Loma Linda University Medical Center

Department of Anesthesia

OB Syllabus

General Information

General Information

Phone Numbers:

Unit 3100 (antepartum)	44331
Unit 3200 (L/D)	44332
Unit 3800 (postpartum)	49700
OB recovery	42210
OB triage	42314
OB Anesthesia Resident call room	43364
OB Anesthesia Attending	51351
OB L/D Anesthesia Resident	52170
OB OR Anesthesia Resident	54131
OB charge nurse	51249
Housekeeping	44326
OB attending	54128
High risk OB senior resident	52166
Low risk OB junior resident	52169

Pagers:

OB Anesthesia Resident call	8500
OB resident blue pager	
OB Anesthesia Attending blue pager	0397

Room codes:

Anesthesia workroom (both in OR and next to L/D)	44331 star
Anesthesia cart	4410
Epidural pump	94629
Refrigerator for medications in workroom	start 044331 start

Four Anesthesia residents are assigned each month to OB. New residents to the rotation should orient themselves to the 3rd floor and get a quick overview of the rotation prior to starting from the senior resident. The program requires two months of OB anesthesia however many residents elect to complete an additional month for more experience.

All call shifts are 24 hours from 7am to 7am. You will have your post call day off. The on call resident should update the anesthesia case log, restock the epidural cart and prepare the OR's if used before leaving.

The on call resident (L/D) is in charge of the epidurals on the floor (Unit 3200) and takes over care of the OB OR once the OR resident leaves. If you are the OB OR resident you areexpected to arrive at 7AM (8:30 on Weds after conference) and check with the 3200charge nurse about cases that day. OB L/D resident should check with charge nurse about any issues on the floor and attend morning report at 7:15.

The OB OR has 3 rooms; room 1 is to be used used for scheduled c-sections. Room 2 is usually reserved for Gyn cases such as D&C. Room 1 or 2 are usually used for postpartum tubal ligations, cervical cerclages, OB OR3 is used for c-sections when room 1 is busy I.E. urgent or emergent cesarean sections coming from 3100 or 3200. All high risk fetal cesarean sections and twin deliveries should be done in OB OR3. All of the OR rooms should be stocked with emergency medication, supplies and fluids. If you use any of the

emergency drugs during a case make sure you replace them at the end. Also replace the circuit and suction if they have been used. In OBOR we do not get anesthesia technicians (AT) help to the extend in the CHOR **so the OR resident is responsible for making sure that the OR is ready** to go in case of emergency procedures. The night time pediatric AT are ordering supplies for OB, they stock the supply rooms also. After GA case you may request AT help at 44442.

Safety

1. Keep your drugs secured or on your person at all times
2. Anesthesia carts should be locked when not in use, as per JCAHO recommendations
3. Drugs should not be left out on top the anesthesia carts
4. Label all medications, including time / date / initials
5. Do not have pre spiked IV fluids unless you plan to give them in the next one hour

Responsibilities

1. Making sure all 3 OR's are ready from an anesthesia standpoint (emergency meds, machine check, airway equipment and a working suction for crash C/S under GA
2. Know location of 2 glidescopes and the difficult airway tower
3. Replacing supplies that are running low, calling anesthesia tech to restock if necessary. This includes epidural cart and emergency medications
4. Updating the call room log book
5. Ensuring accurate documentation of all patients with ongoing anesthetics prior to signing out
6. Completing documentation before sign-out for patients with finished anesthetics including anesthesia stop times, and transfer of care/signout and follow-up note
7. Attending morning report at 7:15 and updating attending on any issues on the floor
8. Responding promptly and professionally to requests for services
9. Consulting on complicated patients requested by the OB or MFM team for evaluation
10. Completing a preop and obtain consent for each patient requesting regional
11. Completing a preop on all OR patients
12. Discussing all plans with covering anesthesia attending

Reading: PDF on the Wiki but can also be accessed on Loma Linda VIP website go to Clinical Desktop and then Clinical Key. All books found on website.

