic

Don't
do this
in ED

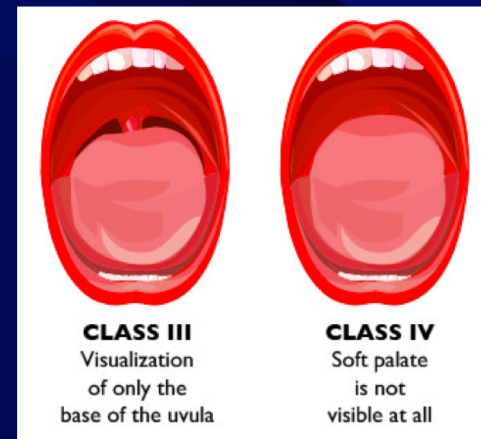


Pre-Sedation Assessment: H&P

- Symptoms (eg cold, active asthma)
- Allergies to any medications, current Meds
- Past medical history, past sedations / reactions
- Last meal (solid and liquid) and timing
- Event leading to need for sedation
- Vital signs, weight
- Upper airway assessment for difficult airway: mouth opening, loose teeth, braces, mandible hypoplasia, neck flexion
 - Mallampati often used in adults, not very helpful for kids



Mallampati Score



ASA Classification

ASA PHYSICAL STATUS CLASSIFICATION

ASA physical status	I	II	III	IV	V	VI
Definition	"Healthy"	"Mild systemic disease"	"Severe systemic disease but not incapacitating"	"Incapacitating disease"	"Dying"	"Declared brain death"
Age	> 3 months to < 65 years	≤ 3 months or ≥ 65 to 84 years	≤ 1 month preterm NB or ≥ 85 years			
Functional capacity; walk up 1 flight of stair or 200 m. on the level	Complete without distress	Rest at completion because of distress	Stop en route because of distress	Unable to do		
Medical status	No organic, physiologic, or psychiatric disturbance	Single/multiple systemic disease(s) with good control No functional limitations or vital organ involvement	Poorly controlled systemic disease(s) Some functional limitations No immediate life threatening condition	Poorly controlled systemic disease(s) Significant functional limitation Constant potential threat to life	End stage disease(s) and not expected to survive within 24 hours	Clinically dead patients awaiting organ harvest
Mortality rate (%)	0.06 – 0.08	0.27 – 0.4	1.8 – 4.3	7.8 – 23	9.4 – 51	
Emergency status	In addition to indicating ASA physical status, any patient undergoing an emergency operation is indicated by the suffix "E", e.g., ASA III E					

Fasting

Guidelines

- ASA says: 2 hours for clear liquids, 4 hours for breast milk, 6 hours for solids, cow's milk, and infant formula
 - But this is healthy children, elective procedures
- ACEP says: Recent food intake is not a contraindication for administering procedural sedation and analgesia, but should be considered in choosing the timing and target level of sedation

Clinical practice advisory

- Step 1: Assess patient risk
 - High risk patients
 - Likely airway difficulty
 - Predisposed to GER (eg hiatal hernia, TEF, PUD, incr ICP, ileus, etc)
 - Extremes of age (<6mo, >70yo)
 - MD judgement
 - Standard risk patients
- Step 2: Assess timing and nature of recent oral intake
 - Make NPO NOW!
- Step 3: Assess urgency of procedure
- Step 4: Balance to select depth, duration

Standard Risk Patients

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

Brief: < 10 minutes

Intermediate: 10-20 minutes

Extended: > 20 minutes

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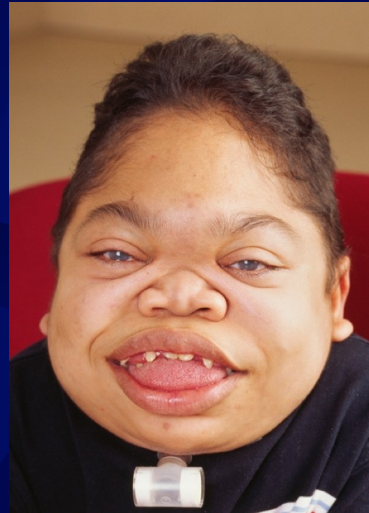
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Extended: > 20 minutes

Special Needs: Difficult Airways



Apert, boneandspine.com



Mucopolysaccharidosis,
www.gfmer.ch



Pierre-Robin,
myhealthfeeling.com

Special Needs

Sacchetti A, et al: Procedural Sedation for Children with Special Health Care Needs. *Pediatr Emerg Care* 2003;19:231-239

- Neurologic / developmental delay
 - May already be on benzos, barbs – give usual dose early, or higher dose
 - Beware when giving flumazenil – could precipitate seizures
- Psychiatric
 - Careful with ketamine if history of hallucinations, schizophrenia
- Respiratory disorders
 - Beware of medications with propensity toward respiratory depression
 - Ketamine is bronchodilating
 - Generic propofol has high concentrations of sulfites – may precipitate bronchospasm

