Emergency Manual, Processes and Guidelines for Obstetric Anesthesia

Obstetric Anesthesiology
Department of Anesthesia, Critical Care and Pain Medicine
Beth Israel Deaconess Medical Center

Version 1.0

Beth Israel Lahey Health
Beth Israel Deaconess Medical Center

Preface

Division of Obstetric Anesthesia in the Department of Anesthesia, Critical Care and Pain Medicine at Beth Israel Deaconess Medical Center was credentialed as a CENTER OF EXCELLENCE by Society for Obstetric Anesthesia and Perinatology in 2019.

The division had been led by our extraordinary founders Dr. Nancy Oriol and Dr. Phil Hess for 40+ years.

The cognitive aids contained within this emergency manual concentrate our institutional tradition and achievements along with significant contributions from our young star physicians. It contains recommendations as well as descriptions of safety and standards. The recommendations are advisory in nature, informational in content and are intended to assist anesthesiologists in providing safe and standardized care in Obstetric Anesthesia.

All content subject to change, updates and addition.

Yunping Li, MD

Contents

PART I

General Information

Important Phone Numbers

Blood Bank East	667-4480
Blood Bank West	754-4330
Blood Bank Resident	p 30003
Anesthesia Office (W)	754-2675
Anesthesia Office (E)	667-3112
Holding area -Shapiro	667-0200
Holding area – Feldberg	667-5663
Holding area – West	754-3100
ICU	
FICU Finard	667-3124
SICU A CC6	754-3250
SICU B CC6	754-2930
T/SICU CC5	754-3130
MICU A	754-3270
MICU B	754-3180
L&D Anesthesia Tech	p 31047
L&D nursing station	667-2295
L&D OR A	667-2354
L&D OR B	667-2455
L&D OR C (Anesthesia)	667-2273
L&D OR C (Nurse)	667-2525
OB Anesthesia Office	667-3077
OB Anesthesia Consult	667-3353
OR front desk – East	667-2411
OR front desk -West	754-3000
PACU Feldberg	667-3905
PACU Shapiro phase I	667-0300
PACU Shapiro phase II	667-4790
PACU West	754-2800

Pharmacy	
East main	667-4247
West main	754-3808
Pharmacy administrator on call	
	P 92428
Radiology	
CT – West	754-2568
CT – East	667-5711
MRI – West	754-2099
INR West	754-2663
IR West	754-2552
IR East	667-2103
Remote	
Cath Lab holding	632-7447
Cath Lab rm 6	632-7476
Cath Lab rm 7	632-7477
ECT	632-8355
Stat Lab	
East	667-5227
West	754-3230
ABG, East	667-3131
Workroom – Feld	667-4481
Workroom – Shapiro	667-3432
Workroom – West	754-3098
Combos	
Blue Bell	31231
Epidural Pump	123
Epidural Carts	3123
L&D utility room	13975
L&D restroom	12345
OB Call room (Attending)	234
OB Anesthesia Office	12345
Workroom	312

COMMONLY USED MEDICATIONS IN OBSTETRIC ANESTHESIA

Azithromycin

- 500mg, diluted in 20ml of NS/LR, infuse slowly over 1 hour.
- 4mg of ondansetron IV before infusion due to significant nausea and vomiting
- Indications: intrapartum cesarean section, spontaneous rupture of membranes

Reference: NEJM 2016; 375:1231-1241

Bicitrate

- 30ml per container
- PO, before epidural placement and before cesarean section

3% Chloroprocaine

- Alkalization of chloroprocaine: in a 30-ml syringe, add 2ml of 8.4% bicarbonate to 20ml of preservative free (PF) 3% chloroprocaine
- Use for emergent cesarean section or for forceps delivery
- **STAT Cesarean Kit**: prepackage in OB Anesthesia Office:
  (1) 3% chloroprocaine (1) 8.4% bicarbonate (1) 30ml syringe (1) blunt needle.
  Replace it after use.

Dexmedetomidine

- Dilute 200 mcg in 20 ml of NS, final concentration 10 mcg/ml.
- Indications:
  - Severe shivering after delivery: 10 mcg IV, may repeat up to 30 mcg
  - Severe pruritus associated with epidural fentanyl, see separate chapter

Reference: SOAP annual meeting abstract 2019

Ephedrine

- Premixed by pharmacy, 5mg/ml
- Historically, ephedrine was used as the "Gold standard" for spinal hypotension.
- Higher placental transfer than phenylephrine; it can cause clinically insignificant fetal acidosis.
- Since late 1990s, used as a second line medicine for maternal hypotension.

Reference: Am J Obstet Gynecol 1968;102:911 Anesthesiology 2009; 111:506-12

Epinephrine

- Add 250 mcg to 150 ml premixed bupivacaine/fentanyl epidural solution; final concentration of epinephrine will be 1.67 mcg/ml
- Add 5mcg/ml of epinephrine into 2% lidocaine for cesarean section
- Mechanism: alpha -2 synergic effect, alpha-1 vasoconstriction to prolong the duration of anesthesia and decrease systemic absorption.

Reference: J Anesth Perioper Med 2019; 6:1-7

2% Lidocaine

- Alkalization of lidocaine: in a 30-ml syringe, add 2ml of 8.4% bicarbonate to 20ml of preservative free (PF) 2% lidocaine
- For cesarean section, add 5mcg/ml of epinephrine

Magnesium

- 2g/hr as maintenance dose
- For preeclampsia, continue magnesium for entire cesarean delivery
- For fetal neuroprotection, discontinue magnesium after delivery

Reference: The Magpie Trial. Lancet 2002;359:1877-90

COMMONLY USED MEDICATIONS IN OBSTETRIC ANESTHESIA

Morphine PF

- 0.5mg/ml for spinal use; 1mg/ml for epidural use
- Pre-made by pharmacy, store at 4°C
- Indications: Cesarean delivery- spinal 250mcg, epidural 3mg
  Labor CSE for dysfunctional labor – spinal 100 mcg
  S/p 3rd degree vaginal laceration repair – epidural 2mg
- Refer to separate chapters for details

Nitroglycerine

- 400mcg/ml, light sensitive. Kept in Omnicell the same drawer with oxytocin. Dilute to 40 mcg/ml or 100 mcg/ml.
- Dose: 80-100 mcg IV, may repeat, titrate to effect
- Indications: cervico-uterine relaxation, uterine inversion, difficult extraction at cesarean delivery

Reference: Am J Obstet Gynecol 1998; 179:813

Phenylephrine

- Pre-made by Pharmacy, 100 mcg/ml
- Indications: first line medication for maternal hypotension
- Phenylephrine use is associated with a decrease in maternal cardiac output, but the clinical significance is not clear
- Infusion 0.5-0.7 mcg/kg/min or bolus 100mcg, titrate to effect

Reference: Anesth Analg 2012; 114:377

Terbutaline

- 1mg/ml, use 0.25mg SC, administrated by L&D nurse
- Indication: Tachysystole contraction with associated FHR changes
  Before external cephalic version (ECV) at Obstetrician's discretion

ACOG Practice Bulletin No. 106

Tranexamic acid

- 1 gram (10ml), infuse over 10 min
- Treatment of postpartum hemorrhage (PPH) after vaginal or Cesarean delivery
- Prophylaxis in patients at high risk for PPH, or women with hypertensive disorder or asthma
- Discourage use of TXA for prophylaxis in low risk women
- Exclusion: Hx of DVT/PE/MI/CVA, metastatic neoplasm, or acquired color blindness.
- Decreased dose (5mg/kg) for renal failure

Reference: NEJM 2018; 379:731-42. Lancet 2017;389:2095-16

Uterotonics

- Including oxytocin, methylergonovine (Methergine), carboprost (Hemabate), misoprostol (Cytotec) and calcium chloride
- Refer to separate chapter for details

Yunping Li, MD

OB Anesthesia dosage cookbook

LABOR

Spinal

Contents:

Fentanyl 12.5mcg
Bupivacaine 2mg
Premixed in Omnicell

Mix 0.25cc of Fent (50mcg/cc) with 0.8cc of Bupivacaine (0.25%)

Epidural

Contents:

Bupivacaine 0.04% +
Fentanyl 1.67mcg/cc.
May add 0.25cc of epinephrine to 150 cc bag (1.67 mcg/cc).

Top up: 10-15 cc of BEF or 5-10 cc of 0.0625% or 0.125% bupivacaine
Add 50-100 mcg of fentanyl for synergy

Bicarbonation

	Drug	HCO_3
Lidocaine	10cc	1cc
CPC 3%	10cc	1cc
Bupivacaine (will precipitate)	10cc	0.1cc

C/S

Spinal

Contents:

Fentanyl 25mcg
Bupivacaine 11.25mg

Mix
0.5cc of Fent (50mcg/cc) with 1.5cc of Bupiv 0.75% (hyperbaric)
May also be mixed with preservative free (PF) morphine 0.25mg (0.5cc)

Epidural

Contents:

Lido 2% x 15-20 cc +
Fent 100 mcg (2cc)

Inject divided doses (3-5cc at a time)

After delivery: may give Morphine (PF) 3mg (6cc). Lido may be replaced with: 0.5% bupivacaine or Chloroprocaine (CPC3%)

Uterotonic agents

Oxytocin: 20 IU in 1L of LR
Beware hypotension
Methergine 0.2mg IM ***not*** IV
Beware hypertension
Hemabate 250µg IM or Intrauterine ***not*** IV
Beware bronchospasm
Cytotec (misoprostol) 1 mg PR

Tranexamic Acid

Background: Obstetric hemorrhage is the leading cause of maternal mortality worldwide. Despite active management during the third stage of labor, postpartum hemorrhage remains a problem and is increasing in the United States, primarily due to the increasing incidence of atony.[1] Tranexamic Acid (TXA) is a lysine analogue and works by binding to plasminogen, thereby inhibiting fibrinolysis. TXA has been used for years in the management and prevention of hemorrhage in the surgical setting including cardiac, orthopedic and trauma surgery.[2,3]

Prior studies have established the safety and efficacy of using TXA in the treatment of PPH. More recently, a large multi-center international RCT (The WOMAN trial) demonstrated a significant reduction in postpartum hemorrhage and death due to bleeding when TXA was used early in the treatment of PPH.[4] Although there is significantly less data, a few of other small studies have demonstrated its efficacy in preventing postpartum hemorrhage in patients at both average or increased risk when given either prior to or immediately after delivery in cesarean deliveries.[5,6] Although less well studied, TXA has also been used to prevent PPH in vaginal delivery.[7] Despite concerns for potentially increasing thromboembolic events, no study to date has indicated any increased risk in gravid patients receiving TXA. Given this data, our goals are outlined below.

Goals:

1. To reduce the incidence of postpartum hemorrhage in patients at high risk for hemorrhage due to known risk factors
2. To reduce the severity of postpartum hemorrhage once a patient has been identified as having a hemorrhage (EBL > 500 ml in vaginal delivery or > 1000 ml in Cesarean delivery)

Clinical Practice:

1. Prophylactic use: Consider prophylactic use in cesarean or vaginal delivery with patients at increased risk for hemorrhage (see criteria below), especially in circumstances where uterotonics may be contraindicated. Discuss possible use at briefing or at team meeting.
2. Therapeutic use: Consider use when patient has been identified as having a hemorrhage. Team agreement prior to administration.

Method of administration:

Dosage: 1 gram given intravenously over 10 minutes. Possible methods of administration include 1g diluted into 10 ml of normal saline or 1g diluted into 100 ml of normal saline.

Timing: Administer **immediately** after delivery of baby in either vaginal or cesarean delivery, or when hemorrhage has been identified. Consider redosing 1g after 30 minutes in continuing hemorrhage. Consider infusion (5mg/kg/hr) if prolonged bleeding period is expected.

Side effects:

Minor: nausea, vomiting, GI upset, headaches, dizziness, hypotension, color blindness

Major: thromboembolic complications (PE, DVT, MI), seizure, anaphylaxis

At increased risk for hemorrhage:

- Abnormal placentation (previa, accreta)
- Polyhydramnios
- History of prior postpartum hemorrhage
- Multiple gestation
- Grand multiparity
- Chorioamnionitis
- Fetal macrosomia (fetal weight > 5000 g)
- Morbid obesity (BMI > 40)
- Known coagulopathy
- Retained placenta
- Suspected placental abruption
- Prolonged induction

Contraindications:

- History of thromboembolic disease (DVT, PE or CVA)
- History of ischemic heart disease
- Known disorder of hypercoagulability (ex. Factor V Leiden)
- Prior reaction to TXA

Relative contraindications:
Oliguria

References

1. Incidence, risk factors and temporal trends in severe postpartum hemorrhage. Kramer S, Berg C, Abehmaim H, Dahhou M, Rouleau J, Mehrabadi A, Joseph KS. American Journal of Obstetrics and Gynecology 2013. Nov 1; 209(5):449.e1-449e.7
2. Efficacy of tranexamic acid on surgical bleeding in spine surgery: a meta-analysis. Cheriyan T, Maier SP 2nd, Bianco K, Slobodyanyuk K, Rattenni RN, Lafage V, Schwab FJ, Lonner BS, Errico TJ Spine J. 2015 Apr 1; 15(4):752-61.

3. CRASH-2 trial collaborators, Shakur H, Roberts I, Bautista R, Caballero J, Coats T, et al. Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant hemorrhage (CRASH 2): a randomized placebo-controlled trial. Lancet 2010; 376:23–32.

4. WOMAN Trial Collaborators. Effect of early tranexamic acid administration on mortality, hysterectomy, and other morbidities in women with post-partum haemorrhage (WOMAN): an international, randomized, double-blind, placebo-controlled trial. Lancet 2017; 389:2105–16
5. Randomized controlled trial of tranexamic acid among parturients at increased risk for postpartum hemorrhage undergoing cesarean delivery. Sujata N, Tobin R, Kaur R, Aneja A, Khanna M, Hanjoora V. International Journal of Gynecology and Obstetrics. 2016; 133:312-315.
6. Novikova N, Hofmeyr GJ, Cluver C. Tranexamic acid for preventing postpartum haemorrhage. Cochrane Database of Systematic Reviews 2015, Issue 6. Art. No.: CD007872. DOI: 10.1002/14651858.CD007872.pub3.
7. Gungorduk K, Asicioglu O, Yildirim G, Ark C, Tekirdag AI, Besimoglu B. Can intravenous injection of tranexamic acid be used in routine practice with active management of the third stage of labor in vaginal delivery? A randomized controlled study. American Journal of Perinatology 2013;30 (5):407–13.

Phil Hess, MD

PART II

Obstetric Emergencies

ACLS IN PREGNANCY

Cardiac arrest in pregnancy follows the SAME algorithms and principles in AHA Guidelines, but has a few IMPORTANT DIFFERENCES, which will be highlighted here

CHEST COMPRESSIONS ARE IDENTICAL (no longer recommended to go higher), CODE MEDICATIONS ARE SAME DOSAGE, DEFIBRILLATION VOLTAGE IS IDENTICAL AS NON-PARTURIENTS.