1. Millers Anesthesia Chapter 77 Anesthesia for Obstetrics
2. Chestnut Obstetric Anesthesia-
   - Chapter 2 (Physiologic Changes)
   - Chapter 12 (Spinal, Epidural and Caudal Anesthesia)
   - Chapter 13 (LA and Opioids)
   - Chapter 17 (Nonob Surgery During Pregnancy)
   - Chapter 23 (Epidural and Spinal Analgesia/Anesthesia for L/D)
   - Chapter 36 (Hypertensive Disorders)
   - Chapter 42 (Cardiovascular Disorders)
3. Supplemental- Articles uploaded on the Wiki/hardcopy in call room.

First Month Objectives

1. Describe the physiologic changes of pregnancy and relate these to alterations required in your anesthetic technique.

2. Describe the anatomy, physiology and effect of anesthetic agents on uteroplacental perfusion.

3. List the factors affecting placental transfer of drugs and their anesthetic implications.

4. Draw the pain pathways for labor and delivery.

5. Describe the detrimental effects of pain on the mother and fetus.

6. Draw and describe the anatomy of the epidural/subarachnoid space.

7. Successfully complete an epidural and spinal anesthetic with efficiency, competence and proper sterile technique.

8. Describe complications associated with neuraxial blocks and describe patients in whom they may be difficult or contraindicated.

9. Achieve and maintain good labor analgesia using epidural or spinal techniques. Make appropriate choices of agents for induction and maintenance to suit the clinical situation.

10. Be able to describe the pharmacokinetic properties of the agents used in epidural or spinal anesthesia.

11. Conduct an anesthetic for c-section.

12. Outline a plan for the management of a difficult or failed intubation in the parturient.

13. Review a fetal heart tracing and identify abnormal fetal tracings.

Second Month Objectives

1. Describe the clinical symptoms and management of a postdural puncture headache.

2. Know the indications and how to perform an epidural blood patch.

3. Evaluate a patient with a postpartum neuropathy to determine sensory and motor nerve involvement and describe the appropriate steps to determine etiology. Be familiar with the common nerve palsies associated with labor and delivery and be able to differentiate these from those associated with regional anesthesia.

4. Describe the relationship between epidural block and postpartum backache.

5. Describe the pathophysiology of preeclampsia and develop an appropriate anesthetic plan.

6. Know the pharmacokinetics for the commonly used tocolytic agents and management of their side effects and how they will affect your anesthetic.

7. Describe the anesthetic management of both vaginal and operative delivery for a patient with multiple gestation.

8. Describe the obstetrical and anesthetic concerns for a patient with a breech presentation.

9. List the causes of antepartum and postpartum hemorrhage and describe the anesthetic and obstetrical management. Identify patients at risk for hemorrhage.

10. Describe the clinical signs and symptoms of amniotic fluid embolus and be able to describe the features, which distinguish it from other types of embolism.

11. Develop an anesthetic plan for fetal distress based on fetal heart tracing.

General Competencies

The residency program, in accordance with ACGME guidelines, requires its residents to obtain competencies in the 6 areas listed below. Toward this end, the program defines the specific knowledge, skills, and attitudes required, and also provides educational experiences as needed in order for residents to demonstrate these competencies.

Patient Care

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Residents are expected to:

- Communicate effectively and demonstrate caring and respectful behaviors when interacting with patients and their families.
- Gather essential and accurate information about their patients.
- Make informed decisions about diagnostic and therapeutic interventions based on patient information and preferences, up-to-date scientific evidence, and clinical judgment.
- Develop and carry out patient management plans.
- Counsel and educate patients and their families.
- Use information technology to support patient care decisions and patient education.
- Perform competently all medical and invasive procedures considered essential for the area of practice.
- Provide health care services aimed at preventing health problems or maintaining health.
- Work with health care professionals, including those from other disciplines, to provide patient-focused care.

Medical Knowledge

Residents must demonstrate knowledge about established and evolving biomedical, clinical, and cognate (e.g. epidemiological and social-behavioral) sciences and the application of this knowledge to patient care. Residents are expected to:

- Demonstrate an investigatory and analytic thinking approach to clinical situations.
- Know and apply the basic and clinically supportive sciences, which are appropriate to their discipline.

