



Johns Hopkins ACCM Medical Student Pre-Operative Evaluation Pocket Card



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Preoperative Diagnosis/Medication*	ECG	CXR	Hct/Hb	CBC	CMP	Cr	Glu	Coags	LFTs	Drug Levels	Ca
History of MI	X			X	±						
Chronic stable angina	X			X	±						
CHF	X	±									
HTN	X	±			X *	X					
Chronic atrial fibrillation	X									X †	
PAD	X										
Valvular heart disease	X	±									
COPD	X	±		X						X ‡	
Asthma	PFT if symptomatic										
Diabetes	X				±	X	X				
Liver disease											
Infectious hepatitis								X	X		
Alcohol or drug induced hepatitis								X	X		
Tumor infiltration								X	X		
Renal disease			X		X	X					
Hematologic disorders				X							
Coagulopathies				X				X			
Stroke	X			X	X		X			X	
Seizures	X			X	X		X			X	
Tumor	X			X							
Vascular disorders or aneurysms	X		X								
Malignant disease				X							
Hyperthyroidism	X		X		X						X
Hypothyroidism	X		X		X						
Cushing disease				X	X		X				
Addison disease				X	X		X				
Hyperparathyroidism	X		X		X						X
Hypoparathyroidism	X				X						X
Morbid obesity	X	±					X				
Malabsorption or poor nutrition	X			X	X	X	X				
Digoxin (digitalis)	X				±					X	
Anticoagulants			X					X			
Phenytoin (Dilantin)										X	
Phenobarbital										X	
Diuretics					X	X					
Corticosteroids				X			X				
Chemotherapy				X		±					
Aspirin or NSAIDs											
Theophylline										X	

*remember to always consider the patient (esp. age) and the surgery in addition to their medical conditions (i.e. healthy 20 year-old with a leg tumor does not necessarily need ECG and CBC)

ASA Category:

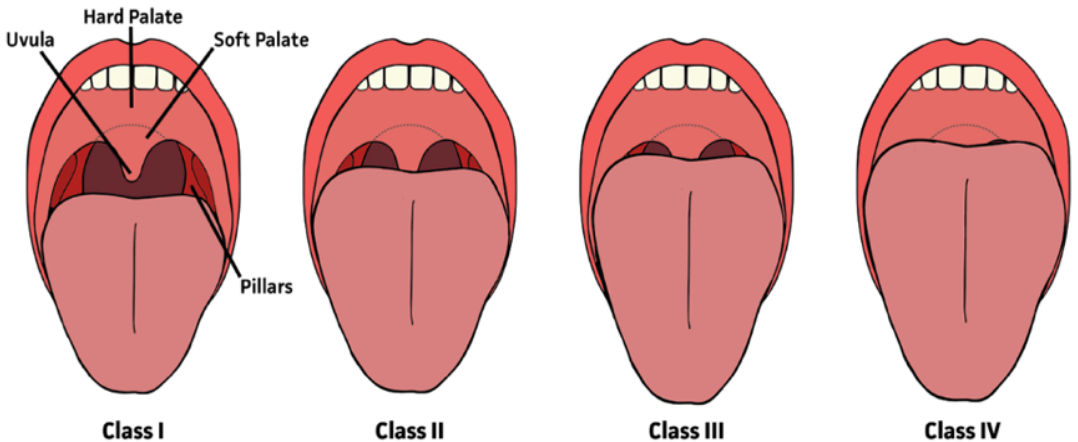
- 1 - normal, healthy patient
- 2 - patient with mild systemic disease
- 3 - patient with severe systemic disease
- 4 - patient with severe systemic disease that is a constant threat to life
- 5 - moribund patient who is not expected to survive without the operation
- 6 - declared brain-dead patient whose organs are being removed for donor purposes

Predictors of Difficult Airway

- history of difficult intubation
- neck circumference:
 - >17 in (M)
 - >16 in (F)
- thyromental distance < 7 cm
- Mallampati III or IV

-difficult bag mask ventilation:

- age > 55
- BMI > 26
- lack of teeth
- beard
- hx of snoring



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Revised Cardiac Risk Index (RCRI): Each is 1 point

- high-risk surgery (intraperitoneal, intrathoracic, or suprainguinal vascular procedure)
- ischemic heart disease (by any diagnostic criteria)
- history of congestive heart failure
- history of cerebrovascular disease
- diabetes mellitus requiring insulin
- creatinine >2.0 mg/dL (176 μ mol/L)
- risk of major cardiac events using RCRI: **0** = 0.4%, **1** = 1.0%, **2** = 2.4%, **≥ 3** = 5.4%