REMEMBER TO CALL FOR HELP, CALL FOR A CODE BLUE AND OB EMERGENCY, which will alert OB staff and NICU, as a STAT Cesarean delivery is a likely outcome.

Location of Code Cart: Alcove between room 7 and 8

CONTINUOUS LEFT UTERINE DISPLACEMENT (LUD) IS ESSENTIAL TO MINIMIZE AORTOCAVAL COMPRESSION—WHICH RENDERS CPR INEFFICIENT. Continuous MANUAL LUD is likely the best form of LUD

Prefer IV's ABOVE the diaphragm since venous return is hindered
Place lateral defibrillation pad below breast tissue **Before administering a shock consider removing fetal monitors if it can be done quickly, do not delay shock for that concern**
If patient is on Magnesium, d/c the Magnesium and strongly consider administrating calcium
Prepare to face a DIFFICULT AIRWAY IN PREGNANCY. First attempt by senior provider with a smaller ETT (6.5)
If no ROSC after 4 minutes, call for a STAT Cesarean delivery ON SITE. **Baby's delivery will improve mother's hemodynamics and chances for ROSC** **Delivery within 5 minutes**
Assess possible etiology of arrest. Hypoxemia should be considered as a cause, O2 reserves lower (LOW FRC) and the metabolic demands are higher in the pregnant patient.

Etiology ABCDEFG:

Anesthesia complications: high/total block, hypotension, airway loss, aspiration, respiratory depression, LAST
Accident: trauma, suicide

Bleeding: massive hemorrhage, coagulopathy, uterine atony, placenta accreta, placental abruption, placenta previa, retained POC, uterine rupture, surgical (retroperitoneal), transfusion reaction

Cardiovascular: MI, peripartum cardiomyopathy, aortic dissection, arrhythmias, valve disease, CHD

Drugs: oxytocin, Magnesium, drug error, illicit drugs, opioids, insulin, anaphylaxis

Embolic: amniotic fluid, air, PE, stroke

Fever: sepsis

General H's & T's

Hypertension: preeclampsia, eclampsia, HELLP

Cardiac Arrest in Pregnancy A Scientific Statement from the American Heart Association Farida M. Jeejeebhoy et.al. 6 Oct 2015**https://doi.org/10.1161/CIR.0000000000000300**Circulation. 2015; 132:1747–1773
Advanced Cardiac Life Support of the Pregnant Patient Chapter 17 Robert A. Raschke

Lior Levy, MD

Amniotic Fluid Embolism

Introduction

A syndrome of 3H's – Hypoxia, Hemodynamic collapse, Hemorrhage
Low frequency 1:8,000 deliveries, but High clinical acuity, High mortality condition.

Very high mortality (50% will die in the first hour, another 10-20% in the next 5 hours). Overall 40-80% mortality with at least 50% permanent neurological damage in survivors.

High vigilance, prompt resuscitation and modern ICU have significantly improved outcomes.

Etiology

Disruption of the fetal/maternal interface w/ fetal debris in the maternal circulation causing an abnormal activation of anaphylactoid inflammatory response. AFE during labor (70%), during 3rd stage (10%), during c-section (20%), or even during postpartum. Occasionally occurring in 1st or 2nd trimester or during termination of pregnancy.

Risk factors

Operative (forceps) vaginal or cesarean delivery, placenta previa, accreta, abruption, meconium, and induction of labor. Other: cervical lacerations, uterine rupture, eclampsia, polyhydramnios, multiple gestation.

Pathophysiology

Passage of amniotic fluid into maternal blood releases pulmonary vasoconstrictors, causing acute RV and late LV failure, cardiopulmonary collapse, severe hypoxemia; Activation of FVII and platelet causes DIC, hemorrhage and organ failure.

Diagnosis

- AFE remains a clinical diagnosis. AFE causes a SUDDEN change in clinical presentation. NOT initially via diagnostic modality such as TEE/TTE.
- Must quickly exclude other possible primary causes such as anaphylaxis, eclampsia, seizure disorder, venous air embolism, PE, total spinal.
- Many patients will initially exhibit sense of doom, anxiety, altered mentation, possible bronchospasm in 15% only.
- Progression to cardiac arrest, PEA, VF, or VT is rapid in severe cases. Gravid patient may have fetus with terminal bradycardia secondary to poor uterine perfusion.

Clinical Responses to AFE From an Anesthesiologist Perspective

Call for Help

- call for **code cart**, high quality **CPR**, consider **massive transfusion protocol** activation.
- Place patient in left uterine displacement **(LUD)** to reduce aortocaval compression
- Consider **early intubation**
- Place additional **Central Line** and **arterial access**
- **Cesarean delivery** indicated if no maternal ROSC after 4minutes
- **Overall Goals: Oxygenation, cardiovascular support, treatment of coagulopathy**

Early Phase: characterized by RV failure.

- Consider **TTE/TEE** for fluid resuscitation
- Consider **norepinephrine, dobutamine, milrinone**.

Second Phase: characterized by LV failure.

- Avoid fluid overload which exacerbates RV function and thus LV function.
- Pressors: **norepinephrine, epinephrine, dobutamine, milrinone or vasopressin**.

DIC Phase (later): Severe coagulopathy can occur early and late. DIC is present in 83%.

- Aggressive treatment of uterine atony and repair other bleeding sites.
- Blood products in **1:1:1**
- **TEG** guidance for replacement
- TXA and rVIIa are controversial

Drugs for cardiovascular support in AFE (RV support)

Sildenafil (20mg via NG)	Dobutamine (2.5-5.0 mcg/kg/min)
Milrinone (0.25-0.75mcg/kg/min)	Inhaled NO (5-40ppm)
Inhaled prostacyclin (10-50ng/kg/min)	IV prostacyclin 1-2ng/kg/min
Norepinephrine (0.025-0.5mcg/kg/min)	Epinephrine (0.03-0.5 mcg/kg/min)

Additional Thoughts

- Post-ROSC mild hypothermia (32-36C for 12-24 hour) treatment is indicated
- Treatment with PVR reduction is indicated- prostacyclin, inhaled NO, sildenafil

Society for Maternal Fetal Medicine (SMFM). Amniotic Fluid embolism; diagnosis and management. Am J Obstet Gynecol 2016;215: B16-24

Joan Spiegel, MD

Caring for patients with Preeclampsia (PEC) and Eclampsia

Review: Pathophysiology and Clinical Diagnosis of PEC

- Multisystem disease attributable to endothelial dysfunction
- Clinically defined by **new onset**, **after 20 weeks gestational age**, of **hypertension** (SBP > 140 mm Hg or DBP > 90 mm Hg) plus **one or more systemic manifestations**
- Early onset (< 34 weeks GA) typically carries greater risk of severe disease and maternal/fetal complications
- Occurrence of seizures not attributable to any other cause = Eclampsia (may be a presenting sign)

Systemic manifestations

Feature	Clinical criteria
Proteinuria	> 300 mg over 24h, or Protein: creatinine ratio > 0.3
Thrombocytopenia	< 100,000 / uL
Renal insufficiency	Serum Cr > 1.1 mg/dL, or doubling from baseline
Liver dysfunction	Transaminases > 2x baseline
Pulmonary edema	Low pulse OX reading
Cerebral symptoms	Unexplained HA not responsive to medical treatment, or visual disturbance

Potential Complications

Cardiomyopathy	Pulmonary edema
Seizure	Intracranial hemorrhage
Thrombocytopenia	Stroke
DIC	Renal failure
Hepatic injury/rupture	Liver subcapsular bleeding
Fetal growth restriction	Placental abruption

Clinical Management

Obstetric decision-making guidelines

*PEC **without** **severe features*** → expectant management until 37 weeks GA, then IOL (or CD)

*PEC **with** **severe features, > 34 weeks GA OR < 34 weeks GA with any clinical instability***
→ delivery soon after maternal stabilization

Intrapartum management cornerstones:

1. BP monitoring and treatment
   - At least once per hour pre-delivery
   - Target SBP < 160, DBP < 110 mm Hg. Be aware that excessive lowering BP can cause a rapid decrease in uteroplacental perfusion.
   - 1st –line therapy: labetalol. 2nd-line: hydralazine, nifedipine

2. Seizure prophylaxis – $MgSO_4$
   - 4-6g bolus followed by 1-2g/h infusion (renally cleared; reduce dose if renal insufficiency)
   - Target range: 4.8-8.4 mg/dL
   - Signs of toxicity: loss of DTR (9.6-12 mg/dL), hypotension, respiratory depression (12-18 mg/dL), hypoxia, EKG changes and cardiac arrest (24-30 mg/dL)
   - Treatment of Magnesium toxicity: $CaCl_2$ intravenously

3. Mild fluid restriction (< 1 mL/kg/h maintenance during L&D)

1. Eclamptic seizure treatment
   - 1st-line: $MgSO_4$ (4g bolus over 5min, then 1g/h infusion)
   - Adjuncts: benzodiazepines, phenytoin
   - Consider alternative causes (LA toxicity, electrolyte derangement)
   - Fetal bradycardia is common due to temporary hypoxemia and hypercarbia, not a necessarily indication for STAT cesarean delivery

Anesthesia Considerations

1. Check platelets prior to neuraxial in any patient with hypertension
2. General anesthesia is less desirable due to the risk of severe hypertension/cerebral hemorrhage with intubation/extubation and possible difficult intubation
3. Spinal anesthesia for cesarean delivery is not contraindicated
4. Consider early epidural or epidural with dural puncture for labor analgesia if platelet is trending down.
5. Fluid restriction (preload/co-load not necessary in PEC; judicious crystalloid use in CD)
6. Beware Magnesium toxicity, especially if renal impairment
7. Beware high risk of postpartum hemorrhage
8. Uterotonic agents: Avoid Methergine. Consider Tranexamic acid and calcium chloride in addition to regular uterotonic agents.
9. Avoid ketorolac if renal insufficiency

Erin Ciampa, MD, PhD

Accreta/Percreta Preparation

OR PREPARATION

Right side of bed

Arterial line transducer
Infusion pump with large neo stick primed
Infusion pump with large norepi stick, not primed
Infusion pump with large epi stick, not primed
Plasmalyte with blood tubing through Ranger warmer
LR with microdrip tubing through gang of 5 (to 20g IV)

Left side of bed

Belmont rapid infuser
Plasmalyte through Belmont
Second Ranger with Plasmalyte with blood tubing

Extra equipment

Red hemorrhage folder contains all necessary paperwork.
Pre-fill ABG and lab paperwork
Patient labels prepped (name, phone extension, date)
SuperSTAT stickers
Bair Hugger X 2 (underbody and upper)
Activate PPV on aline waveform on monitor
Take head segment off top and put on foot end
Ensure RIC kit and CVL kit (MAC line) available in emergency cart

PHARMACY

Workroom Omnicell

Calcium chloride (5) (may need to call pharmacy 7-4247)
50ml phenylephrine & norepinephrine

OR Omnicell

Confirm Hemabate and methergine available in OR fridge (2 of each)

Reminders

Re-dose cefazolin with 1.5L blood loss
1gm TXA load after delivery
Re-dose TXA if excessive bleeding, consider infusion

Accreta/Percreta Preparation

FROM BLOODBANK

Cooler with 4 RBC, 2 FFP to start
Massive transfusion protocol, as needed. Change ratio to 1:1 if fibrinogen <300 mg/dl

DURING CASE

Move regional cart and other equipment out of room after use (create space)
Move nursing computer workstation out of room
Move cysto tower out of room when done
OR C has metal cart used for papers / blood cooler
Make sure nursing is prepared to weigh lap pads

PATIENT PREP

16G or 14G peripheral IV (X2)
Radial arterial line (better on right but not important)
20G IV for infusions (good vein so can be changed for RIC in OR)
CSE or CSE -> GA, as per plan for individual patient

EMERGENCY PHONE #S

Blood bank 7-4480 **All communication is through the blood runner ONLY**
Main Pharmacy 7-4247
STAT Lab 7-1493
STAT lab ABG- 73131
Perfusion pager on-call schedule (should put # on board if they step out)

Workflows for PPH

Additional Monitoring	Medications	Laboratory Test	Transfusion
☐ Arterial line ☐ PPV – validated in non-intubated patients (AA 2015;120:76-84) ☐ Base excess – with prognostic value (M Colella et al. SOAP annual meeting, 2018) ☐ Lactic acid ☐ Quantitative Blood Loss (QBL): ask the circulating nurse ☐ Temperature ☐ Urine output ☐ Ultrasound: volume and contractility assessment	☐ Uterotonics ☐ Tranexamic acid 1g ☐ Cefazolin 2g q4h, repeat when EBL=1500ml ☐ CaCl2, IV when ionized Calcium is low, or with 3rd set of RBC/FFP	Labs sent q30 min for massive PPH ☐ PT/PTT/INR ☐ Fibrinogen ☐ ABG/VBG with pH, BE, K, iCa, Hct, Lactic acid Labs sent q60 min for massive PPH ☐ CBC Note: Consider TEG if coags delayed or not matching clinical picture	☐ Notify resource nurse ☐ Activate Massive Blood Transfusion Protocol ☐ Start 1:1:2, switch to 1:1:1 when coags affected ☐ Designate a Blood Bank runner ☐ Designate a person to run Belmont ☐ Cell saver – call perfusion ☐ Transfusion Guidelines (PTO)

Phil Hess, MD

Transfusion Guidelines

RBC	FFP	Cryoprecipitate	Crystalloid	Platelet
PPV > 10 Hct < 27% Fibrin > 3 g/L	PPV > 10 Hct > 27% Fibrin < 3 g/L	PPV < 10 Hct > 27% Fibrin < 2 g/L	PPV > 10 Hct > 27% Fibrin > 3 g/L	Platelet < 50 K/mm^3 OR < 75K/mm^3 with active uncontrolled bleeding

Phil Hess, MD

FETAL DISTRESS AND INTRAUTERINE RESUSCITATION

Abnormalities in fetal heart tracing (FHT) pattern can be concerning for progressive fetal hypoxia and acidosis. When a **"pattern check"** is called, resuscitative measures are taken to increase O2 delivery to the placenta and umbilical blood flow

ANESTHESIA TEAM SHOULD GO TO THE LABOR ROOM WITH THE "STAT CESAREAN KIT" (CHLOROPROCAINE 3 % 20 cc, AN EMPTY 30 CC SYRINGE, A BOTTLE OF 8.4% BICARBONATE) IN CASE A STAT CESAREAN SECTION IS CALLED

Maternal positioning

- Left Uterine Displacement (LUD) to decrease aortocaval compression and improve maternal hemodynamics and utero-placental blood flow
- "Hands and knees" also used as alternative position

Maternal hemodynamics and oxygenation

- Correct maternal hypotension:
  - IV Fluids
  - **Vasopressors as needed (phenylephrine preferred)**
- **Supplemental O2** to be used ONLY to correct maternal hypoxemia. Empirical use of O2 to improve FHT is not evidence-based, no longer in practice particularly with concerns of COVID-19 transmission

Tocolysis

In the presence of uterine hyperstimulation (uterine tachysystole leading to non-reassuring FHT)

