

A POTPOURRI OF VALUABLE TABLES, HINTS, INFORMATION & FACTS

From reference:

Non-Operating Room Anesthesia

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Table 7-1 American Society of Anesthesiologists Definitions of General Anesthesia and Levels of Sedation and Analgesia

Evaluation Factors	Minimal Sedation (Anxiolysis)	Moderate Sedation/Analgesia ("Conscious Sedation")	Deep Sedation/Analgesia
Responsiveness	Normal response to verbal stimulation	Purposeful* response to verbal or tactile stimulation	Purposeful response* following repeated or painful stimulation
Airway	Unaffected	No intervention required	Intervention may be required
Spontaneous ventilation	Unaffected	Adequate	May be inadequate
Cardiovascular function	Unaffected	Usually maintained	Usually maintained

*Reflex withdrawal from a painful stimulus is *not* considered a purposeful response.

From American Society of Anesthesiologists. *ASA standards, guidelines and statements*, October 2007. <http://www.asahq.org/publications/p-106-asa-standards-guidelines-and-statements.aspx>.

Table 6-1 Continuum of Depth of Sedation: Definition of General Anesthesia and Levels of Sedation/Analgesia

	Minimal Sedation (Anxiolysis)	Moderate Sedation/Analgesia ("Conscious Sedation")	Deep Sedation/Analgesia	General Anesthesia
Responsiveness	Normal response to verbal stimulation	Purposeful response to verbal or tactile stimulation	Purposeful response following repeated or painful stimulation	Unarousable even with painful stimulation
Airway	Unaffected	No intervention required	Intervention may be required	Intervention often required
Spontaneous ventilation	Unaffected	Adequate	May be inadequate	Frequently inadequate
Cardiovascular function	Unaffected	Usually maintained	Usually maintained	May be impaired

From American Society of Anesthesiologists. *Continuum of depth of sedation: definition of general anesthesia and levels of sedation/analgesia—standards, guidelines and statements*. Park Ridge, Ill: American Society of Anesthesiologists; 2009.

Table 6-2 American Society of Anesthesiologists Physical Status Classification System

ASA 1	Healthy
ASA 2	Mild systemic disease
ASA 3	Severe systemic disease
ASA 4	Severe systemic disease that is a constant threat to life
ASA 5	Moribund and not expected to survive
ASA 6	Brain dead; organ donor

Modified from American Society of Anesthesiologists. *Physical Status Classification System*. Park Ridge, Ill: American Society of Anesthesiologists. ASA, American Society of Anesthesiologists.

Table 7-2 Ramsay Sedation Scale

Score	Response
1	Anxious, restless, or both
2	Cooperative, oriented, and tranquil
3	Responding to commands
4	Brisk response to light glabellar tap or loud auditory stimulus
5	Sluggish response to light glabellar tap or loud auditory stimulus
6	No response to stimulus

From Ramsay MA, Savege TM, Simpson BR, Goodwin R. Controlled sedation with alphaxalone-alphadolone. *Br Med J.* 1974;2(5920):656-659.

Table 7-3 Modified Observer's Assessment of Alertness/
Sedation Scale

Responsiveness	Score
Agitated	6
Responds readily to name spoken in normal tone (alert)	5
Lethargic response to name spoken in normal tone	4
Responds only after name is called loudly and/or repeatedly	3
Responds only after mild prodding or shaking	2
Does not respond to mild prodding or shaking	1

From Cohen LB, DeLegge MH, Aisenberg J, et al. AGA Institute review of endoscopic sedation. *Gastroenterology*. 2007;133(2):675-701.