OR Setup:

S – suction

O – oxygen

A – airway

P – pharmacy

I – IV (tourniquet, alcohol swab, 2 16-18 G IV, small gauze, Tegaderm, tape)

M – machine + monitors



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Pharmacology Pocket Card



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Components of anesthesia: (1) **analgesia**: inability to feel pain (2) **amnesia**: loss of memory (3) **paralysis**: inability to move (4):

unconsciousness: inability to maintain awareness of self and environment

Generic (Brand)	MOA	Use (dose)	Pro	Con	Comment
IV Anesthetics					
Propofol (Diprivan)	GABA _A agonist	I (IV: 2-2.5 mg/kg) M (IV: 75-300 mcg/kg/min)	antiemetic property (intra-op: 15-20 mcg/kg/min, PACU: 15-20 mg bolus)	accumulates in tissues w/ prolonged use, pain at injection site, CV and resp depression, hypotension, PRIS	most commonly used IV anesthetic, appears white 2/2 lipid emulsion, ↓ requirement if combined w/ opioid
Etomidate (Amidate)	GABA _A modulation	I (IV: 0.2-0.6 mg/kg, typically 0.3 mg/kg)	minimal CV and resp depression	pain at injection site, N/V, myoclonus, adrenal suppression	no analgesic effect, combine w/ opioid or esmolol for laryngoscopy
Ketamine (Ketalar)	NMDA antagonist	I (IV: 1-4.5 mg/kg, typically 1-2 mg/kg) Adjunctive M (IV cont: 0.1 to 0.5 mg/min)	minimal CV and resp depression, provides analgesia, works IV, PO, IM, or PR	↑ BP, HR, ICP, and SNS post op dysphoria, hallucinations	bad choice for pt w/ CAD, good choice for trauma
Dexmedetomidine (Precedex)	α-2 agonist	S in ICU pt, awake fiberoptic intubation, procedures	minimal respiratory depression	no amnesia (can combine w/ propofol), bradycardia (often dose limiting)	more specific for α-2 than clonidine
Barbituates – thiopental (Pentothal), methohexital (Brevital)	GABA _A agonist	I (methohexital), S	↓ ICP	CV and resp depression, hypotension, porphyria, no reversal agent	not commonly used, no analgesia, useful for neurosurgical cases
Benzodiazepines - Midazolam (Versed), Diazepam (Valium), Lorazepam (Ativan)	GABA _A agonist	<u>Midazolam</u> : A/S (IV: 1-2.5 mg), I (0.3-0.35 mg/kg)*	reversal agent: flumazenil	CV and resp depression, ↓ BP, post-operative delirium	prolonged half-life w/ cirrhosis, no analgesia
*Diazepam: A (IM: 10 mg), ICU S (IV LD: 5-10 mg, IV MD: 0.03-0.1 mg/kg/30 min-6 hr), <u>lorazepam</u> : A/S (0.044 mg/kg 15-20 min before surgery)					
Opioids (reversal agent: naloxone)					
Morphine	Opioid agonist	An (IV: 2.5-5 mg every 3-4 hrs)	long duration of action	resp depression, hypotension, N/V, ↓ GI motility, urinary retention, histamine release	renally excreted (renal failure may prolong action 2/2 active metabolites)
Fentanyl, Alfentanil, Sufentanil, Remifentanil	Opioid agonist	An (fentanyl) IV: 1-4 mcg/kg, ↓ stress response to surgical stimulus	more potent than morphine, short duration of action	resp depression, hypotension, N/V, ↓ GI motility, urinary retention	sufentanil = most potent (1000x > morphine), remifentanil = shortest duration
Hydromorphone (Dilaudid)	Opioid agonist	An (IV: 0.2-1 mg, PCA: 0.05 to 0.4 mg every 10 min)	no histamine release	resp depression, hypotension, N/V, ↓ GI motility, urinary retention	5x more potent than morphine, ideal PK for PCA
Inhalational Anesthetics					
Isoflurane	Alters Ach, GABA, and glutamate receptor activity	M	bronchodilation, S , preserves renal, hepatic, coronary, & cerebral blood flow	MH, cannot use for induction, slowest onset/offset, hypotension, post-op N/V	eliminated via ventilation, highest potency
Sevoflurane	Alters Ach, GABA, and glutamate receptor activity	I (peds), M	bronchodilation, can be used for induction	MH, hypotension, post-op N/V	eliminated via ventilation
Desflurane	Alters Ach, GABA, and glutamate receptor activity	M	rapid onset/offset	\$\$\$\$, MH, cannot use for induction, ↑ catecholamine release, post-op N/V	eliminated via ventilation
Nitrous Oxide	CNS depression	S , An , adjunct to inhalational and IV general anesthetics	↓ volatile anesthetic requirement, less myocardial depression, no odor	diffuses into spaces (i.e. bowel, ETT, pneumothorax, intraocular, pneumocephalus), ↑ pulmonary vascular resistance, ↓ FIO2	eliminated via ventilation, lowest potency, often used in Peds inductions w/ sevoflurane
Neuromuscular Blocking Agents (NMBA)					
Depolarizing – Succinylcholine	ACh receptor agonist causing persistent depolarization	P (0.5 – 1.5 mg/kg)	rapid intubation	↑ serum [K] (cannot use in myopathies, burns), MH, anaphylaxis	phase I: twitching, fasciculations, Phase II: flaccid paralysis
Non-depolarizing – rocuronium, vecuronium, cisatracurium	ACh receptor antagonist	P (IV roc: 0.6-1.2 mg/kg, IV vec: 0.08-0.1 mg/kg, IV cis: 0.15-0.2 mg/kg)	↓ muscle tone, no histamine releasing activity	profound blockade in pt w/ NM disease	flaccid paralysis