- Administer IV fluids
- Stop oxytocin administration
- Administer terbutaline 250 mcg subcutaneously
- No evidence to use tocolytics unless tachysystole (>5 contractions in 10 min averaged over 30 min period) or uterine hypertonus (single contraction lasting >2 min) are present

Progression of labor

- Cervical exam to check for rapid cervical dilation, descent of fetal head or umbilical cord prolapse
- In trial of labor after cesarean (TOLAC) patients, **CONSIDER uterine rupture** (abdominal pain)

- In the presence of variable decelerations, uterine AMNIO-INFUSION with saline can be considered (bolus or continuous)

Obstetrics & Gynecology: November 2010 - Volume 116 - Issue 5 - p 1232-1240 doi: 10.1097/AOG.0b013e3182004fa9
Intrauterine Resuscitation During Labor GARITE, THOMAS J. MD*; SIMPSON, KATHLEEN RICE PhD, RNC†
Clinical Obstetrics and Gynecology: March 2011 - Volume 54 - Issue 1 - p 28-39 doi: 10.1097/GRF.0b013e31820a062b

Lior Levy, MD

Obstetric Emergencies

Shoulder Dystocia

5-9% 4000-4500g 14-21% 4500-5000g
ACOG Recommends c/s for 5000g without diabetes, 4500g with diabetes
*Diagnosis of macrosomia is imprecise

Turtle Sign- Retraction of head against maternal perineum
Resistance of delivery of anterior shoulder with usual traction to fetal head

Risk Factors

Maternal
Abnormal pelvic anatomy
Gestational or pregestational diabetes
Previous shoulder dystocia
Short stature (<60in)
Obese (>200lbs)
Previous large infant (>4000g)
Excessive weight gain

Fetal
Suspected macrosomia

Labor
Operative vaginal delivery
Protracted active phase
Prolonged 2nd stage
Precipitous lab

BE CALM
Breathe, don't push
Elevate legs, McRoberts position (knee/chest supine)
Call for help
Apply suprapubic NOT fundal pressure
Enlarge vaginal opening with episiotomy
Maneuvers to rotate baby to deliver posterior arm

Extraordinary Maneuvers
Fracture clavicle
Zavenelli Maneuver- cephalic replacement for cesarean delivery
Symphysiotomy

Complications
Maternal
PPH
Rectovaginal fistula
Symphysial separation or diathesis with or without femoral neuropathy
3rd-4th degree tear or episiotomy

Uterine rupture

Fetal
Brachial plexus injury
Clavicle or humeral fracture
Fetal hypoxia with or without permanent neurological injury
Fetal death

Umbilical Cord Prolapse

Sudden and significant cord compression leading to immediate and sustained fetal bradycardia

Risks
PROM, Iatrogenic AROM with presenting part not well applied to cervix,
vaginal delivery of twins
vaginal delivery of footling breech
Intervention
Manual elevation of fetal head off cervix until emergent cesarean delivery

Uterine Inversion

Uterus turns itself inside out with the fundus passing through the cervix into the vagina leading to severe and sudden PPH, significant discomfort and severe nausea and vomiting.

Risk
Excess traction on cord applied to facilitate delivery of placenta, or excess fundal pressure on a relaxed uterus

Treatment
Manually pushing the fundus back through the cervix, should be done immediately before cervical constriction, delay delivery of placenta if still attached to limit additional bleeding while maintaining an elevated concern for abnormal placentation
Uterine relaxation can be facilitated with tocolytics: volatile anesthesia, Terbutaline or Nitroglycerine (50-100mcg)
After uterine inversion resolved, immediately provide uterotonics and continue resuscitation of patient.

Justin Stiles, MD

Beth Israel Deaconess Medical Center

Maternal Early Warning Systems (MEWS)

Labor and Delivery

EARLY WARNING SIGNS

VITAL SIGNS (New onset)
HR < 45 or > 120
RR < 8 or > 30
SBP < 90 mm of Hg
SPO_2 < 94%
Temp < 35°C (95°F) or > 38.9°C (102°F)
SBP > 160mm of Hg
DBP > 110 mm of Hg
UO < 30 mL for 2 consecutive hours

OB EVENTS
Retained Placenta
Use of 2nd uterotonic
Opening second 10-pack of laps (vaginal delivery)

NEW LAB ABNORMALITY
Hct < 25
Platelets < 100,000
Fibrinogen < 200 mg/dl

OTHER
Provider/Family Concern
Shortness of Breath
Maternal confusion/agitation
Non-remitting Headache; Right upper quadrant pain

EARLY WARNING RESPONSE

	PRIMARY NURSE	RESOURCE NURSE	MEWS RESPONSE TEAM
ACTION:	• Activates OB MEWS by calling Resource nurse and stating: "Patient X meets MEWS criteria of _____"	Calls/pages to contact MEWS response team: • Attending OB (or Coord. OB) • OB and anesthesia resident • Anesthesia attending	Meets at patient's bedside

MEWS TEAM RESPONSE

HEMORRHAGE	HTN/PREECLAMPSIA	EMBOLISM	SEPSIS	OTHER
Follow OB Hemorrhage protocol	Follow Preeclampsia protocol	Follow Embolism protocol	Follow Sepsis protocol	Appropriate consult service

** FOLLOW UP FOR ALL MEWS

- MEWS response team reconvene no later than one hour to re-evaluate.
- If unresolved after one hour consideration for other interventions, ICU admission and other consult services

PART III

Evaluation and Assessment

BIDMC – Admission & Re- Evaluation for Obstetrical Hemorrhage Risk Tool

Average Risk: H1 • No previous uterine incision or injury • Singleton Pregnancy • <5 previous births • No known bleeding disorder • No history of postpartum hemorrhage	**Actions** • Type and Screen
Above Average Risk: H2 • Previous Cesarean Delivery • Multiple Gestation • 5 or more births • History of Postpartum Hemorrhage • Platelets <100,000 • BMI > 40 • Hematocrit <28% • Macrosomia (EFW >5000gm) • Polyhydramnios (AFI >24) • Uterine fibroid (>6cm) • 5 or more doses of misoprostol • IV oxytocin for >30 continuous hours • Chorioamnionitis • Operative vaginal delivery • Second stage of labor > 3 hours *Consider changing risk group to significant if 3 or more average risk factors exist	**Actions** • Type and Screen – identify if candidate for electronic crossmatch • Identify as "H2" at team meeting and/or pre-op briefing • Confirm adequate IV access • All care staff review Obstetrical Hemorrhage Protocol
Significant Risk: H3 • Placenta Previa • Suspected Abnormal Placentation • Active Vaginal Bleeding • Known Coagulopathy • Suspected Placenta Abruption • Retained Placenta • Known antibody (except Rhogam antibody)* *antibody increases difficulty of cross match; not higher risk for hemorrhage	**Actions** • Type and Cross Match • Obtain second IV access • Identify as "H3" at team meeting and/or pre-op briefing • Inform blood bank of possible need for additional blood products • Uterotonics available in room at delivery • All care staff review Obstetrical Hemorrhage Protocol

Type and Screen and Type and Crossmatch

All parturients will have a sample in Blood Bank.

Patients who require a type and screen prior to Cesarean include:

- Significant Uterine Surgery x3 or greater
- Previous post-partum hemorrhage
- Known Significant Uterine Fibroids (>6cm)
- Multiple Gestations
- Grand multiparous (Para >4)
- Macrosomia (EFW > 5000g)
- Polyhydramnios (AFI > 24)
- Known Antibodies (Except Rhogam Antibodies)
- Placenta Previa
- Abruption in Current Pregnancy
- Concern for abnormal placentation
- Known Coagulopathy

Patients who require a type and crossmatch:

- Placenta previa, abruption, accreta, increta and percreta
- Active postpartum hemorrhage and hemodynamic unstable
- Known antibodies (except Rhogam antibodies)
- Known coagulopathy

Be aware:

- After Rhogam administration, the patient will not be "Electronic Crossmatch Eligible" because presence of the Rhogam antibody. The blood bank needs **75 min** to perform blood crossmatch.
- If a Blood Bank sample will be sent on the day of Cesarean section, please label as "STAT", because non-urgent type and screen specimen will be sent to WEST campus.
- Page the Blood Bank Resident Pager at 30003 if you have any questions.

Reference:
BIDMC OB/Gyn guidelines
ACOG: Optimizing protocols in Obstetrics – management of obstetric hemorrhage

Yunping Li, MD

NPO Guidelines

	Guidelines	Notes
Labor Epidural	• Moderate amounts of **clear liquids** for uncomplicated laboring patients • Solid foods should be **avoided**	• Clear liquids must be **non-particulate** (e.g. water, carbonated/sports drinks, Fruit juices (no pulp), jello, popsicles, Italian ice • **NO** milk/cream/gum/candy
Elective Cesarean	• Last regular meal **prior to midnight** before surgery • Light, low fat snack (e.g. crackers or one slice of dry toast) up to **6 hours** prior to surgery • Clear liquids up until **2 hours** before surgery	• Non-diabetic patients may be instructed to consume carbonated, non-particulate 45g carbohydrate beverage up to **2 hours** prior to surgery
Unplanned Cesarean	• NPO as **soon as the decision** for cesarean section is made	• Depending on the urgency of delivery, anesthesia and obstetric team discuss appropriate timing based on last intake • May utilize ultrasound to assess gastric contents

1) Practice Guidelines for Obstetric Anesthesia: An Updated Report by the American Society of Anesthesiologists Task Force on Obstetric Anesthesia and the Society for Obstetric Anesthesia and Perinatology. *Anesthesiology* 2016;124(2):270-300
2) Considerations for NPO Guidelines and Gastric Emptying during Labor, SOAP Task Force for OB/GYN Continuing Education, 2019
3) Cesarean ERAC CarePath, Department of Obstetric Anesthesiology, Beth Israel Deaconess Medical Center

Maria Borrelli DO

Anesthesia Consultation

Purpose:

Consultation with an anesthesiologist allows for advance planning and preparation for the patients who are at increased risk for anesthetic or obstetric complications. The anesthesia consult will help to determine what additional tests, consults or treatment should be obtained. Antepartum OB anesthesia consults should be obtained after fetal viability, but early enough in gestation to allow for scheduling of appropriate diagnostic tests (Generally between 24 and 34 weeks gestation)

Reasons to request an anesthesia consult:

- Pre-pregnancy BMI >40 or current weight over 300#
- Severe facial and neck edema
- Extremely short stature
- Abnormally short neck (or after a surgery with fusion of the neck)
- Difficulty opening the mouth
- Large thyroid
- Asthma (Severe)
- Serious medical or obstetrical complications, including, but not limited to, medical conditions such as:
    - Cardiac ((e.g., valvular stenosis or moderate to severe regurgitation, significant arrhythmia, cardiomyopathy).
    - Pulmonary, including severe asthma
    - Neurologic
    - Hematologic
    - Spine (hx spinal surgery, significant active or unstable lumbar pain syndrome)
    - Any other significant problem that the obstetrician or patient believes could negatively impact the safe or effective administration of anesthesia for delivery.
- History of complications with anesthetics

Consultation for inpatients may be considered with:

- Pregnancy-associated hypertensive disorders (preeclampsia, HELLP).
- Placental abruption.
- Placenta previa.
- Abnormal placentation (accreta, increta, percreta).
- Platelet count less than 100K.
- Plan for non-obstetric surgery during pregnancy.
- Serious conditions that may necessitate emergency cesarean delivery

To obtain an anesthesia consult:

- Call extension 617-667-3353 to request the consult appointment (Day and Time). The following information is needed:
    - Patient name, MRN and contact information
    - OB name and contact information
    - Indication for consult
    - Estimated delivery date (EDD)
    - Whether interpreter is necessary

An anesthesiologist (a senior resident or fellow, with an attending) will see the patient on Labor and Delivery for the consult, or on the labor floor if the patient is currently admitted.

- For inpatient consultation, please email Yunping Li and OB Anesthesia Fellow.
- There is no fee for this consult.
- The anesthesiologist will write a note in the Online Medical Record and forward this note to the obstetrician. If needed, further communication with the obstetrician of any additional tests, consults, therapies will be made.

Phil Hess, MD

TRANSITION OF CARE ON L&D

GOALS	EXPECTATIONS	RATIONALES
Comprehensive sign out is important for patient care and required by ACGME[1] **[1]ACGME Common Program Requirements (Residency). July 2019** **VI.E.3.a - Structured transition of care** **VI.E.3.b – Monitor effective hand over** **VI.E.3.c – Competency in hand over** **VI.E.3.d – Communication with attending** **VI.E.3.e – Continuity of patient care**	1. The junior residents are expected to arrive at **6:45am.** Please to be ready to work. Check ORs and prepare medications.	The on-call residents could be busy in the early morning. It is not the on-call residents' responsibility to check ORs. Arrival at 6:45am has been our tradition for many years.
	2. The afternoon sign out is at **4:30pm**. The on-call residents (even you do pre-call or work in the OR) need to be here for sign out.	Please let your attending and the floor manager know **EARLY** that you are on OB call so they can plan ahead. The day resident can only be relieved when you are here.
	3. If the on-call residents split the night, please allocate at least 30 minutes to get preops ready for sign out.	Work as a team - if one resident is doing a cesarean in the morning, the other resident should get sign out ready
	4. Comprehensive sign out includes: - Brief general information - Significant medical history - Airway - BMI - IF PIH, criteria for severe features, results of PIH labs - IF TOLAC, indication for prior Cesarean - IF high risk of hemorrhage (H2 and H3), reasons for H2 and H3 - IF thrombocytopenia, the trend of platelet counts - Any significant events / issues	For better patient care

PART IV

Labor Analgesia

Test Dose

Typical BIDMC Dose	• 3 mL of 1.5% lidocaine (45 mg) + 1:200,000 epinephrine (15 µg). Available in the epidural kit
Purpose	• To identify intravascular or intrathecal catheters
Rate of Catheter Misplacement	• Incidence of unintended intravascular catheter is 4.9-7% in the obstetric population (plastic catheter) • Incidence of unintended intravascular catheter is as low as 1% with flexible epidural catheter (BJA 2009; 103:400-5) • Incidence of unintended intrathecal catheter is 0.6%-1.6% in pregnant women

Aspiration	• Incidence of intravascular injection undetected by aspiration:
	  ○ 2.3% for single-orifice catheters
	  ○ 0.6% for multi-orifice catheters
	• Incidence of subarachnoid injection after negative aspiration:
	  ○ Between 0.06% and 0.0008%
	• **EVERY DOSE IS A TEST DOSE**

Positive Test Result	• POSITIVE test dose:
	  ○ HR increase >10 bpm at **25-30 seconds** after the injection of 10 or 15 µg epinephrine
	  ○ Observation of both a metallic taste and tinnitus after the injection of at least 100 mg lidocaine
	  ○ Warm or heavy sensation in the lower extremities, sensory level at 3 minutes
	  ○ Inability to raise legs at 4-10 min after injection of 30 or 45 mg lidocaine (Anesth Analg 2013; 116:125-32)

