**Volatile Agents**

Used for maintaining anesthesia (or induction in pediatrics). All bronchodilate (except desflurane which can cause bronchospasm) and are not metabolized by the body (except halothane). All (except nitrous oxide) can trigger malignant hyperthermia (MH).

**Minimal alveolar conc**: 1 MAC = conc of volatile needed to achieve no response to surgical stimulus in 50% of pts

- **Halothane** (MAC=0.8): slowest onset but highest potency, nonirritating (used for inhalational induction)
- **Isoflurane** (MAC=1.5): slow onset, irritating, preserves renal, hepatic, coronary, and cerebral blood flow
- **Sevoflurane** (MAC=2.2): nonirritating (used for inhalational induction), rapid onset but expensive
- **Desflurane** (MAC=6): rapid onset/offset, irritating, requires special vaporizer due to high vapor pressure

**Nitrous oxide** (MAC=104): fastest onset, lowest potency, cheap, decreases requirement of other volatiles

**Anticholinergic:** Can cause resp depress, urinary retention, N/V, constipation

- **Sufentanil** (1000x) > **remifentanil** (300x) > **fentanyl** (100x) > **alfentanil** (15x) > **morphine** (13x) > meperidine (0.1x)
  - Can cause resp depress, urinary retention, N/V, constipation

**Induction Agents**

- **Propofol**: dec N/V, myocardial depression, vasoaddiction
- **Etomidate**: painful injection, minimal depression of cardiopulm fnx (ideal for CVD pt), adrenal suppression
- **Thiopental**: dec cerebral O2 consumption, neuroperfusion maintained (ideal for neurosurg), cardiopulm depression

**Ketamine**: antag NMDA receptor, inc cardiac demand and secretions, works IV/PO/PR/IM, emergence delirium in pedi

**Midazolam**: premedication for sedation/axiolysis, cardiopulm depression (like other BDZs)

**Neuromuscular Blocking Agents (NMBAs)**

NMBAs facilitate intubation and provide optimal relaxation.

- **Depolarizing**: succinylcholine (hyperk+, MH, inc ICP)
- **Non-depolarizing**: rocuronium, pancuronium, zis-atracurium (varying pharmacokinetics, reversible by anticholinesterases)

**Local Anesthetics**

- **Bind to Na+ channel in inactivated state, no threshold potential reached, affects rapid firing nerves first (myelin >>> unmyelin)**
- **Amides**: Two “I”s in name (ie, lidocaine, prilocaine, bupivacaine), hepatic metabolism
- **Esters**: One “I” in name (ie, novacaine, procaine, tetracaine), metabolized by plasma esterases, PABA metabolite allergy

**Opioids (potency relative to morphine)**

- Agonize opioid receptors (namely μ, κ, δ)
- Sufentanil (1000x) > remifentanil (300x) > fentanyl (100x) > alfentanil (15x) > morphine (13x) > meperidine (0.1x)
- Can cause resp depress, urinary retention, N/V, constipation

**Reversal Agents**

- Acetylcholinesterase inhibitors: neostigmine, physostigmine
- Anticholinergic: glycopyrrolate (prevents bradycardia during reversal, decreases secretions)

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**Anesthesiology Basics for Medical Students**

**Pre-Operative History**

Focus on the organ systems at risk for complications from anesthesia as well as upper/lower airways.

- CAD (quantify exertion, ie flights of stairs)
- HTN (controlled?)
- hepatic or renal dz, endocrine (DM control, steroid use, thyroid) GERD, smoking/ETOH/drugs, FHx (malignant hyperthermia or pseudocholinesterase deficiency), surgical/anesthesia hx (complications? difficult intubation?)
- last meal, medications, allergies

**Pre-operative Physical Exam**

Special emphasis on neck/airway: facial trauma, neck range of motion, micrognathia, macroglossia, deviated septum/polyps, TMJ mobility, dentition, thyromental distance (thyroid cartilage to mandibular mentum with neck in full extension)

**ASA Physical Status Classification System:**

- ASA 1 – normal, healthy pt
- ASA 2 – mild systemic dz
- ASA 3 – severe systemic dz
- ASA 4 – severe dz threat to life
- ASA 5 – not expected to survive without operation

**Mallampati Scoring (1 to 4 from L to R) and Airway Grades**

**Credits**

- Clinical Anesthesia, Barash (5th Ed)
- Anesthesia Secrets, Duke (4th Ed)
- Basics of Anesthesia, Miller (6th Ed)
- Pocket Clinician Manual of Anesthesia Practice, Pardo (1st Ed)

“**The Medical Student’s Anesthesia Pocketbook**” – University of Texas Health Science Center Houston

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Assembled by Rishi Kumar

http://rk.md
**Invasive Monitoring**

*Transesophageal echo (TEE)*: assess wall motion abnl, EF, intracardiac air; used in CABG, thoracic aorta or valvular surgeries, lung transplant, tamponade, major thoracic trauma

*Arterial line (“A-line”):* allows beat-to-beat BP monitoring and easy arterial access (ie, for frequent ABGs)

*Central venous line:* monitor intravascular volume and RV fcn

*Pulmonary artery (PA) catheter:* measures RAP, PA, wedge pressure (LVEDP), CO, and P.O.

**Preoxygenation**

Using the thumb and index finger of each hand, create two semicircles around the mask ensuring it fits over the pt’s mouth and nose. Place remaining fingers along mandible and semicircles around the mask ensuring it fits over the pt’s mouth. Tilt the head back can help.

**IV Induction**

Induction choices include propofol, etomidate, ketamine, thiopental; assess anesthesia by brushing eyelashes and looking for eyelid motion (“lash reflex”).

<table>
<thead>
<tr>
<th>STAGE</th>
<th>PUPIL</th>
<th>RESP</th>
<th>PULSE</th>
<th>B.P.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1ST INDUCTION</td>
<td>USUAL SIZE</td>
<td>REACTION TO LIGHT</td>
<td>IRREGULAR</td>
<td>NORMAL</td>
</tr>
<tr>
<td>2ND EXCITEMENT*</td>
<td></td>
<td>IRREGULAR &amp; FAST</td>
<td>HIGH</td>
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<td>3RD OPERATIVE</td>
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<td>STEADY SLOW</td>
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<td>4TH DANGER</td>
<td>WEAK &amp; TH READY</td>
<td>LOW</td>
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A neuromuscular blocking agent (NMBA) like succinylcholine (depolarizing) or rocuronium (non-depolarizing) is given next. Muscle relaxation takes place (flaccid jaw, decreased TOF twitches). Proceed to intubation if instruments are ready.

**Endotracheal Tube (ETT) Intubation**

Start by holding either the curved Mac or straight Miller laryngoscope in your left hand (regardless of handedness). Use your right thumb and index finger in a scissor-like fashion to open the pt’s mouth. Tilting the head back can help.

Carefully insert the laryngoscope into the right side of the pt’s mouth, advance it to the epiglottis, and sweep the tongue to the left. If using the curved Mac blade, advance further into the vallecula. Lift the laryngoscope using your upper-arm (no rotational motion of the wrist should occur) towards the juncture of the opposite wall and ceiling. Look for the vocal cords (typically white) with attached vestibular folds and arytenoid cartilage. This is different from the esophagus which is, more or less, a large hole with no defining characteristics.

Once the cords are visualized, do not lose your view! Have an assistant pass the ETT tube to you and carefully insert it between the cords until the balloon is no longer visible. Remove the laryngoscope, remote the stylet from the ETT, inflate the balloon cuff, attach the ETT to the circuit, confirm placement (bilaterial breath sounds, fogging of the tube, end-tidal CO2), and tape in place.