-Monitor neuromuscular blockade using "train of four" → ideally 1-2 twitches present

-neostigmine (0.03-0.07 mg/kg), physostigmine, edrophonium = ACh-esterase inhib for reversal of NMBA (can cause bradycardia, ↑ secretions, bronchoconstriction)

-glycopyrrolate (0.2 mg per 1 mg of neostigmine or per 5 mg of pyridostigmine), atropine = ACh antagonists → blocks muscarinic effects of ACh-esterase inhibitor

-give Ach antagonist prior to Ach-esterase inhibitor
 -sugammadex rapidly forms a complex w/ rocuronium or vecuronium and reverses effects of NMBA (can ↓ efficacy of contraceptives) → 2 mg/kg for moderate block (at least 2 twitches), 4 mg/kg for deep block (post-tetanic twitches), 16 mg/kg for immediate reversal of rocuronium

Vasodilators					
Nicardipine	Dihydropyridine calcium channel blocker	HTN (IV: 5 mg/hour)	↓ BP & peripheral vascular resistance	N/V, tachycardia	contraindicated in pt w/ advanced aortic stenosis
Nitroprusside	Direct action on vascular smooth muscle	HTN (start @ 0.3 mcg/kg/min, titrate to max of 10 mcg/kg/min)	↓ afterload, ↓ myocardial O2 demand	infusion rate >2 mcg/kg/min may lead to cyanide toxicity, methemoglobinemia	treat methemoglobinemia w/ methylene blue (IV: 1–2 mg/kg)
Esmolol	β-1 antagonist	HTN (IV: 1 mg/kg over 30 seconds)	↓ chronotropic and ionotropic activity, minimal bronchospasm, fast acting	contraindicated in 2 nd or 3 rd degree heart block, ↓ signs/symptoms of hypoglycemia	↓ BP in <2 min
Labetalol	α, β-1, β-2 antagonist	HTN (IV: 20–80 mg)	dose-dependent ↓ BP, minimal ↓ in HR, CO	cannot use in pt w/ obstructive airway disease, heart block	can also be used for sympathetic overactivity syndrome associated with severe tetanus
Hydralazine	Direct vasodilator	HTN (IV: 1.7–3.5 mg/kg daily in 4-6 doses)	short acting	tachycardia, contraindicated in CAD & mitral valve rheumatic heart disease	may cause drug-induced SLE
Vasopressors/Ionotropes					
Phenylephrine	α-1 agonist	↑ BP during anesthesia (50-100 mcg)	↑ systolic BP and MAP	bradycardia	dilute to 100 mcg/mL
Norepinephrine	α, β-1 agonist (α>β)	Acute hypotension, septic shock (0.01-3 mcg/kg/min)	↑ MAP, constricts both arteries and veins, ↑ contractility	vasoconstriction may ↓ renal, splanchnic, and cutaneous blood flow	use phentolamine for ischemia due to extravasation
Epinephrine	α, β-1, β-2 agonist	Acute hypotension (IV: 0.05-2 mcg/kg/min), anaphylaxis (IM: 0.2–0.5 mg), septic shock (2 nd line)	relaxation of bronchial smooth muscle, cardiac stimulation (↑ HR & CO), dilation of skeletal muscle vasculature	↑ cardiac O2 demand, cannot be combined w/ local anesthetics injected into distal locations (i.e. toe)	do not use in cardiac, shock
Dopamine	D agonist (low dose), β-1 (medium dose), α agonist (high dose)	Cardiogenic, septic shock (IV: 5-10 mcg/kg/min)	renal, mesenteric, coronary, and intracerebral vasodilation at low doses → ↑ RBF, GFR	cannot be used w/ pheochromocytomas	low: 0.5–2 mcg/kg/min, med: 2–10 mcg/kg/min, high: 10–20 mcg/kg/min
Dobutamine	β-1, agonist (mild α-1, β-2 agonist)	Cardiac decompensation (IV: start @ 0.5–1 mcg/kg/min and titrate ↑)	↑ cardiac contractility, ↑ CO	↑ myocardial O2 demand, cannot use in pt w/ hypertrophic cardiomyopathy	no action at dopaminergic receptors
Isoproterenol	β-1, β-2 agonist	Shock (IV infusion: 0.5–5 mcg/min), heart block, bronchospasm	↑ CO, relaxation of bronchial, GI, and uterine smooth muscle, vasodilation of peripheral vasculature	↑ myocardial O2 demand	not often used due to more efficacious other options
Local Anesthetics					
Esters - Procaine, Tetracaine	Voltage-gated Na channel antagonist	An (local and regional)	specific to site (↓ need for opioids)	allergic reactions, AV block, arrhythmias, cardiac arrest, seizures	only 1 'r' in name, metabolized by plasma esterases
Amides - Lidocaine (Xylocaine), Bupivacaine (Marcaine), Ropivacaine	Voltage-gated Na channel antagonist	An (local and regional)	specific to site (↓ need for opioids)	AV block, arrhythmias, cardiac arrest, seizures	≥2 'r's in name, metabolized hepatically