Practice-Based Learning and Improvement

Residents must be able to investigate and evaluate their patient care practices, appraise and assimilate scientific evidence, and improve their patient care practices. Residents are expected to:

- Analyze practice experience and perform practice-based improvement activities using a systematic methodology.
- Locate, appraise, and assimilate evidence from scientific studies related to their patients' health problems.
- Obtain and use information about their own population of patients and the larger population from which their patients are drawn.
- Apply knowledge of study designs and statistical methods to the appraisal of clinical studies and other information on diagnostic and therapeutic effectiveness.
- Use information technology to manage information, access on-line medical information, and support their education.

- Facilitate the learning of students and other health care professionals.

Interpersonal and Communication Skills

Residents must be able to demonstrate interpersonal and communications skills that result in effective information exchange and teaming with patients families, and professional associates. Residents are expected to:

- Create and sustain a therapeutic and ethically sound relationship with patients.
- Use effective listening skills and elicit and provide information using effective nonverbal, explanatory, questioning, and writing skills.
- Work effectively with others as a member or leader of a health care team or other professional group.

Professionalism

Residents must demonstrate a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population. Residents are expected to:

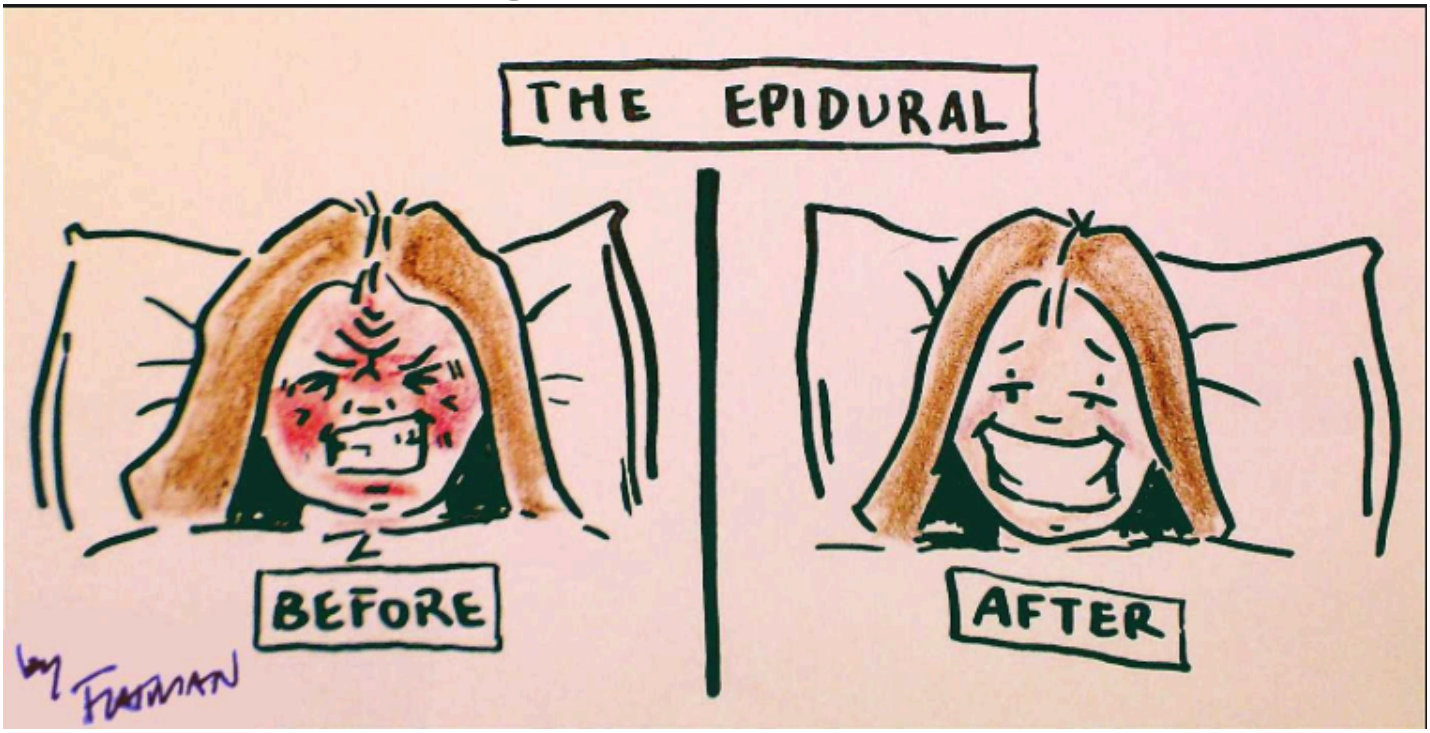
- Demonstrate respect, compassion, and integrity; a responsiveness to the needs of patients and society that supercedes self-interest,; accountability to patients, society, and the profession; and a commitment to excellence and on-going professional development.
- Demonstrate a commitment to ethical principles pertaining to provision or withholding of clinical care, confidentiality of patient information, informed consent, and business practices.
- Demonstrate sensitivity and responsiveness to patient's culture, age, gender, and disabilities.

