Obstetric Anesthesia Pocket Guide

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Acronyms

TOLAC – Trial of Labor After Cesarean
VBAC – Vaginal Birth After Cesarean
AMA – Advanced Maternal Age
IUPC – Intrauterine Pressure Catheter
IUGR – Intrauterine Growth Restriction
GxP_{TPAL}
X = # Pregnancies
T = Term
P = Premature
A = Abortions/Miscarriages
L = Living Children
IOL – Induction of Labor
AROM – Artificial Rupture of Membranes
SROM – Spontaneous ""
PROM – Premature ""
PPROM – Preterm Premature ""
PPS/TL – Postpartum Sterilization/Tubal Ligation
Beta Complete – s/p Betamethasone x2
LUD – Left Uterine Displacement
HELLP - Hemolysis, Elev. LFTs, Low Plts
SBAR – situation, background, assessment, recommendations

Physiology of Pregnancy

CV	- ↑ CO 30-50% 2/2 SV > HR, highest CO immediately postpartum - ↑ blood volume 50% - ↓ SVR, PVR. Unchanged PCWP, CVP - Eccentric LVH with TR, MR - S3 common from rapid filling - May have LAD, flat TIII, ST depr limb/chest
Pulm	- ↑ MV 2/2 TV > RR; ↑ O2 consumption; ↓ FRC 20% - 7.44/30/105/20 normal ABG at end of 1st trimester
Renal	- ↑ GFR by 50% → BUN/Cr ~ 9/0.6
Heme	- Dilutional anemia (Hct ≥ 33) 2/2 ↑ plasma vol > RBC vol - Nose bleeds (boggy, friable mucosa 2/2 progesterone) - ↑ most clotting factors + fibrinogen (~400-500 mg/dL) = hypercoagulable after 1st trimester - Leukocytosis - 5% gestational thrombocytopenia = Asx, usually plt > 100k
GI	- GERD 2/2 progesterone and ↓ LES tone - Delayed gastric emptying *only during* labor - Constipation from ↑ Na and H_2O absorption and ↓ GI motility - ↑ Alk Phos 3x b/c of heat stable isoenzyme from placenta - ↓ albumin
Anes	- ↓ MAC req by 20% until 3d postpartum - Larger volume of distribution - N_2O/propofol have little effect on uterine tone - ↑ sensitivity to local anesthetics

Hypertensive Disorders

Gestational HTN	- New HTN that develops after week 20, resolves after delivery; no associated abnormalities
Pre-Eclampsia	- **DX:** BP > 140/90 w/ > 0.3 g prot/1+ urine dip and/or end organ dysfunc; Severe features: BP > 160/110; HA, epigastric pain, 2x LFTs, visual Δ, plt < 100k, Pulm edema, Cr > 1.1 - **TX:** Consider delivery - **Mg**: 4-6 gm IV load over 15-20 min; 1-2 gm/hr gtt until 24 hr post delivery (do NOT d/c in OR); 10 g IM load described **Mg tox: 6-10 mg/dL ↓ DTRs; > 10 mg/dL resp compromise; > 15 mg/dL cardiac comp: Tx CaCl 1 g IV or CaGluc 1-3 g IV** - Peds present at all deliveries 2/2 floppy baby w/ Mg - If laryngoscopy necessary, control BP (labetalol, Mg, Alfentinil, Remifentinil) first to avoid CVA
Eclampsia	- LUD, airway support +/- ETT (control BP peri-laryngoscopy) - IV access for Mg/benzos. Consider IM/IO routes. - FHR w/ predictable decel and recovery, but reasonable to transfer to OR - Likely no neuraxial until HELLP rule out

Post-Natal

APGAR
0-3 severely depressed
4-6 moderately depressed

Normal Cord Gases

	PCO_2	PO_2
U_A	50	20
U_V	40	30

Points	0	1	2
Activity	Absent	Arm/leg flex	Active movement
Pulse	Absent	< 100	> 100
Grimace	No response to stim	Grimace to stim	Cry, cough to stim
Appearance	Cyanosis	Acrocyanosis	Pink all over
Respiration	Absent	Weak, irregular	Vigorous cry