Potential Side Effects	• Potential for decreased uteroplacental blood flow leading to fetal bradycardia after IV or epidural injection of epinephrine

Potential Side Effects	• Potential for tachy-arrhythmia induction by intravascular injection of epinephrine
	  ○ Epinephrine test dose is considered contraindicated in patients with history of tachy-arrhythmia (e.g. SVT, atrial fibrillation, WPW) or in whom tachycardia would be poorly tolerated (e.g. mitral stenosis or aortic stenosis)
	• Potential for total spinal block and respiratory paralysis with injection of intrathecal lidocaine
	• Potential for sympathectomy and maternal hypotension leading to decreased uteroplacental perfusion and possible fetal bradycardia after intrathecal lidocaine injection
	  ○ Lidocaine test dose is considered contraindicated in patients who would not tolerate sympathectomy (e.g. aortic stenosis, mitral stenosis, HOCM)

Sources:

1. Guay J. The epidural test dose: A review. *Anesth Analg*. 2006; 102: 921-929.

Lindsay Sween, MD

Labor Epidural

Indications	• Per ASA and ACOG: "In the absence of a medical contraindication, maternal request is a sufficient medical indication for pain relief during labor".
	• **<u>Consider early epidural for</u>**:
	  ○ Patients at risk for difficult placement (e.g. scoliosis, obesity)
	  ○ Patients with difficult or challenging airway
	  ○ Patients with history of obstructive cardiac disease, in whom tachycardia and sudden decrease in SVR would be poorly tolerated (e.g. aortic stenosis, mitral stenosis, HOCM)
	  ○ Patients with history of tachy-arrhythmias (e.g. atrial fibrillation, SVT)
	  ○ Patients with concerning (e.g. category 2) fetal heart rate tracing, in whom emergent cesarean delivery may become necessary
	  ○ Patients if platelet count is trending down

Contraindications	• Patient refusal or inability to cooperate • Increased intracranial pressure secondary to a mass lesion • Skin or soft tissue infection at the site of needle placement • Coagulopathy • Recent pharmacologic anticoagulation administration • Uncorrected maternal hemorrhage or hypovolemia
Advantages	• Continuous analgesia • Ability to extend analgesia to anesthesia for cesarean delivery • Immediate confirmation that catheter is functional • Lower concentration and higher infusion rate: lower incidence of hypotension, muscle weakness and better coverage

Disadvantages	• Slow onset of analgesia • Larger drug doses required to attain effective analgesia when compared to spinal techniques -> greater risk for maternal local anesthetic systemic toxicity • Slightly higher failure rate than CSE or Epidural with dural puncture • Slightly higher rate of persistent unilateral/asymmetric catheter (paravertebral catheter)
Potential Side Effects	• Hypotension (14%) • Pruritus • Shivering • Urinary retention • Post-dural puncture headache (~1%) • Inadequate analgesia (catheter replacement rate 5-13%) • Accidental dural puncture with large bore needle (1.5%) • Unintentional intravascular injection of local anesthetic medications (0.02%, 1:5000) • High neuraxial blockade and total spinal anesthesia (0.006%, 1:16,200) • Back pain (~30%) • Epidural hematoma (~0.2:100,000) • Epidural abscess (~0.5:100,000) • Nerve root injury
PCEA Patient-controlled epidural analgesia	• Initiation of epidural: bolus of 10-15ml of Epidural solution For very painful, active labor, could top up with 0.125% Bupivacaine 8ml, add 100 mcg of Fentanyl • Maintenance: 15 ml/hr, self-bolus: 10ml, lockout 20min

Source:

1. Wong CA. Epidural and spinal analgesia: Anesthesia for labor and vaginal delivery. In: *Chestnut's Obstetric Anesthesia Principles and Practice*. 6th ed. Philadelphia, PA: Elsevier; 2020: 474-539.

Lindsay Sween, MD

Labor CSE	
Indications	• Per ASA and ACOG: “In the absence of a medical contraindication, maternal request is a sufficient medical indication for pain relief during labor”.
Contraindications	• Patient refusal or inability to cooperate • Increased intracranial pressure secondary to a mass lesion • Skin or soft tissue infection at the site of needle placement • Coagulopathy • Recent pharmacologic anticoagulation administration • Uncorrected maternal hemorrhage or hypovolemia
Advantages	• Continuous analgesia • Induction of analgesia with low doses of local anesthetic and opioid or opioid alone • Rapid onset of analgesia • Ability to extend analgesia to anesthesia for cesarean delivery • Decreased incidence of failed epidural analgesia (catheter replacement rate ~3% with CSE, compared with ~7% for epidural)
Disadvantages	• Increased incidence of pruritis compared to epidural • Possible higher risk for fetal bradycardia (likely due to uterine tachysystole) • Spinal dose containing both local anesthetic and opioid may increase the incidence of hypotension, which would be poorly tolerated in patients with stenotic heart lesions • Delayed recognition of epidural catheter failure ○ Epidural with dural puncture may be a good choice for some patients (e.g. non-reassuring fetal heart tracing or high BMI)

Potential Side Effects	• Hypotension (14%) • Pruritus • Shivering • Urinary retention • Post-dural puncture headache (~1%, same as epidural rate) • Inadequate analgesia • Accidental dural puncture with large bore needle (0.5 to 1.5%) • Unintentional intravascular injection of local anesthetic medications (0.02%, 1:5000) • High neuraxial blockade and total spinal anesthesia (0.006%, 1:16,200) • Back pain (~30%) • Epidural hematoma (~0.2:100,000) • Epidural abscess (~0.5:100,000) or meningitis (~1:40,000) • Nerve root injury
CSE Methods	• Injection of a spinal dose (premixed Bupivacaine 2mg, Fentanyl 12.5 mcg) • Place an epidural catheter, then give a test dose • No epidural bolus, follow with epidural infusion 15ml/h

Reference:

1. Wong CA. Epidural and spinal analgesia: Anesthesia for labor and vaginal delivery. In: *Chestnut's Obstetric Anesthesia Principles and Practice*. 6th ed. Philadelphia, PA: Elsevier; 2020: 474-539.
2. Pan PH, Bogard TD, Owen MD. Incidence and characteristics of failures in obstetric neuraxial analgesia and anesthesia: a retrospective analysis of 19,259 deliveries. *Int J Obstet Anesth*. 2004; 13: 227-233.

Lindsay Sween, MD

PCA for Labor Analgesia

- **Use it only when neuraxial analgesia is contraindicated**

	Benefits	Side Effects
Fentanyl	• Dose: start with 10 mcg, lockout interval 6 min. Can increase to 20 mcg q6min. No basal rate. • Provides an initial moderate reduction in labor pain in some women (BUT pain scores return to baseline as labor advances) • Fairly rapid onset (transfer half-life into CNS 4.7-6.6 min) • Highly lipophilic, so rapid distribution from plasma into highly vascularized compartments, muscle, and fat ○ Elimination half-life 3-8 hr	• Significantly higher VAS pain scores compared to epidural analgesia • Possible decrease in fetal umbilical artery pH and possible increased risk of Apgar score <7 at 1 minute compared to epidural analgesia or no analgesia • Risk of respiratory depression

Remifentanil	• Dose: 0.2-0.8 µg/kg, with increment 0.05 µg/kg, lockout interval 2-3 min
	• Faster onset and metabolism compared to fentanyl
	  ○ Onset 20-30 sec, peak effect 80-90 sec
	• Metabolism is by tissue and plasma esterase
	  ○ Effective analgesic half-life ~6 min; elimination half-life ~10 min
	• Significantly greater decrease in VAS pain scores at 1-hour post-initiation compared to fentanyl
	• No reported adverse neonatal outcomes
	• **Note** our current IV PCA pumps the minimum lockout interval is 5min
		• Higher incidence of hypoxemia compared to epidural analgesia
		• Must be monitored with RR and pulse oximetry
		• Significantly increased sedation compared to fentanyl
		• Higher cost

Sources:

1. Schug SA, Ting S. Fentanyl formulations in the management of pain: An update. *Drugs*. 2017; 77: 747-763.
2. Nikkola EM, Ekblad UU, Kero PO, *et al.* Intravenous fentanyl PCA during labour. *Can J Anaesth*. 1997; 44: 1248-1255.
3. Morley-Forster PK, Weberpals J. Neonatal effect of patient-controlled analgesia using fentanyl in labor. *Int J Obstet Anesth*. 1998; 7: 103-107.
4. Hosokawa Y, Morisaki H, Nakatsuka I, *et al*. Retrospective evaluation of intravenous fentanyl patient-controlled analgesia during labor. *J Anaesth*. 2012; 26: 219-224.
5. Lee M, Zhu F, Moodie J, Zhange Z, Cheng D, Marin J. Remifentanil as an alternative to epidural analgesia for vaginal delivery: A meta-analysis of randomized trials. *J Clin Anesth*. 2017; 39: 57-63.
6. Weibel S, Jelting Y, Afshari A, Pace NL, Eberhart LH, Jokinen J, Artmann T, Kranke P. Patient-controlled analgesia with remifentanil versus alternative parenteral methods for pain management in labour. *Cochrane Database Syst Rev*. 2017; 4: CDO11989. Doi: 10.1002/14651858.CD011989.pub2.
7. Douma MR, Verwey RA, Kam-Endtz CE, van der Linden PD, Stienstra R. Obstetric analgesia: a comparison of patient-controlled meperidine, remifentanil, and fentanyl in labour. *Br J Anaesth*. 2010; 104(2): 209-215.

Lindsay Sween, MD

Epidural Morphine Following Vaginal Delivery

Patient selection:

- Did the patient undergo either of the following?
  - 3rd or 4th degree perineal laceration
  - Prolonged or complicated repair of perineal or cervical laceration
- Is the patient also complaining of above average pain prior to removal of epidural?
  - A common marker of above average pain is the need for additional epidural bolus medication following the laceration repair.

If YES:

- Discuss with OB team and make suggestion for epidural morphine
- Explain benefits and possible side effects to patient
- Consider giving epidural morphine prior to removal of epidural catheter

If **administration of epidural morphine** is desired, be sure to do the following steps:

- Give **2 mg epidural morphine** (not the full dose of 3 mg in the syringe)
  - Remember to document any waste appropriately in Tab 11
- Document administration dose, time and route via POE
  - Part of the "OB Anesthesia" order set under "OB" tab in "Enter Orders"
  - Include the orders for ketorolac, acetaminophen, naloxone bolus, naloxone drip, and antiemetics as provided in the OB anesthesia order set
- Attach the form titled "Monitoring Flow Record: Neuraxial Morphine for Obstetric Patients" to the outside of the patient's chart and fill out the following:
  - Date and time of morphine administration
  - Date, time, and mode of delivery
- Give appropriate sign-out to OB team and L&D nurse – L&D nurse should communication with postpartum nursing.
- Alert OB anesthesia team and give sign-out to oncoming call team
- Remember: No PO/IV/SQ narcotics or sedatives should then be given to the patient for the following 24 hours, except by order of the OB anesthesiology team

Meredith Colella, MD

Recipes for Labor Analgesia

	Contents	Notes

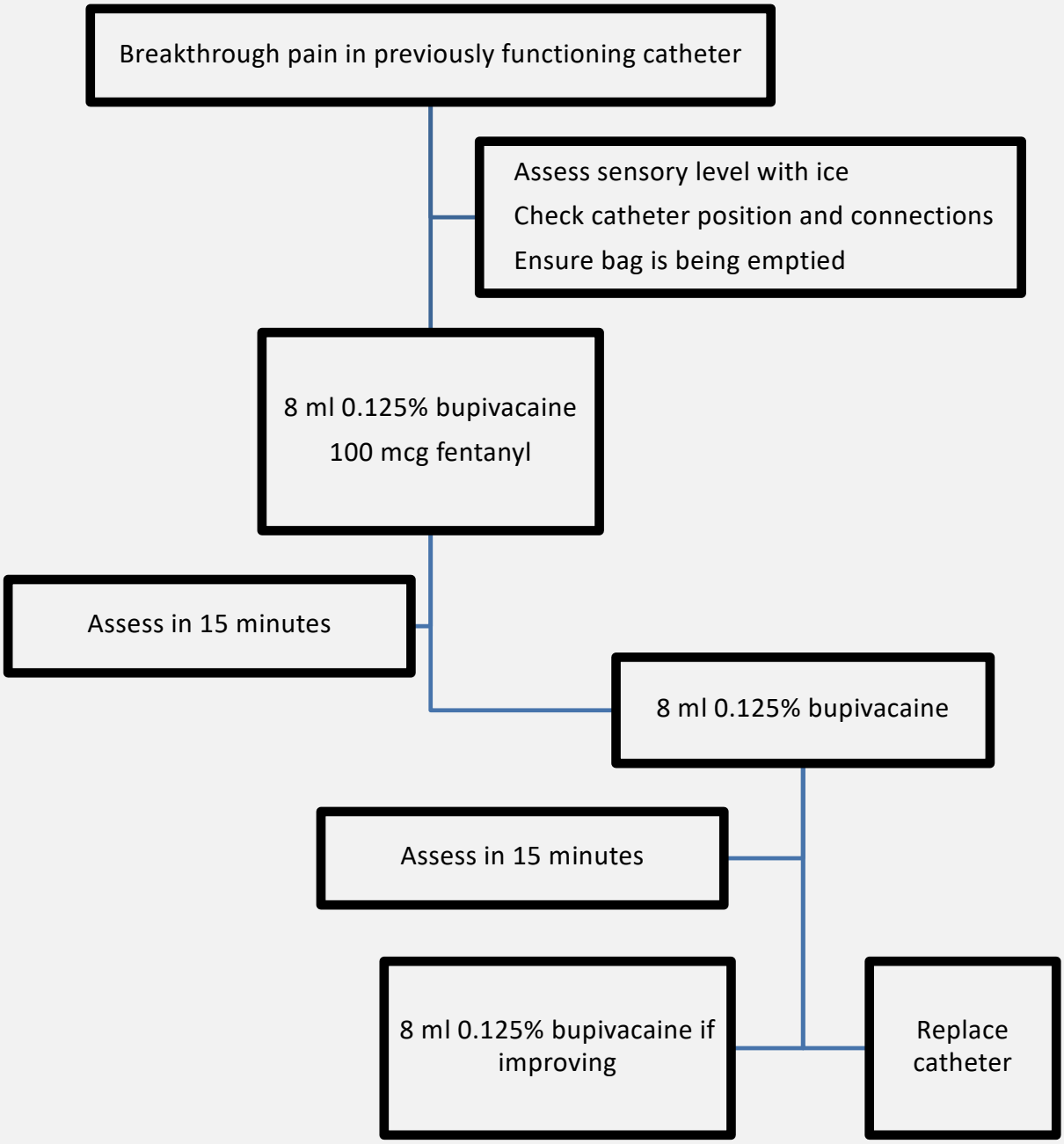
Labor Spinal	• Fentanyl 12.5 mcg
	• Bupivacaine 2 mg total in 1ml
		• Premixed in Omnicell
		• To make from scratch:
		  ○ 0.25 cc of fentanyl (50 mcg/cc)
		  ○ 0.8 cc of 0.25% bupivacaine

Labor Epidural Solution	• Bupivacaine 0.04% • Fentanyl 1.67 mcg/cc • May add 0.25 cc (250 mcg) of epinephrine to 150 cc bag (1.67 mcg/cc)	• Premixed in Omnicell • After negative test dose, bolus 10-15ml of BEF, then run at 15ml/hr
Labor Epidural Bolus	• 10 cc of BEF bolus off the pump **OR** • 8 cc of 0.125% bupivacaine (10 mg) + 2 cc (100 mcg) fentanyl	• Fentanyl: limit 100 mcg per hour, total fentanyl ≤400 mcg for whole labor epidural course

Note: for breakthrough pain, please refer to “Treating breakthrough pain” and “Management of failed epidural”.