Table 7-4 Propofol and/or Remifentanyl Sedation Doses

Drug	TIVA (Propofol: mg/kg/hr; Remifentanyl: mcg/kg/min)	TCI* (Propofol: mcg/mL; Remifentanyl: ng/mL)
Spontaneous respiration		
Propofol (alone)	2-4	1-2
Remifentanyl (alone)	0.1-0.15	2.5-3.5
Laryngeal mask		
Propofol (alone)	4-5	1.8-2.5
Remifentanyl (assisted/controlled ventilation) (alone)	0.2-0.5	4-12
Spontaneous respiration (combination)		
Propofol + remifentanyl	1-3 +0.05-0.1	0.5-1.5 +1-2.5
Controlled ventilation (combination)		
Propofol + remifentanyl	4-5 +0.2-0.5	1.8-2.5 +4-12

TCI, Target-controlled infusion; *TIVA*, total intravenous anesthesia.

*The TCI propofol doses are for the modified (Struys) Marsh effect site model. For the Schnider model the targets should be approximately 25% higher, initially, then down to the levels in Table 7-4 after 10-15 minutes.

Table 7-5 Modified Aldrete Scoring System

Activity	Score
Able to move four extremities voluntarily on command	2
Able to move two extremities voluntarily on command	1
Able to move no extremities voluntarily on command	0
RESPIRATION	
Able to breathe deeply and cough freely	2
Dyspnea or limited breathing	1
Apneic	0
CIRCULATION	
BP \pm 20% of preanesthetic level	2
BP \pm 20%-49% of preanesthetic level	1
BP \pm 50% of preanesthetic level	0
PULSE RATE	
Pulse \pm 20 beats of premedation rate	2
Pulse \pm 50 to 21 beats of premedation rate	1
Pulse $>$ \pm 51 beats of premedation rate	0
CONSCIOUSNESS	
Fully awake	2
Arousable on calling	1
Not responding	0
OXYGEN SATURATION	
Maintains baseline saturation on room air	2
Needs O ₂ to maintain $>$ 90% saturation	1
O ₂ saturation $<$ 90% with O ₂ supplement	0

Table 7-6 Post-Anesthetic Discharge Scoring System

Vital signs: Vital signs must be stable and consistent with age and preoperative baseline	
BP and pulse within 20% of preoperative baseline	2
BP and pulse 20%-40% of preoperative baseline	1
BP and pulse >40% of preoperative baseline	0
Activity level: Patient must be able to ambulate at preoperative level	
Steady gait, no dizziness, or meets preoperative level	2
Requires assistance	1
Unable to ambulate	0
Nausea and vomiting: The patient should have minimal nausea and vomiting before discharge	
Minimal: Successfully treated with PO medication	2
Moderate: Successfully treated with IM medication	1
Severe: Continues after repeated treatment	0
Pain:	
The patient should have minimal or no pain before discharge	
The level of pain that the patient has should be acceptable to the patient	
Pain should be controllable by oral analgesics	
The location, type, and intensity of pain should be consistent with anticipated postoperative discomfort	
Acceptability:	
Yes	2
No	1
Surgical bleeding: Postoperative bleeding should be consistent with expected blood loss for the procedure	
Minimal: Does not require dressing change	2
Moderate: Up to two dressing changes required	1
Severe: More than three dressing changes required	0

(Please check YES or NO and circle specific problems)	YES	NO
5. Have you taken steroids (prednisone or cortisone) in the last year?	<input type="checkbox"/>	<input type="checkbox"/>
6. Have you <u>ever</u> smoked? (Quantify in _____ packs/day for _____ years)	<input type="checkbox"/>	<input type="checkbox"/>
Do you still smoke? (Quantify in _____ packs/day)	<input type="checkbox"/>	<input type="checkbox"/>
Do you drink alcohol? (If so, how much?) _____	<input type="checkbox"/>	<input type="checkbox"/>
Do you use or have you ever used any illegal drugs? (we need to know for your safety)	<input type="checkbox"/>	<input type="checkbox"/>
7. Can you walk up one flight of stairs without stopping?	<input type="checkbox"/>	<input type="checkbox"/>
8. Have you had any problems with your heart? (circle all that apply)	<input type="checkbox"/>	<input type="checkbox"/>
(Chest pain or pressure, heart attack, abnormal ECG, skipped beats, murmur, palpitations, heart failure)		
9. Do you have high blood pressure?	<input type="checkbox"/>	<input type="checkbox"/>