Miscellaneous Techniques

Retained POC, Uterine Invrsn	- **NTG:** 100-400 mcg IV boluses up to 500 mcg or 1-3 SL sprays PRN (400 mcg/spray); both +/- phenylephrine IV 50-200 mcg - **GA:** Req 2-3 MAC volatile gases
PPS/ PPTL	- Existing epidural: 10-15 mL 2% lidocaine w/ epi + NaHCO3 or 10-15 mL 3% chloroprocaine + NaHCO3 to T4-6 level - Spinal: hyperbaric 0.75% bupiv 1.6 mL + 10 mcg fentanyl; or 2% mepivacaine 45-60 mg w/ 1 mL D5W; or 3% chloroprocaine 45 mg
D&C	- Resuscitate PRN, T&C 2 U PRBCs PRN, Consider NPO status, potential coagulopathy - MAC/paracervical block (most common); versed, fentanyl, ketamine, propofol PRN - Existing Epidural: Same as PPS/PPTL - Spinal: Same as PPS/PPTL
External Cephalic Version (ECV)	Need T4-6 surgical anesthesia level in case of c-section. Spinal preferred: hyperbaric bupiv +/- fentanyl. Long-acting opioid depends on disposition: 1. if staying for induction if version successful, give morphine IT 2. if going home if version successful, NO morphine IT 3. if proceeding immediately w/ c-section if version unsuccessful, give morphine IT 4. if going home if version unsuccessful, NO morphine IT

ACLS & ATLS in Parturients

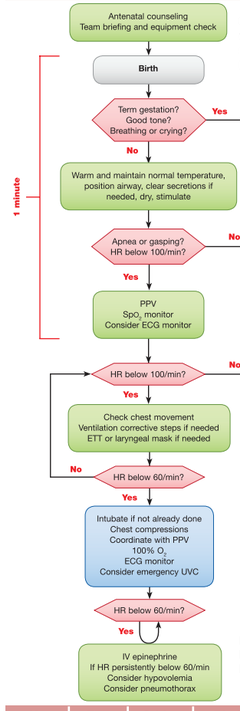
- **Manual LUD (do not tilt pt)** (IVC compressed > 20 wks)
- RSI/cricoid if ETT needed
- If recent Mg, d/c Mg gtt and give CaCl 1 g IV
- IV access above diaphragm
- **CPR** in normal location on chest
- **Emptying uterus** < 5 min ↑ maternal survival **ONLY IF > 20 wks**
- **BEAUCHOPS: B**leeding/DIC, **E**mbolism (PE/AFE), **A**nesthesia (LA tox; tx intralipid 20% 1.5 mg/kg bolus then 0.25-0.5 mg/kg gtt), **U**terine atony, **C**ardiac dz, **H**TN dz, **O**ther (5H's & 5T's), **P**lacenta abruption/ previa, **S**epsis Morris et al, *BMJ*, 2003
- Consider abruption → DIC in trauma Jeejeebhoy et al, AHA Guidelines, *Circulation*, 2015

Post-Partum Hemorrhage (PPH)

4 T's: Tone (atony), Thrombin (coagulopathy), Tissue (retained placenta), Trauma (artery laceration)
Vaginal: > 500 mL || C-section: > 1000 mL