Lindsay Sween, MD

Breakthrough Pain Algorithm



If patient requires 3 or more treatments for breakthrough pain:
Increase epidural solution concentration to:

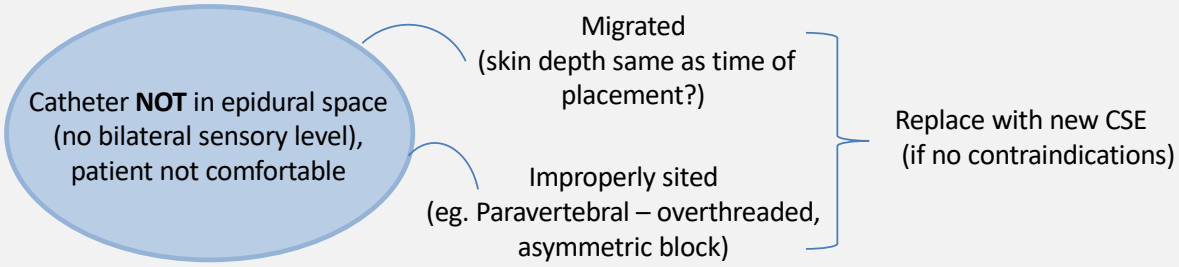
- Bupivacaine 0.125%, fentanyl 3.33 mcg/ml at 10 – 12 ml/hr

For intractable pain

- Consider dexmedetomidine 0.5 – 1.0 mcg/ml
- Consider replacement with CSE including morphine 100 mcg IT

Phil Hess, MD

Management of failed epidural pain relief



*also check for catheter-filter-tubing disconnects!

Catheter **IN** epidural space (✓ bilateral sensory level), patient not comfortable

- Level not high enough? (T10 for labor) → bolus off pump (raise level with *volume*)
- Adequate level but not covering breakthrough pain? → bolus with more concentrated solution (make block *denser*, eg. 0.125% bupivacaine)

*also consider:

1. Alternative reason for pain (eg. full bladder, uterine rupture, chorioamnionitis, hepatic hematoma). Interrogate pain characteristics (Remits between contractions? Radiating?) and accompanying signs (maternal vital signs, FHR)

2. Dysfunctional labor with secondary hyperalgesia (still uncomfortable despite concentrated LA boluses). This is usually a patient making relatively slow or stalled labor progress.
   - Consider increasing epidural infusion solution from 0.04% to 0.125% bupivacaine (see recipes next page), run at 10-12cc/h, PCA dose 0-5mL q20min.
   - Consider new CSE - dense block from new labor spinal will usually provide temporary relief.
   - Consider other adjuncts given epidurally (dexmedetomidine 0.5-1.0 mcg/mL infusion) or intrathecally (morphine 100mcg IT)

References:
1. Vasudevan A, Snowman CE, Sundar S, Sarge TW, Hess PE. Intrathecal morphine reduces breakthrough pain during labor epidural analgesia. Br J Anaesth. 2007 Feb;98(2):241-5.
2. Zhao Y, Xin Y, Liu Y, Yi X, Liu Y. Effect of epidural dexmedetomidine combined with ropivacaine in labor analgesia: a randomized double-blinded controlled study. Clin J Pain. 2017 Apr;33(4):319-324.

Recipes for 0.125% epidural infusion solution:

A. Made from scratch:

0.25% Bupivacaine	30 mL
Normal Saline	26 mL
Fentanyl (50 mcg/mL ampule)	4 mL (2 ampules = 200 mcg)

Total volume = 60 mL (0.125% bupivacaine + fentanyl 3.33 mcg/mL)

B. Made from standard 150cc pre-mixed 0.04% bupivacaine/fentanyl infusion bag from pharmacy:

Bupivacaine/Fentanyl bag from Omnicell	150 mL
0.5% Bupivacaine	36 mL
Fentanyl (50 mcg/mL ampule)	8 mL (4 ampules = 400 mcg)

Total volume = 194 mL (0.125% bupivacaine + fentanyl 3.35 mcg/mL)

Erin Ciampa, MD, PhD

Management of Pruritus from Labor Analgesia

Initial evaluation and guidance

- Itching is often mild and may be self-limiting if associated with spinal fentanyl.
- Often assurance is a good start before the treatment

Prophylaxis (if history of severe pruritus)

- Consider avoiding neuraxial fentanyl if history of intractable pruritus. Discuss with OB team and the patient, other options including omission of IT and epidural fentanyl, or epidural dexmedetomidine.

Omission of Neuraxial Opioid

- Severe itching during labor or prior h/o unremitting severe itching, opioids may be removed from labor epidural infusion.
- Consider bupivacaine 0.125% with epinephrine 2 mcg/ml at 10 ml/hr
- Consider dexmedetomidine (0.5-1 mcg.ml) instead of fentanyl for labor epidural.

Nalbuphine

- Dose: 2.5 mg IV, may repeat times two.
- More effective than placebo, diphenhydramine, propofol or naloxone.
- May also improve opioid induced N/V and respiratory depression.
- Can cause sedation and pain scores at higher doses.

Naloxone

- Dose: 40 mcg IV, may repeat or utilize infusion (on standard order set).
- May also improve opioid induced N/V and respiratory depression.
- Does not cause sedation.
- Aware of reversal of analgesia at higher doses.

Ondansetron

- 8mg IV
- Controversy on the efficacy

Diphenhydramine

- Limited success compared to placebo, less effective than nalbuphine.
- Opioid-induced histamine release from mast cells is not mechanism for pruritus

(1) Cohen SE, et al. Nalbuphine is better than naloxone for treatment of side effects after epidural morphine. Anesth Analg. 1992 Nov;75(5):747-52.
(2) Somrat C, et al. Optimal dose of nalbuphine for treatment of intrathecal-morphine induced pruritus after caesarean section. J Obstet Gynaecol Res. 1999 Jun;25(3):209-13.
(3) Jannuzzi RG. Nalbuphine for Treatment of Opioid-induced Pruritus: A Systematic Review of Literature. Clin J Pain. 2016 Jan;32(1): 87-93.ohn
(3) Kung A et al. Int J Obstet Anesth 2014; 23:222-226

John Kowalczyk, MD

ASSISTED VAGINAL DELIVERY

	INDICATIONS	Side effects
FORCEPS/VACUUM	• Prolonged second stage of labor • Non- reassuring fetal heart rate (NRFHR) • Elective shortening of the second stage: pushing is contraindicated (maternal cardiovascular or neurologic disease) • Maternal exhaustion	Maternal: post-partum hemorrhage (PPH). Obstetric: anal sphincter injury, cervical/vaginal laceration Fetal: bradycardia, scalp injuries, cephalohematoma, intracranial hemorrhage
ANESTHETIC MANAGEMENT: How we do it	• Unit coordinator or resource nurse notifies anesthesia attending/team and NICU. Anesthesia provider stands by in the labor room • 5-10ml of 3% Chloroprocaine epidurally could help forceps delivery without hampering maternal pushing effort	• Anticipate emergency C-SECTION, PPH. • Get medications for emergency C-section (3% CPC, bicarbonate) have them available in the emergency bag, don't draw them up)

Salman et al. Adverse neonatal and maternal outcome following vacuum- assisted vaginal delivery: does indication matter? Arch Gynecol Obstet (2017) 295:1145–1150

Ali and Notwitz. Vacuum assisted vaginal delivery. Rev Obstet Gynecol. *2009;2(1):5-17*

Galina Korsunsky, MD

Delivery of Twins

Background:

- About 40-60% of twin pregnancies enter spontaneous labor before 37 weeks.
- The optimal route of delivery in women with twin gestations depends on the type of twins, fetal presentations, fetal weight, gestational age and the judgment of obstetricians.
- Vaginal delivery is a reasonable option.
- Options for delivery of the second non-vertex presenting twin include:
    - Breech extraction with experienced provider
    - Internal podalic version with breech extraction
    - External cephalic version
    - Cesarean delivery – often **emergent**

For Anesthesiologists:

- As always, ensure that you have a working epidural;
- Once the patient is about to deliver, she will move to an OR (usually OR C is reserved);
- For multiparous, she may enter OR C earlier in anticipation of a quick delivery;
- Close the AIMS in the labor room and continue the same record in the OR;
- Assist the nurse to transfer the patient to an Operating Room so that you can safely set up the epidural pump and your monitors/medications;
- Continue labor epidural infusion;
- The anesthesiologists will be notified when the delivery time is close;
- An anesthesia resident and attending should be present for delivery;
- Be prepared for **STAT** cesarean delivery. Have 3% chloroprocaine and bicarbonate ready (do not draw it up);
- Anesthesia team may step out once both babies have been delivered and things have settled down;
- After delivery, make sure the epidural pump is taken back to the labor room.

Reference:

BIDMC PPGD CP-OB 29
ACOG Practice Bulletin No. 169. Obstet Gynecol 2016; 128(4): e131-46

Yunping Li, MD

PART V

Anesthesia For Cesarean Delivery

Conversion of Labor Epidural for Cesarean Delivery

Emergent

- ✓ Evaluate airway
- ✓ Functional Epidural?
- ✓ Bolus bicarbonated 3% **chloroprocaine** while transporting the patient

Check Level in the OR

No level

- ✓ Prepare for general anesthesia
- ✓ CPC can take 6 min. If working epidural, continue maintaining epidural level for pain control and use it for epidural morphine

Rising

- ✓ 100 mcg fentanyl epidurally
- ✓ 15-20ml total volume of CPC to achieve T4 level
- ✓ Or continue to use bicarbonated 2% lidocaine + epinephrine

Urgent (DDI=30')

- ✓ Evaluate airway
- ✓ Functional Epidural?
- ✓ 5 ml bicarbonated 2% lidocaine + 5mcg/ml epinephrine (in room or in OR)

Check Level in the OR

Rising

- ✓ 100 mcg fentanyl epidurally
- ✓ 15-20ml total volume of CPC to achieve T4 level
- ✓ Or continue to use bicarbonated 2% lidocaine + epinephrine

Dysfunctional

Epidural does not work well,

- ✓ Replace epidural or new CSE
- ✓ IV ketamine (10mg x3), or fentanyl (50mcg x2), or propofol (20mg x3)
- ✓ Dexmedetomidine 20-30mcg epidurally
- ✓ Pour 20ml of bicarbonated 3% CPC intraperitoneally
- ✓ Consider GA

How to Maintain Epidural level during Cesarean Delivery?

- ✓ Check level every 20 minutes
- ✓ Anticipate moments when highest coverage is needed (delivery, putting uterus back in)
- ✓ Bolus epidural **When**:
  - Patient in pain (chest or epigastric often first sign)
  - Epidural level is receding
  - Bolus 5ml of chloroprocaine q15 min unless the level >T4
  - Bolus 5ml of lidocaine q20-25 min unless the level >T4

Yunping Li, MD

Spinal Anesthesia for Cesarean Delivery

Decision Making

Spinal Anesthesia
- ❑ Expect <90 minutes
- ❑ Primary or 1st repeat CD
- ❑ Thin patient

CSE
- ❑ Possible > 90 minutes
- ❑ Multiple repeat, previous surgery, high BMI
- ❑ Elevated hemorrhage risk: accreta

Epidural with Dural Puncture
- ❑ Expect > 90 minutes
- ❑ Multiple surgeries, surgical mesh

Spinal medications

- ❑ Bupivacaine 0.75%
  1.5 ml, +/- 0.2 ml for ≤60 & ≥70 inches
- ❑ Fentanyl 0.5 ml (25 mcg)
- ❑ Morphine 0.5 ml (250 mcg)

Workroom omnicell

Blood pressure

- ❑ Phenylephrine 10ml syringe (HR >70 give 100 mcg)
- ❑ Can also run as infusion 0.5 mcg/kg/min, titrated
- ❑ Ephedrine 5 ml syringe (HR< 90 give 5 – 10 mg)

Other Medications

- ❑ Antibiotics
- ❑ Oxytocin bag (bottom drawer)
- ❑ Uterotonics (in-room fridge)
- ❑ Oxygen via Face mask – only if O_2 Sat < 96%

OR omnicell

Phil Hess, MD

General Anesthesia for Cesarean Delivery

Background:

- General anesthesia associated with higher maternal mortality and morbidity.
- Indications:
  - Maternal refusal
  - Severe psychiatric or developmental disorder
  - Coagulopathy
  - Local Infection at neuraxial site
  - Severe, uncorrected hypovolemia
  - Intracranial mass with increased ICP
  - Emergent cesarean without preexisting epidural catheter
  - Incomplete coverage of spinal segments
  - Multiple failed neuraxial placements
  - Persistent intraoperative pain that is uncontrolled
- STAT or intrapartum indications for general anesthesia should involve constant communication between the OB and anesthesiologist

Pre-operative

- Perform **AIRWAY EXAM** and preop evaluation.
- Place 16 or 18 G IV and obtain CBC and T&S.
- Administer nonparticulate antacid <30 min before induction.
- Consider metoclopramide 10 mg and/or ranitidine 30 mg IV if >30 minutes prior to induction.
- Place patient in Left Uterine Displacement and attach monitors.
- Preoxygenation with either 100% O2 for 3 minutes or 4-8 vital capacity breaths.
- **Before induction**, ensure patient is prepped and draped, perform time-out and confirm surgeon is ready for incision.

Induction

- Initiate rapid sequence induction.
- Propofol 2.0-2.5 mg/kg of IBW and succinylcholine 1.0-1.5 mg/kg of TBW.
  - Avoid opioids and benzodiazepines (neonatal respiratory depression).
- Tracheal intubation:
  - Airway edema associated with pregnancy, labor and pre-eclampsia
  - Consider video laryngoscopy as first choice.
  - Endotracheal tube size 6.5 or 6.0 mm due to airway edema.
- Confirm ET tube placement and inform OB team it is safe to initiate surgery.

Intra-operative prior to Delivery

- Use volatile anesthetic (sevoflurane, isoflurane) at approximately 1 MAC.
- Recommended initial ventilator settings of 6-8 ml/kg of IBW and a RR of 14-18.
    - There is a respiratory alkalosis in pregnancy with a normal PaCO2 of 30 mmHg. Ventilator setting should be titrated to limit hypercapnia.