Special Needs

- Heme-Onc
 - Anemia (incl sickle cell) – low threshold for supplementary oxygen
 - G6PD: only sedation/analgesia agents reported to cause hemolysis are acetaminophen, ASA
- Cardiovascular
 - Least hypotension: ketamine, etomidate, fentanyl
 - Cyanotic CHD, univentricular lesions high risk
- Endocrine / Metabolic
 - Diabetics, IEM: extended propofol = large caloric load
 - Avoid etomidate in disorders of HPA axis
 - Avoid barbiturates, ketamine in porphyria
- Oropharyngeal procedures – higher risk of laryngospasm

Special Needs

- General principles
- Talk to the subspecialist, anesthesiology
- Do a literature search / internet search on that syndrome and sedation for case reports
- Prepare for anticipated difficult airway
 - Alternatives, eg LMA, video laryngoscopy
 - Consider asking for anesthesia backup
- Sometimes the O.R. is the best place for a procedure to be done (stand your ground)
- Butler MG, et al: Specific genetic diseases at risk for sedation/anesthesia complications. *Anesth Analg* 2000;91:837-855

Drug choices for pediatric procedural sedation

- Simple analgesia
 - NSAIDs
 - Opiates (incl. PO, IN)
- Anxiolysis
 - Benzodiazepine
 - Don't forget PO or IN
- Painless (eg imaging)
 - Benzodiazepine
 - Barbiturate
 - (Chloral hydrate)
- Minimal pain / short
 - Local/Topical +/- anxiolysis
 - Nitrous oxide
 - Etomidate + analgesic
- Moderate pain / long or immobility required
 - (Opiate + benzo)
 - Ketamine
 - Propofol + analgesic
 - Ketofol

Analgesia & Anxiolysis

- Acetaminophen 15 mg/kg PO, PR (maximum 650 mg)
- Ibuprofen 10 mg/kg PO (ceiling effect for analgesia at 400 mg)
- Hydrocodone 0.05-0.2 mg/kg
 - Often mixed with acetaminophen, hydrocodone usually 2.5 mg / 5mL
- Oxycodone 0.05-0.2 mg/kg
 - Oral solution available in 5mg / 5mL and 20mg / mL
- Fentanyl
 - Intranasal 0.1-0.15 mg/kg
 - 1 mcg/kg IV
- Morphine
 - Oral 0.3 mg/kg (adult 10-20mg)
 - IV 0.1 mg/kg (adult 3-5mg)
- Hydromorphone 0.015 mg/kg IV (adult 1 mg)
- Midazolam anxiolytic only
 - Intranasal 0.2-0.3 mg/kg (max 1mL per nostril, max 10mg)
 - Oral 0.5 mg/kg, max 20mg

EMNote American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

Codeine: Time To Say “No”

Joseph D. Tobias, MD, Thomas P. Green, MD, Charles J. Coté, MD, SECTION ON ANESTHESIOLOGY AND PAIN MEDICINE, COMMITTEE ON DRUGS

Codeine → CYP2D6 (liver enzyme) → **Morphine**
Inactive prodrug → Active metabolite

1. Codeine **should not be prescribed** to children
2. Codeine may cause unanticipated respiratory depressions and deaths in children who are **ultrarapid metabolizers**

Pediatrics. 2016;138(4):e20162396 @jackcfchong

Nitrous Oxide

Use

- Inhaled, 50% NO, 50% O₂ most common (up to 70/30)
- Scavenger system needed
- May help to flavor mask
- Rapid onset / offset 3-5 minutes
- Amnestic, anxiolytic, analgesic, euphoric
- Moderate sedation only
- Adverse effects uncommon
 - Nausea / vomiting, dizziness
 - Minimal respiratory or cardiovascular effects
 - Rare seizures, MI, neuropathy
- Wash out with 100% O₂ after

Contraindications

- Increased air pressure
 - Pneumothorax
 - Bowel obstruction
 - Otitis media
 - Pulmonary blebs
 - Air embolism
 - Intraocular gas bubble
 - Increased ICP condition
- Respiratory compromise / hypoxia
 - Pulmonary hypertension
- Pregnancy
- Vitamin B12 deficiency



Etomidate

Uses

- No analgesia, + amnesia
- Minimal cardiovascular effects
- Dose 0.2 mg/kg IV for PSA
- Rapid onset / offset
 - Peak effect one minute
 - Duration 2-15 minutes
 - Redose 0.1 mg/kg prn
- Contraindicated in sepsis