Oxytocin/Pitocin	- MOA: ?; ↑ intracellular Ca - IM/IV/intrauterine routes (WHO rec: 10 U IM/IV) - Do NOT bolus IV rapidly - Consider rule of 3's: 3 U load IV over 30 sec, consider repeat 3 U rescue loads q 3 min for total of 3 doses; gtt at 3 U/hr for up to 3^3 (9) hr postop - **COMMUNICATE** W/ OB TEAM RE: UTERINE TONE Q 3 MIN UNTIL ADEQUATE - Side Effects: hypoTN, N/V, coronary spasm Kovacheva et al, *Anesthesiology*, 2015
Methylergonovine /Methergine	- Ergot alkaloid (dopa, serotonin, alpha adrenergic) → smooth muscle contraction - 0.2 mg IM: q 5-10 min max 2 doses, then q 2-4 hr - Avoid IV, but if IV, 0.2 mg/10 mL NS, give 2 mL q 1 min - Relatively Contraindicated if GHTN, HTN, Pre-E - Side effects: HTN, seizures, HA, N/V, chest tightness
Hemabate/ Carboprost (15-methyl-PGF2α)	- 0.25 mg IM (only IM or intrauterine) q 15-90 min, NTE 2 mg/ 24 hr - Contraindicated if asthma - Side effects: N/V, flushing, bronchospasm, diarrhea (2/3rd of pts have diarrhea)
Misoprostol/ Cytotec (PGE1 analog)	- 600-1000 mcg buccal/PR (10 min onset) - Side effects: temp ↑ to ~ 38.1, N/V, diarrhea
Tranexamic Acid/ TXA (anti-fibrinolytic)	- Inhibits conversion of plaminogen to plasmin - Consider for all PPH - 1 g IV over 10 min, repeat x 1 after 30 min if needed - ↓ mortality due to PPH: WOMAN, *Lancet*, 2017 - Little data for aminocaproic acid (Amicar) in PPH
Fibrinogen concentrate/ RiaSTAP	- Human-derived, pooled - Consider for PPH w/ confirmed or suspected low fib state (DIC, AFE, abruption, major hemorrhage) - 2 g fibrinogen conc = 2 vials RiaSTAP = 2-4 U FFP = 10-20 cryo U (1-2 pools) - To ↑ fibrinogen 100 mg/dL, give 2-4 g fibrinogen conc - Look for upcoming randomized trial: Aawar, *Trials*, 2015 Wikkelso et al, *BJA*, 2015
Other	- Keep pt warm - Don't forget CaCl - Consider activating MTP - Consider cell salvage (call OR front desk) - Consider POC testing, e.g. ROTEM - Syntometrine = oxytocin + ergometrine (Makerere U only)

Neonatal Resuscitation



OP/NP Suctioning: reserved for neonates who have obvious obstruction to spontaneous breathing or who require PPV (Class IIb, LOE C)

Meconium Stained Amniotic Fluid: ETT suctioning no longer recommended, even for non-vigorous neonates.

PPV:
RR 40-60,
P < 20 cm H_2O
if possible
(Class IIb, LOE C)

Targeted Preductal SpO_2 After Birth	
1 min	60%-65%
2 min	65%-70%
3 min	70%-75%
4 min	75%-80%
5 min	80%-85%
10 min	85%-95%

3:1
compression:vent
at 120 events/min

Epi 10-30 mcg/kg IV
Epi 50-100 mcg/kg ETT (*unvalidated)
IVF 10 mL/kg bolus PRN

Modified from:

Kg	ETT	@ Lips	Blade	LMA	RR	HR	MAP
< 1	2.5	7 cm	Mil 0	1	< 60	140s	30s
1-2	3	8 cm	Mil 0	1	< 60	140s	30s
2-3	3.5	9 cm	Mil 0-1	1	< 60	130s	30s
> 3	3.5-4	10 cm	Mil 0-1	1	< 60	130s	40s

Labor Analgesia

Cover T10-L1 1st Stage; S2-4 2nd Stage

Misc.
- Breathing techniques; ambulation; subQ sterile water injections

N_2O
- AKA Nitronox: 50/50 N_2O/O_2; requires 45-60 sec to peak
- Nausea, dizziness common
- N_2O possibly teratogenic; do NOT use during 1st trimester

Epidural

'Standard' Recipes
- **Epinephrine** – 2 mcg/mL
- **Fentanyl** – 2 mcg/mL
- **Clonidine*** - 50-100 mcg bolus (wait 10 min) then 1-2 mcg/mL
  *Black box warning for maternal hypoTN and bradycardia

Initiation
- Lidocaine 1.5% + epi 1:200K test dose, 3-5 mL, consider w/holding epi in hypertensive/cardiac patient
- 10-15 mL manual bolus of infusate (5 mL divided doses)