Intra-operative post Delivery

- Initiate continuous infusion of oxytocin.
    - Consider additional IV boluses of Oxytocin 2-3 IU
    - Consider early use of secondary uterotonics
    - Consider TIVA instead of volatile agent.
- Adjust maintenance anesthetic:
    - Reduce volatile anesthetic to 0.5 MAC (cause uterine relaxation).
    - Add nitrous oxide (60% to 70%).
    - Midazolam 2mg (increased risk of awareness).
    - Place temperature probe and upper body forced air warmer.
    - Administer intravenous ketorolac and opioids for post-operative pain and ondansetron for PONV.
- Extubation
    - Majority of respiratory-related deaths occurred during emergence, extubation and recovery.
    - Insert an OGT to empty the gastric contents if patient did not meet NPO guidelines or concern for full stomach.

Post-operative

- Evaluate post-operative issues in PACU.
- Consider Quadratus Lumborum or Transversus Abdominis Plane Block for post-operative pain.

(1) Mhyre JM. A series of anesthesia-related maternal deaths in Michigan, 1985-2003. Anesthesiology. 2007 Jun;106(6):1096-104.
(2) Kodali BS, Chandrasekhar S, Bulich LN, et al. Airway changes during labor and delivery. Anesthesiology.
(3) Gambee AM, Hertzka RE, Fisher DM. Preoxygenation techniques: comparison of three minutes and four breaths. Anesth Analg.

John J. Kowalczyk, MD

Enhanced Recovery After Cesarean Delivery CarePath

	Scheduled Cesarean CarePath	Unscheduled Cesarean CarePath
Goal	Increase patient satisfaction and outcomes by reducing post-op pain, nausea/vomiting, time to void and time to ambulation by minimizing opioids and maximizing alternative medications and techniques	
To whom it applies	Patients with scheduled cesarean sections at BIDMC	Patients with unscheduled cesarean sections at BIDMC (e.g. intrapartum)
NPO guidelines	Patients should keep their usual diet until midnight on the night before surgery. They may have a light, low fat snack (e.g. crackers or one slice of dry toast) up to 6 hours prior to surgery. They may have clear liquids up until 2 hours before surgery. Patients will be instructed to drink a non-carbonated, non-particulate 45-gram carbohydrate beverage (e.g. Gatorade or apple juice) up to two hours prior to surgery for nondiabetic patients.	Patients should be NPO as soon as the decision for cesarean section is made. Depending on the urgency of delivery, the anesthesia and obstetric team will discuss appropriate timing based on last intake. If patients have neuraxial anesthesia during labor, their diet should be changed to clear liquids at time of placement.
Pre-op (anesthesia)	Anesthesia assessment	
Intraop (anesthesia)	- Antibiotics within 60 minutes of skin incision (Cephalosporin preferred. Add azithromycin if patient in labor or membranes ruptured) - Regional anesthesia preferred method - Aspiration prophylaxis with non-particulate antacid - Appropriate patient monitoring - **IV fluid warming** and increased OR temperature to at least **68°F** are recommended to prevent hypothermia in patients under neuraxial anesthesia; forced air warming can be added for patient	

	comfort, skin to skin, or general anesthesia - Prophylactic IV Ondansetran 4mg x 1 - Treat shivering PRN (e.g. dexmedetomidine 10mcg once, may repeat x1) - Consider giving first dose of ketorolac 30mg intra-op after fascia is closed
Post-op orders	Order set to be placed by OB and anesthesia teams
L&D recovery	**Pain medications:** - IV ketorolac 30mg q6h x 24 hours, then transition to PO ibuprofen 800mg q8h and acetaminophen 1gm q8h - Oxycodone 5mg q4h PRN severe pain - Pre-emptive or rescue supplementary regional blocks as indicated by anesthesia **Nausea medications:** Ondansetron 4mg PRN and Haldol 0.5-1mg once PRN

Sources:

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2. Wilson RD *et al*. Guidelines for antenatal and preoperative care in cesarean delivery: enhanced recovery after surgery society recommendations (Part 1). *AJOG*. 2018. https://doi.org/10.1016/j.ajog.2018.09.015
3. Caughey AB *et al*. Guidelines for antenatal and preoperative care in cesarean delivery: enhanced recovery after surgery society recommendations (Part 2). *AJOG*. 2018. https://doi.org/10.1016/j.ajog.2018.08.006
4. Macones GA *et al*. Guidelines for antenatal and preoperative care in cesarean delivery: enhanced recovery after surgery society recommendations (Part 3). *AJOG*. 2018. https://doi.org/10.1016/j.ajog.2019.04.012

Lindsay Sween, MD and Phil Hess, MD

Anesthesia for ECV

Anesthesia for EXIT Procedure

Uterotonics

- Be proactive to fight PPH

	How to give it	Side effects and contraindications
First Line	Immediately after delivery: 1. Start Oxytocin: 20 IU in 1L of LR: titrate to uterine tone. Generally, 100-20U/hr. 2. If C-section for labor arrest after oxytocin augmentation, may consider additional 2-3 IU oxytocin IV (0.2-0.3ml from 10 IU/ml bottle) before infusion	Hypotension Nausea When given in large doses or over extended periods, antidiuretics may produce water intoxication, hyponatremia and seizures
Second Line	1. Methergine 0.2mg IM **NOT IV** Can be repeated q2-4 hours	Beware hypertension due to direct vasoconstriction (do not give if patient has hypertensive disorder)
	2. Carboprost- PGF2α (Hemabate) 250 μg IM **NOT IV** Can be repeated q15min, not to exceed four doses	Beware bronchospasm (do not give if history of asthma or reactive airway)
	3. Cytotec (misoprostol, a synthetic analog of PGE1) 1mg PR	Beware of severe rigors and fever

(1) Heesen, M., et al. (2019). International consensus statement on the use of uterotonic agents during caesarean section. *Anaesthesia, 74*(10), 1305-1319.
(2) Balki, M. C. et al. (2006). Minimum Oxytocin Dose Requirement After Cesarean Delivery for Labor Arrest. *Obstetrics & Gynecology, 107*(1), 45-50.
(3). California Maternal Quality Care Collaborative. Obstetric Hemorrhage Toolkit 2015

Dillon Schafer, MD and Yunping Li, MD

PART VI

Postpartum Care

Caring Patients After Neuraxial Morphine

Background Information:

- Neuraxial morphine (intrathecal or epidural) has been used since the early 1980s to provide postpartum post-surgical pain relief. It is effective and safe (Anesth Analg 2013; 117:1368-70)

- The respiratory depression associated with neuraxial morphine occurs with an average time of onset of 8-12 hours.
    - Vigilant monitoring of the patient's respiratory status must therefore occur for 24 hours after injection.
    - Respiratory depression is most often associated with the use of supplemental narcotics or sedatives.

- For breastfeeding patients, the newborn is not appreciably affected by morphine excretion in the colostrum after neuraxial administration of morphine in small doses.

Procedure for Implementation:

- **It is prohibited to administer any opioids or sedatives in 24 hours after neuraxial morphine installation. Please discuss with your attending if patient needs an early dose of opioid**.

- Document administration dose, time and route via POE
    - Part of the "OB Anesthesia" order set under "OB" tab in "Enter Orders"
    - Order set also includes orders for:
        - Ketorolac and acetaminophen for first 24 hours post-surgery for management of possible breakthrough pain
        - Naloxone (both single PRN dose and infusion) for management of pruritis, respiratory depression, or oversedation
        - Antiemetics for management of nausea and vomiting

- Attach the form titled "Monitoring Flow Record: Neuraxial Morphine for Obstetric Patients" to the outside of the patient's chart and fill out the following:
    - Date and time of morphine administration
    - Date, time, and mode of delivery

- Inform postpartum L&D nurse when giving report that patient has received neuraxial morphine

- The postpartum L&D nurse will monitor the patient for the following every 30 minutes until transfer to the postpartum unit, or for the first 6 hours post-surgery:
    - Respiratory status
    - Sedation level

- Patients at high risk for respiratory depression will also require monitoring every hour for the remaining 18 hours following neuraxial morphine administration:
    - Patients who received any additional opioid for breakthrough pain
    - Morbidly obese patients
    - Patients diagnosed with obstructive sleep apnea (OSA)
    - Patients who have received or are still receiving an infusion of magnesium sulfate for treatment of preeclampsia

Management of Other Issues:

- OB Anesthesiology team will be consulted within the first 24 hours of morphine administration to manage breakthrough pain or adverse effects of neuraxial morphine

- Please discuss with your attending regarding the treatment plan for breakthrough pain.

- Breakthrough pain:
    - Orders should be entered at time of morphine administration for ketorolac and acetaminophen **around-the-clock dosing** for first 24 hours post-surgery
    - Our research identified that the patients underwent cesarean after labor are at high risk for persistent pain despite use of neuraxial morphine. Consider a TAP or QL block prior to transfer of patient to the postpartum unit (J Anesth Perioper Med 2019; 6:15-22)
    - If patient declines a TAP/QL block, or has breakthrough pain despite block, ketorolac and acetaminophen, administration of an additional narcotic may be considered
        - If the patient is on the postpartum floor, give a **single dose** of oxycodone (5-10 mg), and the patient needs to be monitored with RR and pulse oximetry
        - If the patient is in the PACU, consider using small dose of intravenous Fentanyl or Morphine

- Moderate to severe pruritis:
    - Exclude other possible causes of itching
    - Orders should be entered at time of morphine administration for:
        - Naloxone bolus, 40-80 mcg IV
            - May be repeated after 5 minutes if necessary, for a maximum total of 3 boluses
        - Naloxone IV infusion, to be started if severe pruritis recurs after 3 boluses
            - Infuse for 2 hours at a rate of 200 mcg/hr
        - Infusion should be stopped, and OB anesthesiology team called if pruritis persists, or if pain returns

- Nausea/vomiting:
    - Orders should be entered at time of morphine administration for multiple antiemetics, including ondansetron as a first line

- Respiratory depression or oversedation/somnolence:
    - OB anesthesiology team should be called immediately to bedside for evaluation
    - Naloxone bolus of 40-80 mcg IV from OB anesthesia order set should be administered by bedside nurse immediately

References

ASA Practice Guidelines for the prevention, detection, and management of respiratory depression associated with neuraxial opioid administration. Anesthesiology 2016; 124(3): 535-552
A Retrospective assessment of the incidence of respiratory depression after neuraxial morphine administration for postcesarean delivery analgesia. Anesth Analg 2013; 117:1368-70

Meredith Colella, MD

TREATMENT OF PAIN AFTER CD

TREATMENT OF PRURITUS POST CESAREAN DELIVERY

PROPHYLAXIS (if Hx severe pruritus)

1. Consider Morphine via epidural instead of spinal
2. Consider neuraxial Dexmedetomidine
    a. 10 mcg lasts 4 to 6 hr
3. Consider avoiding Morphine if Hx intractable pruritus (discuss with patient, other options may include regional techniques or a PCA)

TREATMENT

1. Assess the patient, often assurance is a good start before treatment
2. Small dose of Naloxone (on standard order set), aware of reversal of analgesia
3. Nalbuphine (partial mu-receptor agonist/antagonist) 2.5mg IV
4. Ondansetron (5HT3 receptors) 8 mg IV
5. Dexmedetomidine 10 mcg IT/EP/IV
6. Benadryl does not work but might help with sedation and sleep

TREATMENT OF NAUSEA/VOMITING POST CESAREAN DELIVERY

PREVENTION

1. Ondansetron 4 mg IV (5HT3)
2. Dexamethasone 4-8 mg IV (slow onset)
3. Avoid Scopolamine patch (anticholinergic) in breastfeeding women
4. Consider avoiding Morphine if Hx intractable PONV (discuss with patient, other options may include regional techniques or a PCA)

TREATMENT

1. Ondansetron 4-8 mg IV
2. Second line agents for Hx of PONV
    a. Haloperidol 0.5-1mg IV
    b. Promethazine (Phenergan) 6.25 mg IV
3. Low dose propofol (20 mg IV)
4. Dexmedetomidine (slow onset)

Dominguez JE Habib AS. Prophylaxis and treatment of the side-effects of neuraxial morphine analgesia following cesarean delivery. Current Opinion in Anaesthesiology 2013;26(3):288–295
Yurashevic M, Habib AS. Monitoring, prevention and treatment of side effects of long acting neuraxial opioids for post-cesarean analgesia. Int J Obstet Anesth. 2019 Aug;39:117-128
Mo Y, Qiu S. Effects of dexmedetomidine in reducing post-cesarean adverse reactions. Exp Ther Med. 2017;14(3):2036–2039 George et al. Randomized trial of phenylephrine infusion versus bolus for nausea and vomiting during cesarean in obese women Can J Anaesth. 2018 March; 65(3): 254–262

Galina Korsunsky, MD 2020

Treatment of Hypothermia after Use of Intrathecal Morphine

Background	Intrathecal morphine can produce hypothermia after Cesarean delivery, likely due to a central effect on opioid receptor for thermoregulation.
Timing	Hypothermia is identified after Cesarean delivery while in the recovery room.
Diagnosis	Core temperature **< 35.8°C** (**<96.4°F**) **Paradoxical** symptoms: diaphoresis, subjectively feeling hot. Can be sedated or feel dizzy. The incidence is about 6-7% in elective cesarean cases.
Treatment	Conservative treatment: warm blankets, heating lamps and Bair hugger forced hot air warmer; Patients often feel uncomfortable with heat Medication: Lorazepam 0.5-1mg, IV
Observation	After Lorazepam administration, immediate cessation of symptoms and an increase to normothermia temperature within 90 minutes were observed.
Reference	Hess PE et al. Int J Obst Anesth 2005; 14:279-283

PACU Nursing Notification Pathways

What is Altered	Primary Manager	Ensure Notification	Associated MEWS
Glucose			
HIGH or LOW	Joslin or	Anesthesia	
DKA	OB Resident		
Hemodynamics			
HIGH BP	OB Resident	Anesthesia	SBP > 160 / DBP > 110
Bleeding	OB Resident		2ND Uterotonic
LOW BP	Anesthesia		SBP < 90
Fluid management	Anesthesia	OB Resident	
Urine Output	Anesthesia		UO < 30ml X 2 Hrs
Pain	Anesthesia	OB Resident for PCA	RR < 8 Headache / RUQ Pain
Nausea / Vomitting	Anesthesia		
Temperature	Anesthesia	OB Resident for MEWS	Temp > 102 °F (38.9 °C)
CNS			
Seizure	Anesthesia	OB Resident	Maternal Confusion or Agitation
Sensory / Motor	Anesthesia		

PART VII

High Risk Obstetrics

Cardiac Patient in Obstetrics

Anesthetic

Determined on individual basis.
No evidence of different outcome for labor or cesarean

Patient preparation

One or two IV's as indicated
Arterial line for NYHA 3 or 4, or high risk patient
Central line for major vasopressors (e.g. epi, norepi)
ECG monitoring
Pulse oximetry for pulmonary hypertension

Medications

From main Omnicell

Cardiac syringe pack
- Phenylephrine 50 ml
- Norepinephrine 50 ml
- Nitroglycerine 20 ml
- Epinephrine 50 ml

From Main Pharmacy (as needed)

Nitroprusside
Anti-arrhythmic agents

Uterotonics

Oxytocin – no contraindication
Hemabate – use with caution in Pulmonary hypertension
Methergine – use with caution with obstructive lesions , coronary disease, pulmonary hypertension
Misoprostil –Large doses may cause rigors and fever (increased oxygen demand)

Goals

- Maintain vital signs near baseline
- Avoid sympathetic stress
- Maintain fetal perfusion
- Tolerate post-delivery volume expansion

This is intended as a general pathway, which can be modified as needed.