See #6, sometimes I am reluctant

Table 11-2 Drugs Commonly Used in Electrophysiology Procedures

Category	Concentrations
ANESTHETIC AGENTS	
Muscle Relaxants	
Succinylcholine	Bolus: 100 mg
Opioids	
Remifentanyl	Infusion: 0.01-0.2 mcg/kg/min
Fentanyl	Bolus: 50-100 mcg
Induction Agents	
Propofol	Bolus: 2 mg/kg Infusion: 5-150 mcg/kg/min
Etomidate	Bolus: 0.1-0.3 mg/kg
Benzodiazepines	
Midazolam	Bolus: 1-2 mg
Alpha-2 (α_2) Adrenergic Receptor Agonists	
Dexmedetomidine	Loading dose: 1 mcg/kg over approximately 10 min Infusion: 0.2-1 mcg/kg/hr
CARDIOVASCULAR AGENTS	
Phenylephrine	Bolus: 100 mcg Infusion: 10 to 500 mcg/min
Epinephrine	Bolus: 8 mcg Infusion: 1 to 8 mcg/min
Atropine	Bolus: 0.5 to 1 mg
Isoproterenol	Infusion: 3 to 40 mcg/min
COMFORT AGENTS	
Dexamethasone	Bolus: 4 to 10 mg
Ondansetron	Bolus: 4 to 8 mg
Acetaminophen	Bolus: 1 g if normal liver function
Ketorolac	Bolus: 15-30 mg if normal renal function

Table 15-1 Continuum of Depth of Sedation

Signs	Minimal Sedation Anxiolysis	Moderate Sedation/ Analgesia	Deep Sedation/ Analgesia	General Anesthesia
Responsiveness	Normal response to verbal stimulation	Purposeful response to verbal or tactile stimulation	Purposeful response after repeated or painful stimulation	Unarousable even with painful stimulation
Airway	Unaffected	No intervention required	Intervention may be required	Intervention often required
Spontaneous ventilation	Unaffected	Adequate	May be inadequate	Frequently inadequate
Cardiovascular function	Unaffected	Usually maintained	Usually maintained	May be impaired

Modified from Gross J, Bailey PL, Connis R, et al. Practice guidelines for sedation and analgesia by nonanesthesiologists. *Anesthesiology*. 2002;6(4):1004-1017.³³

Box 15-2 Predictors of Difficult Mask Ventilation and Difficult Intubation

Increased body mass index ($>30 \text{ kg/m}^2$)

History of snoring or sleep apnea

Presence of beard

Lack of teeth

Age greater than 55 years

Mallampati class III or IV

Limited mandibular protrusion

Male gender

Airway masses or tumors

Modified from El-Orbany M, Woehlck HJ. Difficult mask ventilation. Anesth Analg. 2009;109(6):1870-1880.

Table 18-1 Normal Range of Vital Signs in the Pediatric Patient

Age Group	Heart Rate (beats/min)	Systolic Blood Pressure* (mm Hg)	Respiratory Rate (breaths/min)
Neonate (<30 days)	120-160	60-75	40-60
1-6 mo	110-140	65-85	25-40
6-12 mo	100-140	70-90	20-35
1-2 yr	90-130	75-95	20-30
3-5 yr	80-120	80-100	18-28
6-8 yr	75-115	85-105	18-25
9-12 yr	70-110	90-115	15-25
13-16 yr	60-110	95-120	9-15
>16 yr	60-100	100-125	9-15

*As measured using an oscillometric blood pressure device.

Modified from Gottlieb EA, Andropoulos DB. Pediatrics. In: Miller R, ed. *Basics of anesthesia*. 6th ed. Philadelphia: Saunders; 2011:548, 550.