MOA: mechanism of action; **N/V:** nausea, vomiting; **I:** induction; **M:** maintenance; **A:** anxietylisis; **An:** analgesia; **S:** sedation; **H:** hypnosis; **P:** paralysis; **PRIS:** propofol-related infusion syndrome (acute refractory bradycardia, severe metabolic acidosis, cardiovascular collapse, rhabdomyolysis, hyperlipidemia, renal failure, and hepatomegaly); **LD:** loading dose; **MD:** maintenance dose; **MH:** malignant hyperthermia; Minimum alveolar concentration; (**MAC**): concentration needed to achieve no response to surgical stimulus. 95% of population will not respond at MAC = 1.3. IV anesthetics agents can alter MAC.

α-1: ↑ **vascular smooth muscle contraction**, mydriasis, ↑ intestinal and bladder sphincter muscle contraction

α-2: ↓ **sympathetic tone**, ↓ insulin release, ↓ lipolysis, ↑ platelet aggregation, ↑ aqueous humor

β-1: ↑ **HR**, ↑ **contractility**, ↑ renin release, ↑ lipolysis

β-2: **vasodilation**, **bronchodilation**, ↑ lipolysis, ↑ insulin release, ↓ uterine tone, relaxes ciliary muscle, ↑ aqueous humor