Adverse effects

- Myoclonus
 - May interfere with procedure
- Adrenal corticosteroid synthesis suppression for 24 hours or more
- O₂ desaturation
- Emesis
- Hiccups
- Pain with injection

Ketamine

- Anxiolytic, analgesic, and amnestic
- Airway reflexes maintained
 - Relatively SAFE
 - Fasting probably not necessary
- Almost always effective
- Dissociative = on/off, so no titration
- 3 concentrations
 - 10 mg/mL (IV)
 - 50 mg/mL (IV and IM)
 - 100 mg/mL (IM)
- IV: 1 to 1.5 mg/kg initial bolus
 - 0.5-1 mg/kg additional boluses as needed
 - Give SLOWLY over a full minute
- IM: 4-5 mg/kg
- Preparation : tell the parent
 - Child's eyes may remain open
 - Child may vocalize some
 - Child will not remember procedure
- Preparation: tell the child
 - Try to think of something positive to have good dreams

Ketamine IV versus IM

- IM avoids cost, time, and discomfort of IV access
- RN needs to feel comfortable could get IV access if needed
- 5-10 minutes to onset, duration 20-30 minutes
- 20 minutes longer than IV for recovery
 - Time takes to place IV may balance out
- IM may cause more adverse events
- Children anxious about a “shot” may have an “unpleasant” dissociation (bad trip)
- IV better for lengthy procedures
- IV better for adults / those likely to need adjunctive benzodiazepine
- Immediate onset, duration 10-15 minutes
- IV available in case of rare AE requiring IV med

Ketamine

Contraindications

- Absolute
 - Less than 3 months old
 - Psychotic or h/o psychosis
- Relative
 - Major post pharynx procedure
 - History of airway instability, tracheal surgery, stenosis
 - Active pulm disease, including URI, asthma
 - Known or suspected cardiovascular disease
 - CNS masses or hydrocephalus (but not just head trauma)
 - Glaucoma, acute globe injury
 - Porphyria, thyroid disorder/med

Ketamine Effects

- Laryngospasm 0.3%
- Respiratory depression / apnea 0.8%
- Transient fall in pulse oximetry 1-2%
 - Jaw thrust
- Emesis 7-8%
 - Often during recovery or at home
 - Reduced with Ondansetron
- Emergence reactions 9-20%
 - May be pleasant
 - 2 RCTs: not reduced with prophylactic benzo in kids
- Nystagmus
- Hypersalivation 1.7%
- Sympathomimetic
- Increased IOP, ICP?
- Transient rash

Propofol

- Sedative-hypnotic unrelated to other drugs, NO analgesia nor amnesia
 - Often given with fentanyl for analgesia
- Rapid onset and offset = good for ED flow
- Pain on injection: give lidocaine 0.5 mg/kg IV 30-120 seconds prior to propofol or in same syringe
- Initial bolus 1 mg/kg IV slow, add 0.5 mg/kg every 3 minutes prn
- Contraindications: allergy to soybean oil, egg yolk, glycerol, disodium edetate, hypovolemia / hypotension, difficult airway anticipated
- Adverse effects:
 - Apnea – brief BVM needed in 3-9% of patients
 - O2 desaturation up to 40%
 - Laryngospasm 0.11%
 - Hypotension: treat with fluid boluses
 - Bacterial contamination of lipid emulsion (rare)
 - Rare propofol infusion syndrome