Table 18-2 Endotracheal Tube Sizes

Age Group	Uncuffed ETT Size (ID mm)	Cuffed ETT Size (ID mm)
Preterm	2.5-3.0	NA
Term	3.0-3.5	3.0-3.5
1-6 mo	3.5	3.5
7-12 mo	4.0	3.5-4.0
1-2 yr	4.5	4.0-4.5
3-4 yr	4.5-5.0	4.5
5-6 yr	5.0-5.5	4.5-5.0
7-8 yr	5.5-6.0	5.0-5.5
9-10 yr	6.0-6.5	5.5-6.0
11-12 yr	6.5-7.0	6.0-6.5
13-14 yr	7.0-7.5	6.5-7.0
14+ yr	NA	7.0-7.5

Calculation of appropriate tube size for uncuffed endotracheal tubes

Divide the age by 4 and add 4 (for ages >1 yr). *Example for a 8 year old:*
 $8 \div 4 + 4 = 6$

Depth of insertion

Multiplying the ID of the ETT by 3 yields the proper depth of insertion to the lips in cm. *Example:*

4 mm ETT \times 3 = 12 cm for depth of insertion.

ETT, Endotracheal tube; ID, internal diameter.

Modified from Gottlieb EA, Andropoulos DB. Pediatrics. In: Miller R, ed. *Basics of anesthesia*. 6th ed. Philadelphia: Saunders; 2011:554.

Table 18-3 American Society of Anesthesiologists Nil Per Os Guidelines

Ingested Material	Minimum Fasting Period (hr)
Clear liquids Examples include water, juice without pulp (apple or white grape juice), clear tea, black coffee	2
Breast milk	4
Infant formula	6
Nonhuman milk Nonhuman milk is similar to solids in gastric emptying time; the amount ingested must be considered when determining the appropriate fasting time	6
Light meal Typically toast and clear liquids. Meals including fatty foods or meat may prolong gastric emptying time. Both the amount and type of foods ingested must be considered when determining the appropriate fasting time	6

These recommendations apply to healthy patients of all age groups scheduled to undergo elective procedures. They are not intended for women in labor. Following these guidelines does not guarantee complete gastric emptying.

Modified from Practice guidelines for preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration: application to healthy patients undergoing elective procedures. *Anesthesiology*. 1999;90(3):896-905.