PCEA
(bolus/lockout/rate/hr limit)
- 0.08% bupiv 8 mL / 8 min / 8 mL / 32 mL
- 0.1% bupiv 5 mL / 10 min / 8 mL / 32 mL

PIB
0.0625-0.1% Bupiv +/- fentanyl 5-10 mL q 30 min;
PCEA 5-10 mL q 10-15 min

- Assisted Vaginal delivery w/ epidural in place: if vacuum AVD, may need nothing extra; if forceps AVD, 5-10 mL1-2% lidocaine +/- $NaHCO_3$
- Lac repair: 5-10 mL 2% lidocaine

CSE combined spinal-epidural
- Bupiv (*isobaric*) 0.25% 1-2 mL IT +/- 10-25 mcg fentanyl
  ***CAUTION W/ BOLUSING epidural except 3 mL test dose – risk high spinal

DPE dural puncture epidural
- After LOR w/ Tuohy, insert spinal needle until CSF return. Do NOT inject IT meds. Remove spinal needle & insert epidural catheter — Chau et al, *A&A*, 2017
- Advantage over CSE: early recognition of epidural failure

SSS single shot spinal
- Bupiv (*isobaric*) 0.25% 1-2 mL +/- 10-25 mcg fentanyl
- Usually multip fully dilated, analgesia lasts < 90 min
- Assisted Vaginal Delivery: < 30 mg mepivacaine 1.5%, < 30 mg 3% chloroprocaine, or 2.5-5 mg bupiv

Labor Analgesia (cont)

Narcotic
- Morphine "sleep": 10-20 mg morphine IM +/- 25-50 mg hydroxyzine (or 25 mg promethazine) IM/PO
- Fentanyl: 1 mcg/kg IV single dose prior to c-section, no adverse effects, possibly preferable to meperidine — Frolich et al, *Can J Anaesth*, 2006
- Meperidine/Pethidine: Most commonly used worldwide; IM 50-100 mg (peak 30-50 min); IV 25-50 mg; DOA 2-4 hr; Possibly less ↓ RR vs morphine; May ↓ FHR variability — Rayburn et al, *Am J Obstet Gyn*, 1989

Remifentanil PCA
- Typically reserved for patients w/ neuraxial contraindications
- Initial dose: 20 mcg/inj or 0.25 mcg/kg ideal body weight (IBW)
- Lockout: 2 min, no basal
- ↑ 10-20 mcg q 10 min or q 3 contractions up to ~ 50-80 mcg (Typically: ~ 30-40 mcg in latent labor, 50-60 mcg during active labor)
- 30-60 sec onset; peak 2.5 min; half life ~3.5 min
- Maternal, fetal, placental esterases limit fetal effect
- Supplemental O_2 and continuous SpO_2 required
- Peds should be present at delivery

Continuous Spinal
- Thread catheter: bolus 0.25% isobaric bupiv 1 mL; run bupiv 0.25 % at 1 mL/hr and titrate (1-3 mL/hr) to effect. no patient-administered bolus.
  Clearly label catheter and pump as intrathecal catheter. Alert nursing and OB team. Follow anticoag guidelines.

Labor Epidural Troubleshooting

CAUTION BOLUSING IF HYPOTENSION OR FETAL DISTRESS
- Were expectations set? - Did epidural ***catheter*** ever work?
- Check connections & ensure running; check if bolus button used.
- Is pain due to lack of volume/spreading or lack of density or both?
  - Check a level.
  - If volume/spreading issue, give a bolus and ↑ basal rate.
    - Consider ~ 10 mL 0.125% bupiv or ~ 6 mL 0.25% bupiv
    - Consider pulling catheter back 1-2 cm
  - If density issue, add adjuncts (fentanyl, epi, clonidine) vs. ↑ bupiv conc
- Consider fentanyl 100 mcg epidural bolus in 2nd stage.
- Strongly consider early catheter replacement; # of boluses predicts failure.