Adjuncts: Restraint, Distraction, Comforting Position with Parent

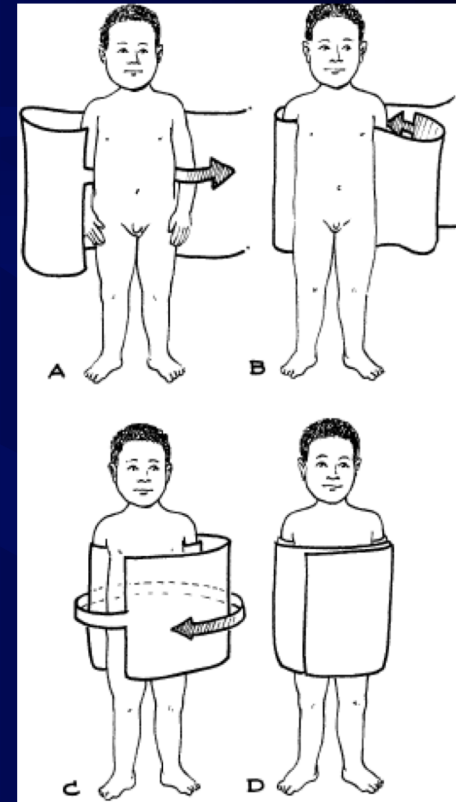
Age appropriate distraction

Infant: pacifier, sucrose, toys, bubbles

Toddler: bubbles, songs, pop-up books, videos

School-age: videos, video games, search for objects in pictures, stories, jokes

Adolescent: music, video games



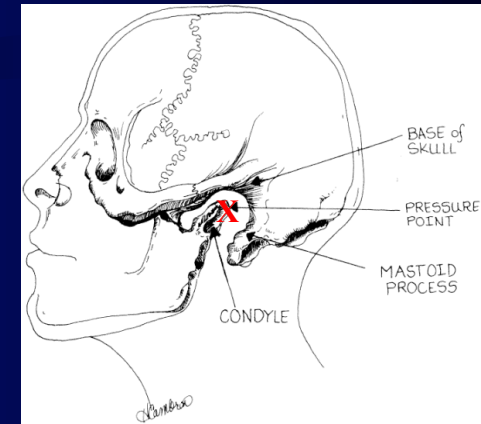
apps.who.int

Procedure

- Obtain informed consent
- Gather equipment:
 - Suction hooked up & turned on
 - BVM with proper sized mask and attached to O2
 - Intubation tray nearby, appropriate sized equipment selected
 - Videolaryngoscope and other airway adjuncts (OPA, NPA, LMA) nearby
 - Preoxygenation method (nasal canula, through ETCO2 canula)
 - Check that all equipment is functioning yourself
- Monitoring
 - Attach to pulse oximetry
 - Attach to ETCO2
 - Attach to cardiorespiratory monitor
 - Periodic vital signs
 - Look for chest rise
- Perform a Time Out: right patient, right procedure, right dose



Laryngospasm notch



Complications

- Respiratory depression
 - Recognize: Pulse oximetry (without supplemental oxygen), Capnography, Chest rise
 - Manage: Open airway (jaw thrust), Suction prn, Airway adjuncts, BVM, Reversal agents if indicated
- Laryngospasm
 - Recognize: Stridor, struggle to breathe / no chest rise
 - Manage: Bag through it, Succinylcholine and intubate, Lidocaine 1-1.5 mg/kg IV suggested by some, Laryngospasm notch pressure (inward and anterior)
- Cardiovascular
 - Hypotension: generally fluid responsive
 - Ketamine: expect increase in BP, HR
- Paradoxical excitation: treat with benzodiazepines, diphenhydramine
- Chest wall rigidity with fentanyl: paralyze and BVM / intubate
- Seizures: treat as for any other seizure

Discharge Instructions

- Observe patient closely for first few hours, especially after respiratory depressant
 - When noxious stimulus of procedure removed, respiratory depression more likely
 - Make sure child not obstructing airway from carseat position
 - If reversal agent given, keep longer in ED for observation
- Child may vomit on the way home or once at home
 - Take it slow with oral intake
 - Start with clear liquids
 - Avoid heavy, fatty meal
- Child is a little “borracho”
 - No driving, biking, scootering, skateboarding, other activities that require balance



www.car-seat.org

Procedural Pain Management

All patients: age-appropriate explanation, avoid delays between telling patient about procedure and performing it, give illusion of choice, position patient in comforting restraint w/parent or caretaker (but not held down by parent)
Parents & providers: avoid criticism, apology, reassurance, buzz words eg hurt, shot, sting, burn, pain
Discuss with parent **distraction** methods to use during procedure: books, videos, games, bubbles, party blowers, etc.

Pretreatment & Adjuncts – use liberally in all patients

Minor painful procedure: **oral analgesic** (acetaminophen, ibuprofen, oral opiate), **intranasal fentanyl** 1.5 mcg/kg

Anxiety: **Midazolam intranasal** 0.3mg/kg (max 20mg) 5' before **or PO** 0.5mg/kg (max 20mg) 20' before

Laceration: topical **LET** (30') **Needle procedure:** **EMLA** (60') **or LMX** (30') **Neonate/infant:** **oral sucrose** & pacifier during

IV, Venipuncture, IM shot, Fingerstick
Use ultrasound or vein transilluminator, **counterpressure** (rub surrounding skin), J-tip **subQ lidocaine**, **vapocoolant / cold**

Urethral catheterization:
check bladder full with ultrasound, **viscous lidocaine** at urethra
NGT placement:
nebulized lidocaine

Suturing, Abscess I & D, Lumbar puncture, Central line
Injected local anesthetic (buffer, warm, use small gauge needle to inject, inject slowly, counter-irritate surrounding skin to decrease injection pain)
Nitrous oxide if available

Very painful or invasive procedure:
eg fracture /dislocation reduction, chest tube
Procedural sedation dep on provider experience & training: Ketamine, Propofol, Fentanyl & Versed

Summary

- Perform a pre-sedation assessment
- Select your drug(s) based on procedural needs
- Get informed consent
- Set up equipment and monitoring ahead of time
- Anticipate common complications
- Give discharge instructions (& document)