Systems-Based Practice

Residents must demonstrate an awareness of and responsiveness to the larger context, and system of health care and the ability to effectively call on system resources to provide care that is of optimal value. Residents are expected to:

- Understand how their patient care and other professional practices affect other health care professionals, the health care organization, and the large society and how these elements of the system affect their own practice.
- Know how types of medical practice and delivery systems differ from one another, including methods of controlling health care costs and allocating resources.
- Practice cost-effective health care and resource allocation that does not compromise quality of care.
- Advocate for quality patient care and assist patients in dealing with system complexities.
- Know how to partner with health care managers and health care providers to assess, coordinate, and improve health care and know how these activities can affect system performance.

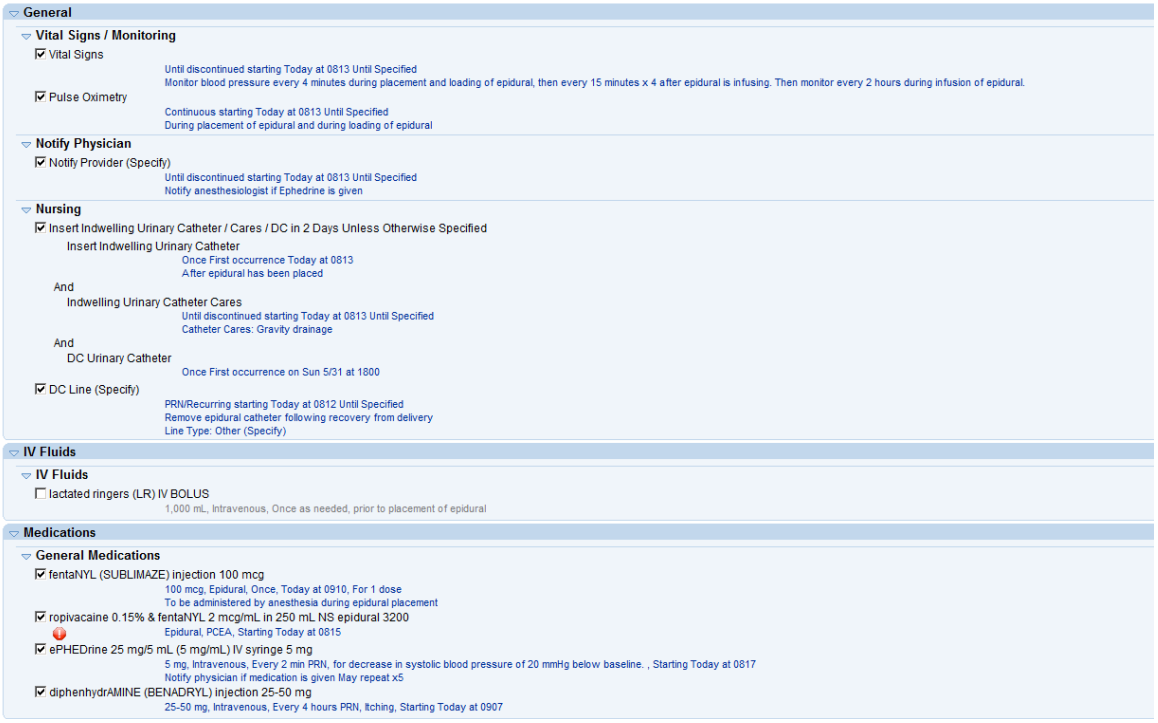
Drugs & Procedures



Drugs and Procedures

LABOR EPIDURAL

Preop patient, check labs and obtain consent
Ensure patient has received or bolus of fluids is running
Go to order sets and order “epidural order set”



Bring cart into room
Hook up monitors, make sure change BP to check every 3mins. During placement and initiation of epidural analgesia we monitor patients with pulse oxymeter and a BP cuff.