Phil Hess, MD

Risk Definitions

NYHA functional classification

1 – No limitations of physical activity.

2 – Slight limitation with physical activity, comfortable at rest.

3 – Symptoms with less than ordinary physical activity, comfortable at rest

4 – Symptoms present at rest

CARPREG risk score

NYHA > 2

Cyanosis on RA

Prior cardiac event

LVEF <40%

Left Heart Obstruction

# Predictors	Risk in Pregnancy (12 months)
0	5%
1	27%
>1	75%

High Risk

Pulmonary Hypertension (SBP>70mmHg

Mitral stenosis

Aortic senosis

Systolic dysfunction (LVEF <40%)

Variable Risk

HOCM

Mitral Valve Prolapse with regurgitation

Arrhythmias

Lower Risk (usually)

Mitral regurgitation

Aortic Regurgitation

This is intended as a general pathway, which can be modified as needed.

Phil Hess, MD

Titration for Labor Epidural Analgesia: Vaginal Cardiac Delivery

Placement as per usual

- May use spinal needle to ensure epidural space.
- NO test dose (epinephrine may be deleterious).
- Aspirate catheter prior to all injections
- If in painful labor, may give 25mcg fentanyl IT
  - NO bupivacaine
- No PCEA

- Begin infusion of 0.04% bupivacaine with fentanyl 1.7mcg/cc at 15cc/hr.
  - NO bolus to avoid hypotension
- After 1 hour, check for sensory change.
  - Usually tingling in both feet and/or sensory level to cold
- May change to 0.0625% after 1 to 2 hours
- Can Increase bupivacaine concentration every 2 hours.
  - Maintain infusion rate at 15cc/hr
  - 0.08%, 0.125%, 0.1875% as needed to have dense sacral level.

After sympathectomy has been achieved additional local anesthetic should not cause a significant change in BP.

- i.e. OK to use lido or CPC for cesarean.

This is intended as a general pathway, which can be modified as needed.

Goals

- Reduce stress during labor
- Maintain fetal perfusion
- Maintain maternal BP

Target

- Slow onset sympathectomy
- Dense blockade during second stage

Phil Hess, MD

Cardiac Delivery Epidural Titration

1. **Bupivacaine 0.04%, Fentanyl 1.7mcg/ml**
    a. Pre-made BF bag from Omnicell
    b. No epinephrine added

2. **Bupivacaine 0.0625%, Fentanyl 1.7 mcg/ml**
    a. Bupivacaine 0.25% 15ml
    b. Fentanyl 50mcg/ml 2ml
    c. Normal saline 43 ml
    Total 60ml

3. **Bupivacaine 0.08%, Fentanyl 1.7 mcg/ml**
    a. Bupivacaine 0.25% 19ml
    b. Fentanyl 50mc/ml 2ml
    c. Normal saline 39ml
    Total 60ml

4. **Bupivacaine 0.125%, Fentanyl 1.7 mcg/ml**
    a. Bupivacaine 0.25% 30ml
    b. Fentanyl 50mcg/ml 2ml
    c. Normal saline 28ml
    Total 60ml

5. **Bupivacaine 0.1875%, Fentanyl 1.7 mcg/ml**
    a. Bupivacaine 0.25% 112.5ml
    b. Fentanyl 50 mcg/ml 5ml
    c. Normal saline 32.5ml
    Total 150ml

Phil Hess, MD

Cesarean Epidural Management Obstetric Cardiac Patient

Preparation

Phenylephrine infusion in line
Norepinephrine (not primed) (obstructive lesions, Cardiomyopathy)
Nitroglycerine (not primed) (Mitral stenosis, Coronary disease)
Minimize fluid administration

Epidural Anesthesia

Placement as per usual

- May use spinal needle to ensure epidural space
- NO test dose for obstructive lesion or arrhythmia (epinephrine may be deleterious)

Example of Titrated Dosing

- Bupivacaine 0.5%
- 2 cc given every 5 min
- 50 mcg fentanyl on 3rd dose
- Test level after 5th dose
    - Assess for sensory changes in feet
    - Level to cold
- After 20 cc wait for level to T10
- Fentanyl 50 mcg when level T10
- May use lidocaine 2% with Bicarb (no epinephrine) after T6 level achieved

After Delivery

Autotransfusion management for Mitral Stenosis

- 10mg furosemide
- Nitroglycerine infusion titrated to symptoms or CVP/PA
- Consider phlebotomy for acute decompression of volume overload (obtain from Blood bank)

This is intended as a general pathway, which can be modified as needed.

Goals

- Reduce stress during surgery
- Maintain fetal perfusion
- Maintain maternal BP

Target

- Slow onset sympathectomy
- Dense blockade during surgery

Phil Hess, MD

CARING PATURIENTS WHO HAVE OPIOID USE DISORDER UNDERGOING FOR CESAREAN DELIVERY

Obstetric Anesthesia | Beth Israel Deaconess Medical Center | 2020

SCOPE OF THE PROBLEM

Substance use in pregnancy has escalated in recent years. Opioid dependent patients frequently have severe postoperative pain due to buprenorphine-induced hyperalgesia or methadone-induced opioid tolerance

(Am J Drug Alcohol Abuse. 2009; 35:151-156).

Currently, lacking research data and guidelines at national level hampers healthcare providers to optimize the management for this group of patients.

LIST OF MEDICATIONS

Medications	Mechanisms	Half life
Methadone	Full agonist	8-59 hrs
Buprenorphine (Subutex)	Partial agonist	24-60 hrs
Suboxone (Buprenorphine +Naloxone)	Agonist and antagonist	~ 37 hrs
Naltrexone	Pure opioid Antagonist	13-14 hrs

- The human mu opioid receptor occupancy by buprenorphine is dose-related: 27-47% at 2mg and 89-98% at 32mg (Biological Psychiatry 2007; 61:101-110).
- Naloxone is not orally active. It is used to reduce diversion because Suboxone causes severe withdrawal symptoms when injected (ACOG Committee Opinion Number 711, August 2017).

GOALS

Multimodal analgesia and team collaboration are preferable to achieve the best possible postoperative pain control and patient satisfaction.

SUGGESTIONS

Preoperative

- In patients taking buprenorphine or suboxone,

    1). Continue buprenorphine if the patients are on low dose (< or = 8mg)

    2). Give daily total dose in divided q8h doses if the patients are on high doses (>or = 16mg)

3). Taper to stop 72 hr prior to scheduled Cesarean delivery, then transition to traditional opioid (it may **not** be practical).

- In patients taking methadone, continue the medicine.
- In patients taking Naltrexone, taper to stop 72 hr prior to scheduled Cesarean delivery.
- Obstetric Anesthesia consult and discussion of patient wishes for postpartum opioids.

On the Day of Surgery

- The team will discuss the multimodal plan for pain control that tailors to individual patient.
- Neuraxial anesthesia is preferred.
- Consider **NOT** to use neuraxial morphine in patients on high dose of methadone (> 60-80mg) or buprenorphine (>8mg).
- May consider using intrathecal dexmedetomidine.
- Consider low dose intraoperative ketamine intravenously.
- Consider thoracic epidural for postoperative analgesia.

Postoperative

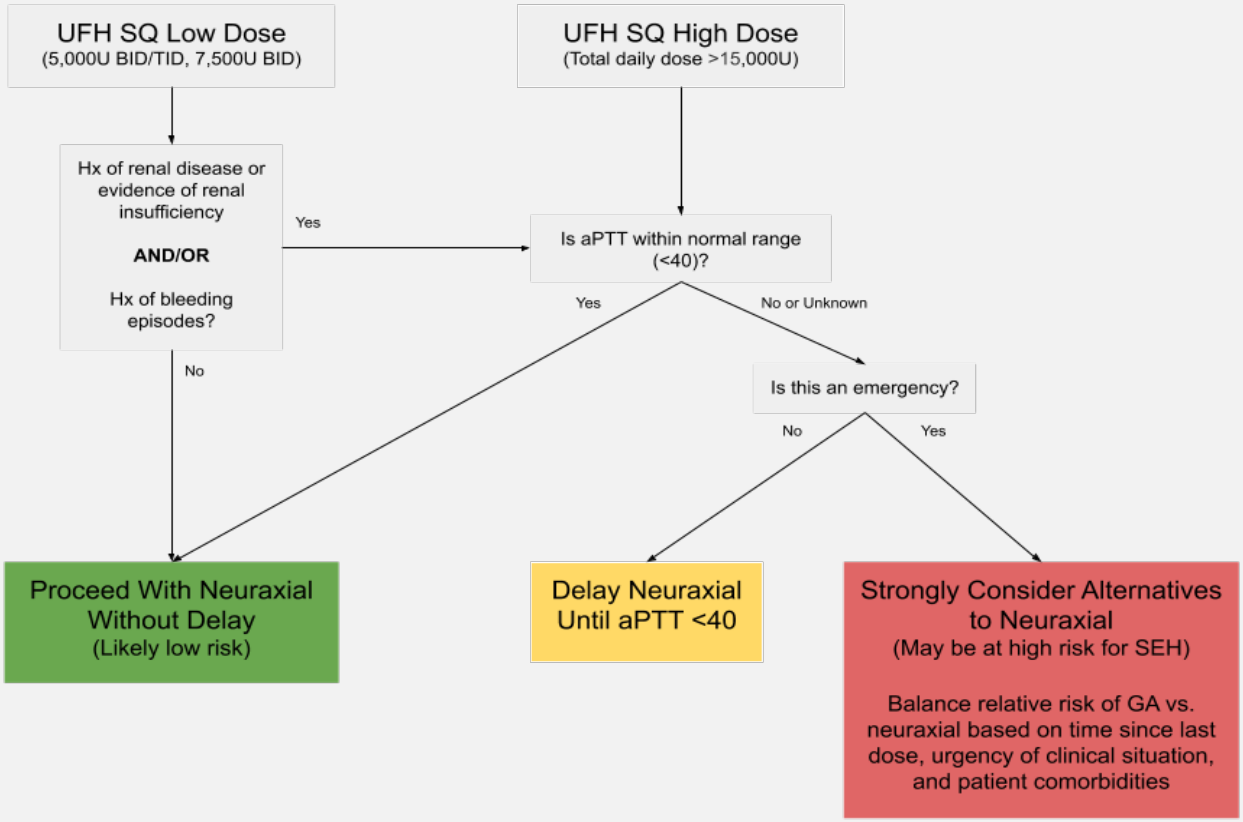
- Continue the baseline dose of methadone or buprenorphine.
- Use hydromorphone PCA for postop analgesia for breakthrough pain at 1.5-2 times the routine dose if the patient did not receive intrathecal morphine.
- Round-the-clock ketorolac and acetaminophen.
- Consider TAP or QL blocks.
- Consider using thoracic or high lumbar epidural and using plain bupivacaine only
- Paturients on methadone required 70% more opioids following cesarean delivery.
- Opiate agonist/antagonist medications such as nalbuphine or butorphanol are **contraindicated** as opiate withdrawal may be precipitated in the opioid dependent patient.

References

1. Anesth Analg 2017; 125(5): 1779-1783
2. Journal Subst Abuse Treat 2008; 35(3):245-259
3. Opioid use and opioid use disorder in pregnancy. Committee Opinion No. 711. ACOG. Obstet Gynecol 2017; 130: e81-94

By Merry Colella, MD and Yunping Li, MD

Guidelines for Patients on Unfractured Heparin



Additional Guidelines:

1. For patients on enoxaparin, adhere to the ASRA guidelines for timing of neuraxial as there is insufficient data currently to change this practice.

2. For patients on heparin for >4 days, check a platelet count from within the past 24 hours prior to performing neuraxial procedures, due to the risk of heparin-induced thrombocytopenia.

Merry Colella, MD

Non-Obstetric Surgery during Pregnancy

Background & Planning

- Non-Obstetric Surgery during Pregnancy occurs in between 0.3-2.2% of pregnancies.
- Human studies have **not conclusively shown** that any anesthetic agent results in increased congenital abnormalities. (previous studies that suggested teratogenic effects of nitrous oxide and benzodiazepines are not supported by more recent studies and epidemiologic data).
- General timing principals include:
    - If surgery is elective, defer until postpartum if appropriate.
    - If surgery is non-elective and can be delayed without maternal harm, postpone until second trimester (1st trimester - potential teratogenic risk, 3rd trimester - preterm labor risk).
    - If surgery is emergent, proceed as necessary.
- **Early communication** with Obstetrician for appropriate pre-, post- and possible intra-operative monitoring.
- Intra-operative monitoring typically reserved for after the age of viability (>24 weeks) and per OB and patient discretion.
    - Requires a L&D nurse in the OR and that an OB be available on stand-by.
    - Cesarean section tray needs to be in the OR at the start of the case along with neonatal resuscitation equipment (including a neonatal warmer).
    - OBs may want to dose perioperative glucocorticoids for infant lung maturity (requires 48 hours).
- Increased maternal sensitivity to sedatives, narcotics and local anesthetics.

Pre-operative

- Perform evaluation, consent and discuss plan with OB and surgery team.
- Administer Sodium citrate 30 ml PO <30 min before induction, if >12-16 weeks gestation.
    - May consider metoclopramide 10 mg and/or ranitidine 30 mg IV, >30 minutes prior to induction.
- Midazolam is not contraindicated, utilize if necessary.

Induction

- Place patient in Left Uterine Displacement, if >18-20 weeks gestation. Maintain throughout surgery, if possible.
    - If prone, ensure abdomen is uncompressed.
- Preoxygenation with either 100% O2 for 3 minutes or 4-8 vital capacity breaths.
- Rapid sequence induction.
- Tracheal intubation:

- Airway edema associated with pregnancy
- Video laryngoscopy may be considered first choice.
- Endotracheal tube size 6.5 or 6.0 mm in light of possible airway edema.