Table 18-4 Common Hypnotic Drugs, Dosages, Duration, and Properties

Drug	Dosage and Route	Onset and Duration	Of Note
Chloral hydrate	** 50-100 mg/kg PO	Onset: 10-20 min Maximal effect: 30-60 min Duration: 4-8 hr	Oral medication. Commonly used on children under 10 kg Prolonged sedation
Midazolam	0.5-0.75 mg/kg PO 0.025-0.5 mg/kg IV 0.2-0.3 mg/kg intranasal 0.1-0.15 mg/kg IM	PO: onset 10-20 min, duration 1-2 hr IV: Onset 1-3 min, duration 20-30 min Intranasal: Onset 5 min, duration 30-60 min IM: Onset 5 min, duration 2-6 hr	Versatile administrative routes Caution when combined with other sedatives Intranasal route is very irritating May have paradoxical reaction
Pentobarbital	2-6 mg/kg PO 1-3 mg/kg IV	IV: Onset 3-5 min, duration 15-45 min Oral: Onset 15-60 min, duration 1-4 hr	Long history of use for radiological imaging Prolonged wake-up time Children often irritable on emergence
Methohexital	0.75-2 mg/kg IV 20-35 mg/kg rectal	IV: Onset 1 minute, duration 7-10 min Rectal: Onset <10 min	Shorter duration of action, good for CT scans Rectal route associated with apneas
Fentanyl	1-3 mcg/kg IV	IV: Onset 1 min, duration 30-60 min	Used primarily as an adjunct to sedation when performing painful procedures Risk for hypoventilation and apnea when used in conjunction with other sedatives
Etomidate	0.1-0.4 mg/kg IV	IV: Onset 30-60 seconds, duration 2-10 min	Minimal effect on hemodynamics Can suppress adrenal axis Generally used for induction of an anesthetic
Ketamine	6-10 mg/kg PO 3-7 mg/kg IM 1-2 mg/kg IV	PO: Onset 30 min IV: Onset 30 seconds, duration 5-10 min IM: Onset 3-4 min, duration 15-30 min	Maintains respiration unless combined with other sedatives Possible hallucination and delirium Associated with drooling Analgesic properties
Nitrous oxide	Up to 50% in 50% oxygen for sedation Up to 70% in 30% oxygen for induction of anesthesia	Rapid onset Requires continuous flow for maintenance	The patient desaturates quickly when apneic Analgesic properties Odorless May cause nausea and vomiting
Dexmedetomidine	Load 0.5-1 mcg/kg over 10 min Infusion 0.2-1 mcg/kg/hr	Slow onset, usually requires load	Maintains respiration Risk for bradycardia Minimal analgesic properties.
Propofol	1-3 mg/kg boluses 100-200 mcg/kg/min	Onset 30 seconds Duration 3-10 min depending on single dose	Should be used only by practitioners skilled at airway management/intubation Can easily achieve general anesthetic levels and loss of airway reflexes Painful on injection
Sevoflurane	2%-3% in oxygen MAC 2.5-3.3	Rapid onset Requires continuous flow	Exclusively used by anesthesiologists Always a general anesthetic Loss of airway reflexes, increased risk for laryngospasm at lighter levels of anesthesia

**

discontinued

CT, Computed tomography; MAC, monitored anesthesia care.

Modified from Cravero JP, Blike GT. Review of pediatric sedation. *Anesth Analg*. 2004;99:1355-1364; Lexicomp Pharmacopeia. <http://www.lexi.com>.

Box 18-1 Pediatric Anesthesia Preoperative Checklist for Outside the Operating Room

Preoperative

- Thorough review of medical history and physical assessment of patient
- Consider upper respiratory tract infection, obstructive sleep apnea, syndromes, comorbidities, age-related concerns
- Understand the anticipated procedure
- Discuss the needs of the proceduralist and anesthesiologist with staff
- Obtain anesthesia consent
- Verify procedure consent
- Premedication and/ or parental presence

Setup

ASA monitoring: capnography, pulse oximeter, electrocardiography, blood pressure, temperature

- Need appropriate sizes
- Able to view monitors at all times
- May need to be MRI compatible
- May need to be viewed by video camera or remote viewer
- Machine check and scavenging system
- Bag-valve-mask (either self-inflating or flow-regulated)
- Suction
- Oxygen source (central gas supply or tank with sufficient residual gas)
- Infusion pumps
- Appropriate fluids and intravenous access supplies
- Appropriate-sized airway equipment
 - Calculated endotracheal tube size (± 1 size)
 - Difficult airway cart (if needed)
- Drugs (know the appropriate doses)
 - Hypnotics
 - Opioids
 - Paralytics

- Infusions (depending on case: vasopressors, inotropes, vasodilators)
- Emergency drugs

Location

- Examine resources and available personnel
- Consider lighting (flashlight backup)
- Check positioning of anesthesia equipment
- Prepare for accessibility of the patient during the procedure
- Examine the ability to see procedure and monitors during anesthesia
- General anesthesia versus monitored anesthesia care and sedation
- Induction
- Placement of ASA monitors
- Mask or intravenous induction
- Place or confirm intravenous access
- Airway management

Maintenance

- Positioning
- Inhalationals, infusions, intermittent boluses
- Blankets or warming devices (e.g., Bair Hugger, 3M, St. Paul, Minn.)