Draw up: 100mcg of fentanyl and 10cc of 0.2% ropivacaine if plan is to load catheter (may not need to give bolus in certain cases for example patient not having contraction and getting epidural placed prior to pitocin being started)
Macros are in epic to simplify documentation. Click the LABOR EPIDURAL macro
Always have a hat and a mask on
Open Epidural Kit, add a Tegaderm and 5 cc syringe
Prep using Chlorprep x2 and Drape
Use sterile gloves
Place Epidural

Test dose – to be given after negative aspiration. 3cc of 1.5% lidocaine w/1:200,000 epi
Tegaderm and tape catheter closest to infusion pump
Activation - 100mcg fentanyl and 5-10cc of 0.2% Ropivacaine given slowly a couple milliliters at a time. Monitor vitals for hypotension and fetal distress after loading epidural. Fill out a Labor Analgesia Note, note is linked to the epidural line and it will appear after the note is completed.

Of note: Extra epidural needles (including 5 and 6inch long needles) are located in anesthesia workroom. Spinal needles (25g 5inch) for through and through technique for CSE are also

located in workroom in cabinet above the sink.

The key for the infusion pump is passed around from resident to resident so make sure you have it prior to starting epidural

Pump set up: Infusion (premixed bag given to you by the nurses) 0.15% ropivacaine w/2.5mcg/cc fentanyl
Code- zip code in reverse 94629
Select Program
New program
Put in code
Yes to erase
Bag volume: 190cc
Maintenance infusion rate: 8-10cc/hr
PCEA bolus: 8cc
Bolus interval lockout: 20mins
Max per hour: 2
** Consult your attending for appropriate doses**

Top off: Before giving a top-off ask patient where she has pain. If she has rectal pressure, the OB should exam patient first. Check sensory levels (alcohol swab is an excellent way to test sensory levels). If block is one-sided ask pt to lie on side that is still painful and then bolus. Also may consider pulling the catheter back 1-2cm depending on how far it was threaded.

Medication: 0.2% ropivacaine - 5-10cc in 5cc increments
0.125% Bupivacaine – 5-10 cc
1% Lidocaine
1.5% Chlorprocaine
The above concentrations are achieved when you further dilute the local anesthetics with preservative free normal saline. Make sure you use only PF medications, always aspirate before administering epidural bolus. Remember that Lidocaine and Chlorprocaine will affect motor strength and ability to push, dilute and be aware of the degree of cervical dilatation.
Perineal dose: For perineal repairs only. 3% 2-chloroprocaine (5-10cc in 5cc increments) or 2%lidocaine w/epi (5-10cc in 5 cc increments)

Don't forget to log all cases in the call room logbook. Please include if there is any complications such as dural puncture.

** DO NOT WITHDRAWL CATHETER THROUGH NEEDLE AS IT CAN CAUSE SHEARING OF THE CATHETER**

Emergent c-sections w/ existing epidural:

Ask the secretary on 3200, Team leader (TL) or circulating nurse to create a C-Section chart, if no time continue on same anesthesic record as labor epidural and click epidural to OR button. Consider starting to bolus epidural with lidocaine w/epi in patient room prior to going to OR or give the first dose immediately on arrival to OR prior to transfer to OR table

Medication and dose:
15-20cc 2% lidocaine w/ epi (consider adding 2 cc bicarb to 18 cc of Lidocaine)

3 - 3.5 mg of PF Morphine after baby is delivered

OR

20cc 3% 2-chloroprocaine (2-2.5cc per segment needed)

50-100mcg Fentanyl

2 - 3.5 mg PF Morphine after delivery

If truly STAT and cannot start bolus in patient room use chloroprocaine

Additional lidocaine w/epi in *5* cc boluses may be needed intraop to maintain levels (max 7 mg/kg). ** Remember local anesthetics are additive and proportional**

Drugs and Procedures

Combined Spinal/Epidural - CSE

At two separate levels:

Ideal for patients with advanced dilatation, high pain scores, inability to position and remain still for epidural placement. Intrathecal administration of the medications listed will make the patient comfortable and cooperate with positioning. May be done in lateral position and after pain is relieved position the patient sitting. After placing the spinal, wait for 5 minutes before proceeding to the epidural. Place the epidural as usual with test dose however do not activate or give fentanyl. Set infusion at 3 - 4 cc/hour without PCA to keep catheterpatent and load the epidural with ropivicaine once pain and sensory/motor levels return – about 2 hours. At this time you may increase the rate and allow the patient to bolus themselves (see labor epidural).