Non-OB Surgery in Parturients

- Prefer elective surgery in 2nd trimester (post organogenesis; ↓ risk of preterm labor compared to surgery during 3rd trimester)
- Avoid N_2O in 1st trimester
- FDA 2014: pregnant women in 3rd trimester w/ GA > 3 hr may affect the development of children's brains (propofol, ketamine, bdzs, barbs, and volatiles)
- FHR: pre/post if pre-viable; consider continuous and c-section readiness if viable
- LUD if > 20 wks — Koren G et al. *N Engl J Med, 1998*

Elective C-Section - Neuraxial Anesthesia

Goal: T4-6 surgical level of anesthesia
Preop: NaCitrate 15-30 mL PO +/- ondansetron 4 mg IV +/- metoclopramide 10 mg IV

Spinal
- 12.5-15 mg 0.5-0.75% hyperbaric bupiv +/- 10-15 mcg fentanyl +/- 100-150 mcg morphine +/- 50-100 mcg epinephrine
- Duramorph: Peaks at 2 hr *and* 6-12 hr, thus only for postop pain; Dose > 200-300 mcg = ↑ side effects
- 0.75% bupiv may have better density than 0.5% bupiv; 1% results in ↑ backaches
- IT lidocaine 2% (3-4 mL; DOA 30-45 min); lidocaine 5% (1-1.5 mL; DOA 60-90 min)
- Will likely need vasopressor support: consider phenylephrine gtt

Epidural

Lidocaine 2% + 1:200K epi + NaHCO3 - Recipe: 20 mL lido 2% + 100 mcg (0.1 mL 1:1000 amp) epi + 1 mL NaHCO3 8.4%, redose 5 mL~ q 45 min, ~ 20-30 mL needed
Additives: Fentanyl 100 mcg epidural after T4 level achieved. Duramorph 2-3 mg epidural at *end of case*

Continuous Spinal
- 0.5% isobaric bupiv 1 mL bolus to effect (10-15 mg total dose) +/- 15 mcg fentanyl +/- 100-150 mcg morphine — Gehling et al, *Anaesthesia*, 2009

Urgent C-Section - Neuraxial Analgesia*

Spinal
As above for Elective. *Caution if recently bolused epidural.

Epidural
Lidocaine: As above for Elective. ~15 mL needed if epidural was running before
Chloroprocaine: Recipe: 20 mL chloroprocaine 3% + 1 mL NaHCO3 8.4%, redose 5 mL ~ q 30 min; chloroprocaine inhibits action of epidural morphine

Emergent C-Section - Neuraxial Anesthesia*

Spinal
As above for Elective. *Caution if recently bolused epidural (high spinal risk)

Epidural
Chloroprocaine: - Recipe: 20 mL chloroprocaine 3% + 1 mL NaHCO3 8.4%, redose 5 mL ~ q 30 min; chloroprocaine inhibits action of epidural morphine

Emergent C-Section - General Anesthesia*

Call for help, AMPLE Hx
***Ask OB if time for neuraxial. If yes, see above, otherwise:**
IV access, NaCitrate, pulse ox, **LUD**, pre-oxygenate 4 breaths
ENSURE OBs PREPPED AND DRAPED BEFORE INDUCTION
RSI w/ cricoid: Sux 1.5 mg/kg + (propofol 2-3 mg/kg or etomidate 0.2 mg/kg or ketamine 1-2 mg/kg or thiopental 4-5 mg/kg)
Once ETT 6.5 placement verified, **INSTRUCT SURGEONS TO "CUT"**
High gas flow and 2 MAC volatile ***until*** cord clamp. Try to avoid benzos/narcotics
(0.5 MAC volatile + 70% N_2O) or TIVA ***after*** cord clamp. Benzos/narcotics OK
When stable: Time out, ABX, OGT, +/- NMB; consider post-op TAP block, PCA

*If c-section for fetal distress, improve oxygen to baby: **SPOILT** (**S**top oxytocin, **P**osition (LUD), **O**xygen, **IV** fluid, **L**ow BP (give pressor), **T**ocolytics (terbutaline 250 mcg subQ; consider NTG SL spray 400 mcg x 2)