Intra-operative

- Goal is to maintain appropriate pregnancy homeostasis.
- Maintain normotension.
- Recommended initial ventilator settings of 6-8 ml/kg of IBW and a RR of 14-18.
  - There is a respiratory alkalosis in pregnancy with a normal PaCO2 of 30 mmHg. Ventilator setting should be titrated to limit hypercapnia.
- Volatile anesthetics
  - MAC decreased by 20-30%.
  - May cause decreased variability of fetal heart rate (>25-27 weeks).
  - Dose dependent uterine relaxation.
- If uterine contractions noted, consider tocolytics in consult with OB attending (nitroglycerin 50-200 mcg IV or terbutaline 0.25 mg IM).
- Laparoscopy: maintain a low pneumoperitoneum pressure (< 15 mmHg).
- Avoid NSAID's due to risk of prematurely closure of ductus arteriosus.
- Safe to use opioids.
- Dexmedetomidine crosses placenta and may cause fetal bradycardia at high dose, use with caution.
- For reversal of Neuromuscular Blockade:
  - Sugammadex appears safe to use, although there is limited data.
  - Be aware that neostigmine crosses the uteroplacental barrier to a greater degree than glycopyrrolate. The use of glycopyrrolate with neostigmine may lead to marked fetal bradycardia, which may prompt OB's to initiate emergent cesarean.
  - Atropine will cross the uteroplacental barrier and may be used as an adjunct for reversal. This may cause both maternal and fetal tachycardia.
- Pay careful attention to extubation with patient maintaining appropriate respiratory physiology, fully awake and following commands.
  - Majority of respiratory-related deaths occurred during emergence, extubation and recovery.

Post-operative

- Avoid NSAIDs.
- Evaluate for normal post-operative issues including pain, nausea and vomiting.
- Patient may need transport to L&D. OBs will likely obtain post-operative Fetal Heart Rate tracing and monitor for contractions.
- Venous thrombosis prophylaxis should be considered, if the patient is expected to be admitted.

(1) Mhyre JM. A series of anesthesia-related maternal deaths in Michigan, 1985-2003. Anesthesiology. 2007 Jun;106(6):1096-104.
(2) Kodali BS, Chandrasekhar S, Bulich LN, et al. Airway changes during labor and delivery. Anesthesiology.
(3) ACOG Committee Opinion No. 474: Non obstetric surgery during pregnancy. ACOG Committee on Obstetric Practice. Obstet Gynecol. 2011;117(2 Pt 1):420-1.

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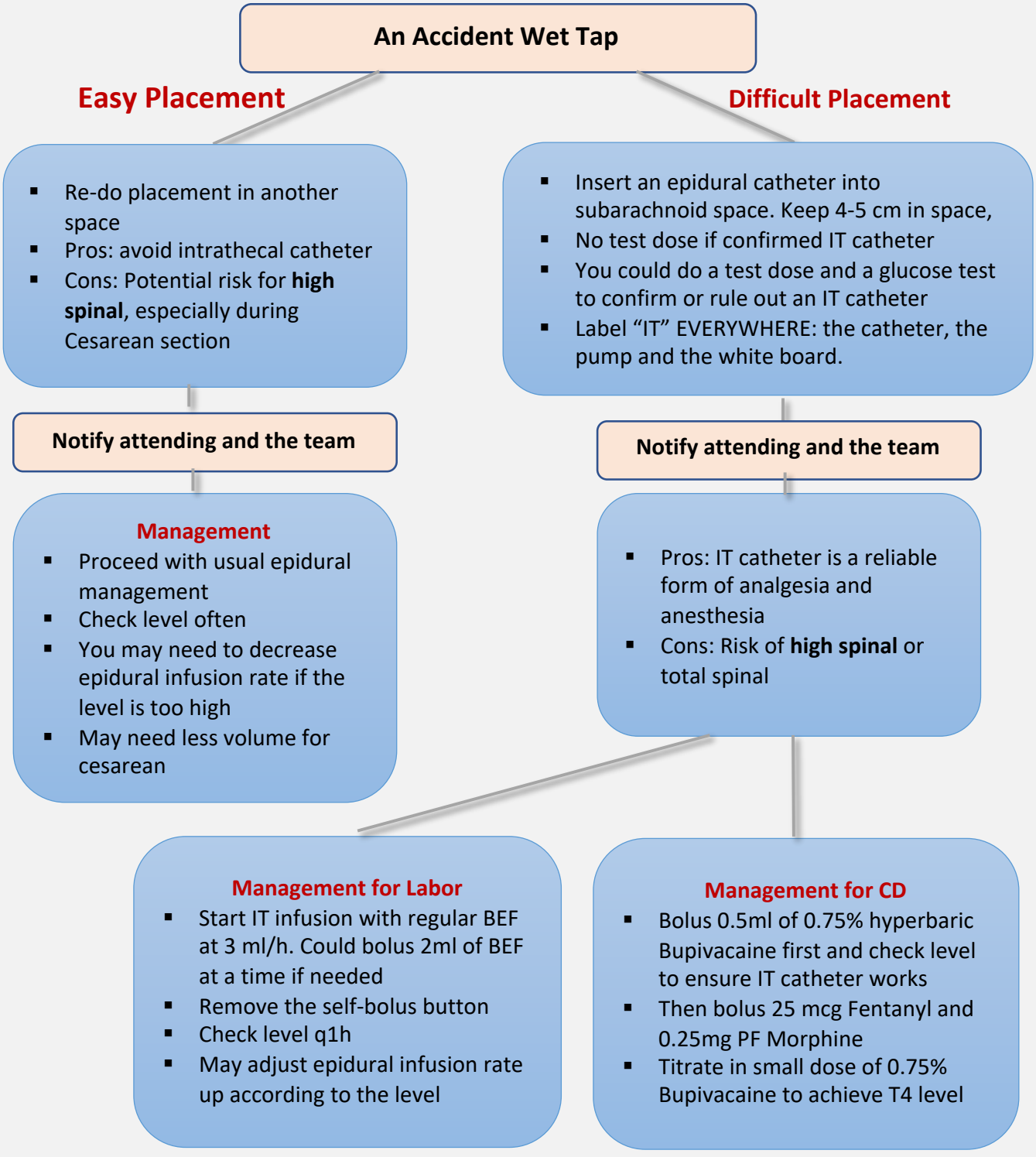
PART VIII

Anesthetic Complications

Management of Intrathecal Catheter



Yunping Li, MD

High Neuroblockade & Total Spinal Block

Clinical Significance

High neuraxial block was the leading cause of anesthesia-related maternal death[1]. It was also the leading cause of legal claims for maternal death or permanent brain injury filed between 1990-2003[2]

Risk Factors

- Unrecognized intrathecal catheter – Immediate onset
- Subdural catheter -delayed onset
- Spinal after failed epidural anesthesia for cesarean delivery -immediate
- After an unintentional dural puncture, the epidural catheter was inserted in a different space. During cesarean delivery, epidural local anesthetics enters subarachnoid space through the dural defect -delayed onset
- Overdose of local anesthetics in the epidural space

Symptoms and Signs – vary in presentation

- Agitation to sudden loss of consciousness, coma or seizures
- Inability to speak to difficult of breathing to respiratory arrest
- Mild hypotension to cardiac collapse
- Paralysis and dysphasia
- Subdural block – may involve the cranial nerves, apnea and Horner's syndrome can occur

Prevention

- Aspiration of the catheter before each bolus
- Administration of test dose and careful assessment of the patient's response
- During labor epidural analgesia, when late onset of hypotension and high block occur, you need to rule out the possibility of intrathecal catheter.
- Incremental dosing of epidural (5ml), EACH DOSE IS A TEST DOSE

Treatment

- Maintain oxygenation, ventilation (may need intubation) and circulation

References:
1. Hawkins JL et al. Anesthesia-related maternal mortality in the United States: 1979-2002. Obstet Gynecol 2011; 117:69-74
2. Davies JM et al. Liability associated with obstetric anesthesia: a closed claims analysis. Anesthesiology. 2009; 110:131-139

Yunping Li, MD

Local Anesthetic Systemic Toxicity (LAST)

Background

- Incidence after peripheral nerve blocks is higher than epidural
- The first case of successful use of a 20% lipid emulsion in a patient after LAST with cardiac arrest (Anesthesiology 2006; 105:217-8)
- Use of epinephrine in LA decreases systemic absorption.

Risk Factors

- Extremes of age
- Nerve block site
- Patient-related factors: cardiac, renal and hepatic diseases
- Multiple procedures, like labor analgesia to cesarean section, regional block after cesarean section
- Multiple routes of administration: local infiltration, irrigation, neuraxial, nerve blocks and lidocaine patch.

Diagnosis

- The signs, symptoms and timing of LAST are unpredictable and can be subtle
- Mental status change to convulsions.
- Cardiac instability to cardiac arrest.
- **Be vigilant.** Early diagnosis is the key for successful resuscitation.

Treatment (ASRA guidelines)

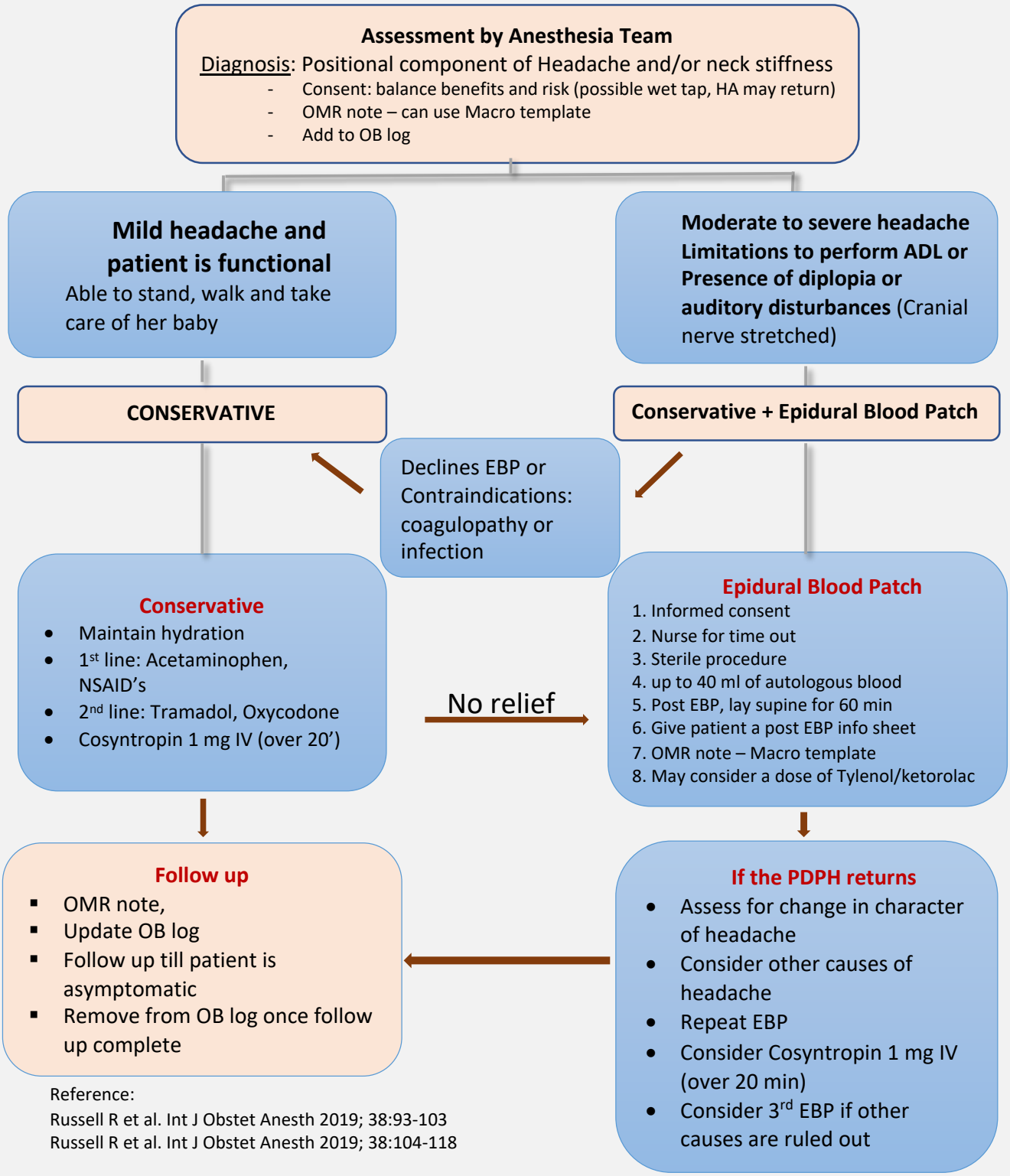
American Society of Regional Anesthesia and Pain Medicine

- **Bolus** 1.5ml/kg, of 20% Lipid IV over 1min **(100ml for 70 kg)**
- **Infusion** 0.25 ml/kg/min for 30-60 min
- **Repeat Bolus** 1-2 times for persistent cardiovascular collapse
- **Double Infusion** if BP returns but remains low
- **Avoid** vasopressin, beta blockers, calcium channel blockers and propofol

References: Weinberg GL et al. Anesthesiology 1998; 88:1071-5
Reg Anesth Pain Med 2010; 35: 152-161

Yunping Li, MD

Management of Postdural Pucture Headache



Reference:
Russell R et al. Int J Obstet Anesth 2019; 38:93-103
Russell R et al. Int J Obstet Anesth 2019; 38:104-118

Vimal K. Akhouri, MD

Spinal Puncture/Headache Information

What you need to know

During the placement of your epidural, a layer around the spinal fluid, called the dura, was punctured with a needle. The puncture of the dura happens on occasion during the placement of an epidural catheter. The hole allows spinal fluid to slowly drain.

You are at risk of developing a 'spinal' headache.

A spinal headache usually starts one to three days after the puncture of the dura, and can range from mild to severe. The headache is usually felt in the front or back of the head, or may even cause a muscle cramping between your shoulder blades. It always gets worse when you stand or sit. It improves or goes away when you lie down.

Other symptoms may include: nausea and vomiting, ringing in your ears, sensitivity to light, and double vision.

We can discuss treatment options with you.

If you develop a headache, please call:

- OB Anesthesia Office: 617-667-3077, or
- Labor and Delivery: 617-667-2295, or
- Department of Anesthesia: 617-667-3112

Ask for the OB Anesthesiologist.

You may also call your Obstetrician (OB), who can get in touch with us.

<u>Things you should know:</u>

- These headaches ultimately go away without treatment – it can take days to a couple of weeks.
- The most effective treatment is an epidural blood patch, which your provider can explain in detail.
- Drink enough water to avoid being dehydrated, eat, and sleep to the best of your ability as you would normally.
- Do not stand for prolonged periods of time, even if the headache is mild.
- If the headache is severe or you think you need treatment, please contact us.
- You can use Tylenol (acetaminophen) or Ibuprofen for pain control, if you do not have any other contraindications to these medications. You may also trial caffeine.

Department of Anesthesia
Obstetric Anesthesia

Post-Epidural Blood Patch Instructions

1. No heavy lifting, bending, or straining for the first 48 hrs

2. Take Tylenol as needed for back discomfort

3. You may shower

4. If you have symptoms of fever, chills, worsening headache and/or severe back pain, please call your obstetrician's office

5. Expect a call from an Obstetric Anesthesiologist tomorrow to follow up

6. If you have further questions/concerns about blood patch, please feel free to call 617-667-2295 and ask for an Obstetric Anesthesiologist. We are here 24 hours a day and are happy to address your questions/concerns as soon as possible

THANK YOU

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