β-3: ↑ lipolysis, ↑ thermogenesis in skeletal muscle

DA-1: renal, cerebral, coronary and splanchnic arteries vasodilation

DA-2: modulates neurotransmitter release



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Intraoperative Pocket Card

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Airway Management

- oral airway: prevent tongue from covering epiglottis
- bag mask ventilation: need seal between facemask and pt face + unobstructed airway
 - C method: thumb+index finger form C to create seal while other digits lift mandible
- laryngeal mask airway (LMA):
 - supraglottic airway (more definitive than facemask but less invasive than ETT)
 - used in diagnostic and minor surgical procedures
 - advantages: less invasive, no need for muscle relaxation
 - disadvantages: no protection from laryngospasm, ↑ risk of aspiration, no effective at ↑ airway pressures
- endotracheal tube (ETT):
 - sizing measured via internal diameter (ID)
 - typically 7 mm for women, 8 mm for men
 - larger tube = ↑ risk of laryngeal/tracheal trauma but ↓ resistance
 - ID < 7.5 mm precludes therapeutic fiberoptic bronchoscopy
 - orotracheal intubation (most common method):
 - advantage: ↓ trauma, larger ETT
 - disadvantage: potential damage to teeth, stimulate gag reflex
 - nasotracheal intubation:
 - often used in intraoral/oropharyngeal surgery, oral route not possible (i.e. mandible fracture), alternative to tracheostomy for ICU patients
 - advantage: better tolerated by awake patient (bypasses gag reflex)
 - disadvantage: epistaxis, contraindicated w/ maxillary/skull base fractures
- laryngoscopy:
 - direct (most common):
 - Macintosh** (curved, size 3-4): ↑ room for ETT passage, ↓ risk dental damage
 - Miller** (straight, size 2-4): better view of glottis, better for short thyromental dis.
 - 1) "sniffing position" - 35° neck extension
 - 2) hold laryngoscope in L hand
 - 3) open mouth w/ R hand using scissors technique
 - 4) insert laryngoscope on R and sweep tongue to L
 - 5) proceed to insert laryngoscope along base of tongue
 - 6) Macintosh inserted into vallecula, Miller inserted to below epiglottis
 - 7) Orient force 45° away from yourself and lift
 - 8) Insert ETT and visualize passing through vocal cords
 - indirect:
 - indications: anticipated difficult airway, undesirable extension of neck, ↑ risk of dental damage, limited mouth opening
 - Fiberoptic: flexible, can be used in anesthetized or awake pt
 - McGrath: distally angulated blade, cordless and portable
 - Glidescope: distally angulated blade, 7-inch LCD monitor
 - C-MAC: based on Macintosh but can directly lift epiglottis, has D-blade that is distally angulated like a McGrath, ↓ intubation times

ASA Standards for Basic Anesthetic Monitoring

-Standard I: qualified anesthesia personnel present in room general, regional, and monitored anesthesia care

-Standard II:

- oxygenation: inspired gas (FiO₂ analyzer + low O₂ concentration alarm), pulse oximetry
- ventilation: continuous capnography (with expired TV), disconnect alarm required if mechanically ventilated
- circulation: EKG, blood pressure (\leq q5 min)
- temperature: temperature probe (only if clinically significant Δ in body temp anticipated)

Indications for arterial line

- moment-to-moment BP Δ anticipated and rapid detection is vital
- planned pharmacologic or mechanical manipulation
- repeated blood sampling
- failure of NIBP
- supplementary diagnostic information (perfusion of dysrhythmic activity, volume status, IABP)

Evaluating arterial line BP reading

- overdamped: systolic pressure overshoot, difficult to discern diastolic notch
- underdamped: slurred upstroke, absent diastolic notch, and loss of fine detail
- MAP will remain unaffected w/ under- or overdamped system

Routine extubation criteria

- 1) **vital signs stable** (HR/BP WNL, T > 35.5 C, spontaneous RR=6-30, SpO₂>90%)
- 2) **ABG** (FiO₂≤40%): pH≥7.30, PaO₂≥60mmHg, PaCO₂≤50-60, normal lytes
- 3) **reversal of neuromuscular blockade**: TOF 4/4, TOF ratio > 0.9
- 4) **respiratory mechanics adequate**: spontaneous TV>5 mL/kg, VC>15mL/kg
- 5) **protective reflexes returned**: gag, swallow, cough
- 6) **awake, alert, and able to follow commands**

Ventilator settings

Minute ventilation (MV) = tidal volume (TV) x respiratory rate (RR)

Volume modes: delivery of a set tidal volume

- Controlled Mandatory Ventilation (CMV): MV set, breaths not synchronized to patient effort
- Assist Control (AC): minimum MV set, pt can initiate breaths and set TV delivered
- Intermittent Mandatory Ventilation (IMV): minimum MV set, pt can initiate extra breaths but no volume delivered with extra breaths
- Synchronized Intermittent-Mandatory Ventilation (SIMV): variation of IMV where ventilator delivered breaths are synchronized w/ pt breaths

Pressure modes: delivery of set pressure

- uses same modes (CMV, AC, IMV, SIMV) but pressure is set instead of volume
- Pressure Support Ventilation (PSV): pt determines TV and RR but set pressure delivered, augments spontaneous breathing, good method for weaning off ventilator

Normal Vital Signs by Age

Age	HR	Systolic BP	Diastolic BP	RR
Premie	120-170	55-75	35-45	40-70
0-3 mo	110-160	65-85	45-55	30-60
3-6 mo	100-150	70-90	50-65	30-45
6-12 mo	90-130	80-100	55-65	25-40
1-3 yrs	80-125	90-105	55-70	20-30
3-6 yrs	70-115	95-110	60-75	20-25
6-12 yrs	60-100	100-120	60-75	14-22
Adult (>12 y)	60-100	90-120	60-90	12-20