Neuraxial Troubleshooting for C-Section

If inadequate anesthesia from neuraxial:
- Consider redoing neuraxial immediately or after worn off, if time allows
- Ensure epidural adjuncts: 1:200K epi, fentanyl 100 mcg; consider epidural clonidine (caution black box warning for maternal hypoTN and bradycardia)
- Consider IV bolus of fentanyl, midazolam, ketamine, and/or meperidine (let peds know of IV meds)
- Local anesthetic infiltration by surgeons
- Consider N_2O
- Consider GETA

Consider TAP block postop — Kagwa et al, *The Lancet*, 2015

C-section Antibiotics

Low-risk	Cefazolin 2 gm IV (3 g if ≥ 120 kg) x 1 (Re-dose if surgery ongoing > 4 hr since 1st dose or blood loss > 1500 mL)
PCN-allergic	Clindamycin 900 mg IV x 1 & Gent 5 mg/kg IV x 1 ** Gent dose based on actual weight. If actual weight > 20% ideal body weight (IBW), use dosing weight ***dosing weight** = (adj BW) = IBW + 0.4(actual weight – IBW) (Re-dose clindamycin, NOT gent, if surgery ongoing > 6 hrs or blood loss > 1500 mL)
High-risk (discuss w/ OB)	Cefazolin as above & Azithromycin** 500 mg IV x 1 **Infuse over 1 hr, faster rates associated w/ local IV site rxn (Do NOT re-dose Azithromycin)

PDPH Management

- Check BP to rule out pre-E — Katz et al, *A&A*, 2017
- Consider caffeine 300 mg PO x 1, hydration, or fioricet 2 tabs PO q 8 hr ATC immediately PP. **These conservative measures have limited efficacy
- Epidural blood patch (EBP): **Best evidence; inject autologous blood until pt feels back pressure or 20 mL; 80-90% effective; consider fluoroscopy if difficult

Neuraxial Risks & Contraindications

Risks:
1:100 wet tap; **1:100** HA; 7% failure rate (3.5% if CSE)
1:10,000 nerve injury (lasting weeks to months)
1:150,000 hematoma/infection (**1:250,000** permanent severe neuro deficit)
- "bloody tap" = 10 x ↑ risk epidural hematoma

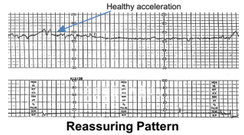
1:20 postpartum women **w/o neuraxial** have postpartum sensory deficit by exam

Effect of epidural on labor:
- No RCTs for labor so best study compares early vs. late epidural
- 1st stage shortened vs. no change, 2nd stage prolonged by ~ 30 min
- ? more instrumented deliveries with epidural
- No difference in c-section rate — Wong, *NEJM*, 2005

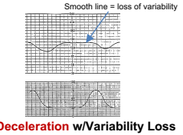
Contraindications:
- Volume depletion, sepsis w/ potential for hemodynamic instability, coagulopathy, local infection, neuro deficits, ↑ ICP, patient refusal

Fetal Hear Rate Monitoring

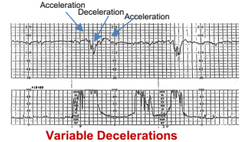
Category I	- Normal HR 110-160 bpm, moderate variability (6-25 bpm, peak to 15 bpm above baseline x 15 sec), +/- early decels; +/- accels - Occurs in 99% of all parturients = ~ normal
Category II	- All non-category I or III; 'atypical'; occurs in 84% of all parturients
Category III	- Sinusoidal OR, no variability AND: recurrent late decels OR recurrent variable decels OR bradycardia - Occurs in 0.1% of all parturients — Macones et al, *Obstet Gyn*, 2008



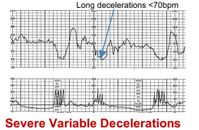
Reassuring Pattern



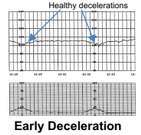
Late Deceleration w/Variability Loss



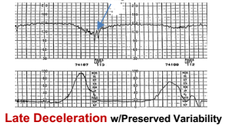
Variable Decelerations



Severe Variable Decelerations



Early Deceleration



Late Deceleration w/Preserved Variability

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