Medication for spinal portion for CSE when placed for labor analgesia:

15-25 mcg fentanyl
3.75 mg of 0.75% hyperbaric bupivicaine (0.5 cc)
2.5 mg of 0.25% isobaric bupivicaine (1 cc)

or

2.5 mg of 0.25% isobaric bupivicaine (1 cc) only

or

15-25 mcg fentanyl only

Needle through needle technique:

CSE labor analgesia can be the ideal choice of labor analgesia in multiparous patients in advanced labor. Provides faster onset and better sacral coverage. However, there have been adverse side effects reported. If narcotics are given in the IT space rarely there can be rostral spread which can lead to respiratory depression. Another problem that has been associated with CSE labor analgesia is fetal bradycardia. It is thought that the rapid profound relief in analgesia causes a sudden drop in endogenous catecholamine levels leading to uterine hypertonus which compromises uteroplacental perfusion. Also another concern with CSE is

the presence of an untested epidural catheter. Until the intrathecal analgesia resolves one cannot be certain the epidural catheter is functioning properly, which is concerning if the patient necessitates a C-section. Consider avoiding CSE if the patient is at high risk for cesarean delivery.

When an epidural catheter is placed in addition to the intrathecal dose, no loading dose is required because the parturient will have analgesia from the spinal dose that will normally last until an epidural infusion can reach a steady state.

Medication for spinal portion for CSE when placed for labor in this technique are the same as above.

Medications for spinal portion for CSE when placed for c-section:

- 12-15 mg hyperbaric bupivacaine (depending on length and patient height)
- 150 mcg PF Morphine and 20mcg fentanyl.

CSE- Needle-through-needle techniques

This technique combines the benefits of spinal and epidural I.E. fast onset and ability to extend the duration of surgical anesthesia. An epidural needle is used to identify the epidural space. A 5 inch spinal needle (24, 25 or 26G, located in the OR workroom labeled CSE use only) is passed through the epidural needle into the intrathecal space and the subarachnoid block is performed. After removal of the spinal needle, an epidural catheter is placed that can be later used. Make sure you draw up medications used for spinal portion prior to sterile prep.

Drugs and Procedures

SPINAL FOR C-SECTION

11-15 mg hyperbaric bupivacaine (depending on length and patient height)
150mcg PF morphine
20mcg fentanyl.

Need T5-T6 sensory level for adequate anesthesia.

Prior to placing the block place monitors and ensure patent IV is in place and working. Current practice is co-loading with 1000 ml crystalloid bolus during spinal placement and starting Phenylephrine gtt immediately after placement. Start Phenylephrine at 30-40 mcg/min and titrate to BP within 10-15% of baseline. After block put patient in supine position with left lateral tilt to avoid supine hypotension syndrome. Test levels and watch closely, adjust bed as needed to achieve desired level of the block.

Administer antiemetics:

Bicitra – 30 ml PO 30 min prior to start
Ondansetron – 4 mg IV

Metoclopramide – 10 mg IV
Famotidine – 20 mg IV
Dexamethasone – 4 mg IV.
May consider omitting Dexamethasone in DM and GDM patients

SPINAL ANESTHESIA FOR POSTPARTUM TUBAL LIGATIONS (PPTL)

T8 level is required for adequate anesthesia. Note decreased cephalad spread, because increased intraabdominal pressure is no longer present after delivery.

13.5-15 mg hyperbariac Bupivacaine
Recommend adding 20-25 mcg of IT Fentanyl, to decrease visceral pain.
IT administration of short acting narcotics (Fentanyl) requires only 2 hrs of respiration monitoring, incision is small so IT morphine not necessary

Existing epidural may be loaded instead of placing a spinal. Often the labor epidural catheters are pulled after delivery and can be unreliable therefore spinal anesthetic is often used the following day for PPTL. If epidural was difficult to place and a difficult spinal is suspected consider leaving epidural in place for PPTL and running normal saline through epidural to keep patent.