Recovery

- Possible parental presence
- Timing and location of emergence
- Location of recovery (recovery room, day surgery, or procedure location)
- Transport with oxygen and monitors
- Discharge criteria: special considerations
 - Former premature infant
 - Apneas, croup, laryngospasm, upper or lower respiratory tract infection
 - Increased bleeding risk
 - Other comorbidities

The following ASA guidelines when providing anesthesiology services in NORA sites need to be considered during the design process¹:

1. A source of oxygen for the duration of the procedure, preferably piped from a central source
2. A source of suction, preferably one that meets operating room standards
3. A scavenging system if inhalational gases are used
4. A self-inflating hand resuscitator bag, anesthesia drugs and equipment, monitoring equipment, and an anesthesia machine maintained to operating room standards
5. An adequate number of electrical outlets for anesthesia equipment with isolated electric power or electric circuits with ground fault circuit interrupters if needed (i.e., in “wet areas” such as birthing rooms or cystoscopy rooms)
6. Adequate lighting of the patient and anesthesia equipment
7. Sufficient space for necessary imaging and anesthesia equipment and all personnel that allows easy access to the patient
8. An emergency cart with a defibrillator, emergency drugs, and rescue equipment
9. Adequate staff to support the anesthesiologist and reliable two-way communication to request assistance
10. Observation of all applicable building and safety codes and facility standards
11. Appropriate post anesthesia care, including personnel and equipment

Measuring what goes wrong:

One approach that has been extensively used in anesthesia is the ASA Closed Claims analysis. This method allows examination of adverse events and may help determine risk factors for these events.

In 2009, non–operating room closed claims were compared to those in the operating room.¹⁰ Adverse respiratory events, including inadequate oxygenation and ventilation, were the most common cause for NORA claims.

Monitored anesthesia care (MAC) was the most common anesthetic, and over sedation and lack of end-tidal carbon dioxide monitoring was the most common scenario encountered.

These events happened in older, sicker patients, most often in the gastroenterology suite, and more often resulted in death than events in the operating room.

However, closed claims analysis provides only a retrospective look at adverse events, without the benefit of a control group or large number of patients.

Definition of MAC by ASA: Monitored Anesthesia Care

MAC applies only to a patient who receives care from an anesthesiologist for non-painful or minimally painful procedures in which local or regional anesthesia is provided.

MAC allows for administration of sedative and analgesic medicines in doses that exceed those used for moderate sedation and includes the possibility of having the patient go through all of the levels of sedation to general anesthesia, as needed.

Even if no medications are used, the presence of the anesthesiologist is required to safely monitor patients who may become unstable.

For many diagnostic and minimally invasive non–operating room procedures, particularly in pediatric patients, the level of sedation required to obtain optimal conditions often is deep sedation.

Because the nature of sedation is fluid, it is easy for the patient to go from one level of sedation to the next.

All personnel administering sedation to patients outside the operating room must be properly credentialed and trained in rescuing patients from a sedation level deeper than was intended.

A practitioner who is planning deep sedation must be able to manage a patient who becomes truly anesthetized.

This skill is part of credentialing for anesthesia practice, but many nonanesthesiologist practitioners will need to acquire additional skills and training to gain this ability.

WHICH PATIENTS SHOULD WE THINK TWICE ABOUT? (OR THRICE?)

Box 24-2 Potential Triage Criteria in a Gastroenterological Endoscopy Center Using a Nurse Sedation Model*

Patients with any one of the following characteristics should undergo procedures at locations staffed by anesthesia providers:

Prior difficulty with sedation or anesthesia

Body mass index >50

Oxygen use at home

Previous head or neck cancer and associated surgery or radiation

Obstructive sleep apnea

High-dose opioid use

American Society of Anesthesiologists physical status IV

*Criteria may be modified based on the unique capabilities or characteristics of the center. Complex endoscopies may require deep sedation or general anesthesia and need care given by anesthesia providers.