SPINAL ANESTHESIA FOR CERCLAGE

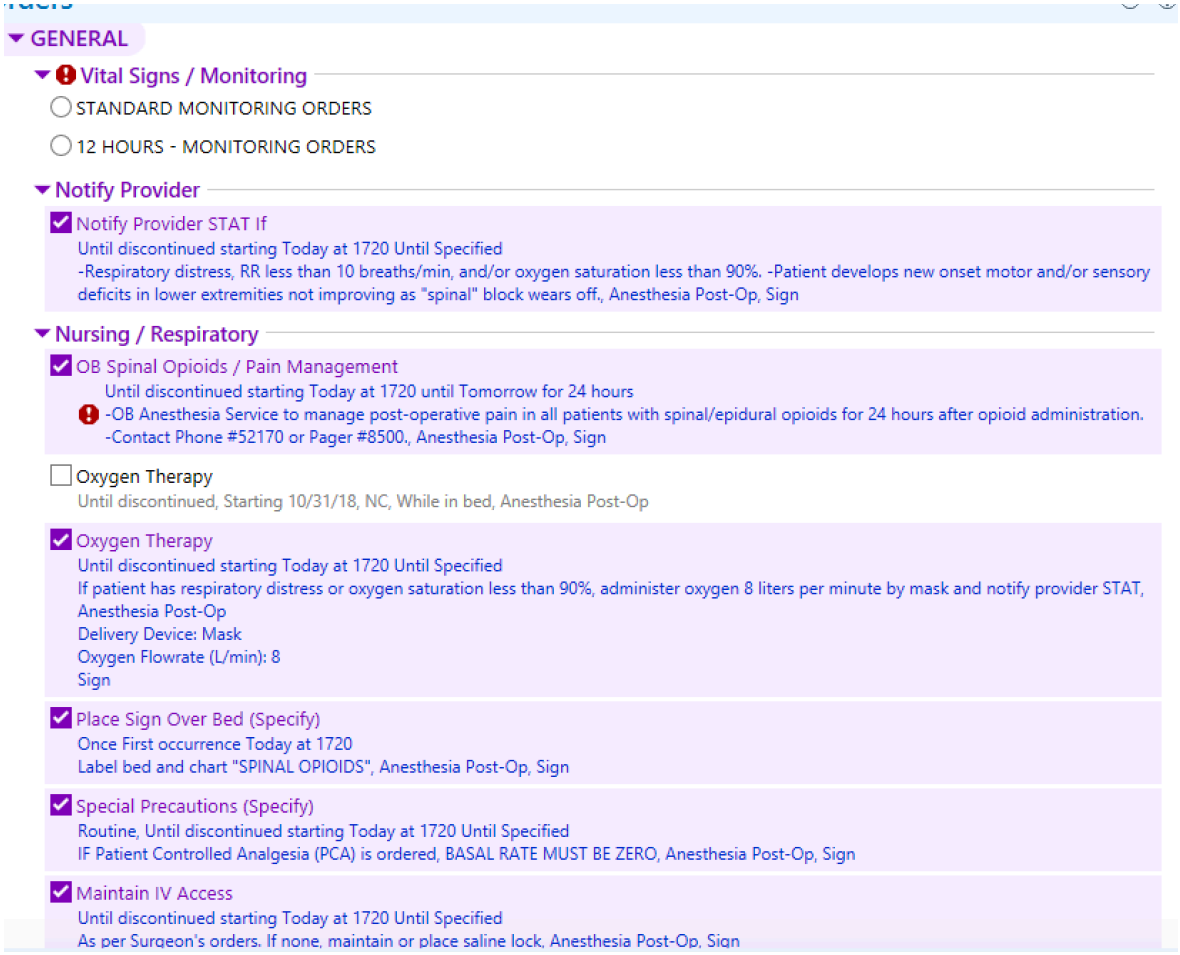
T10 sensory level is required

12-15 mg hyperbaric Bupivacaine
Consider keeping the patient sitting for 2-5 min.
No need for narcotics.

POSTOPERATIVE ORDERS AFTER CESAREAN SECTION:

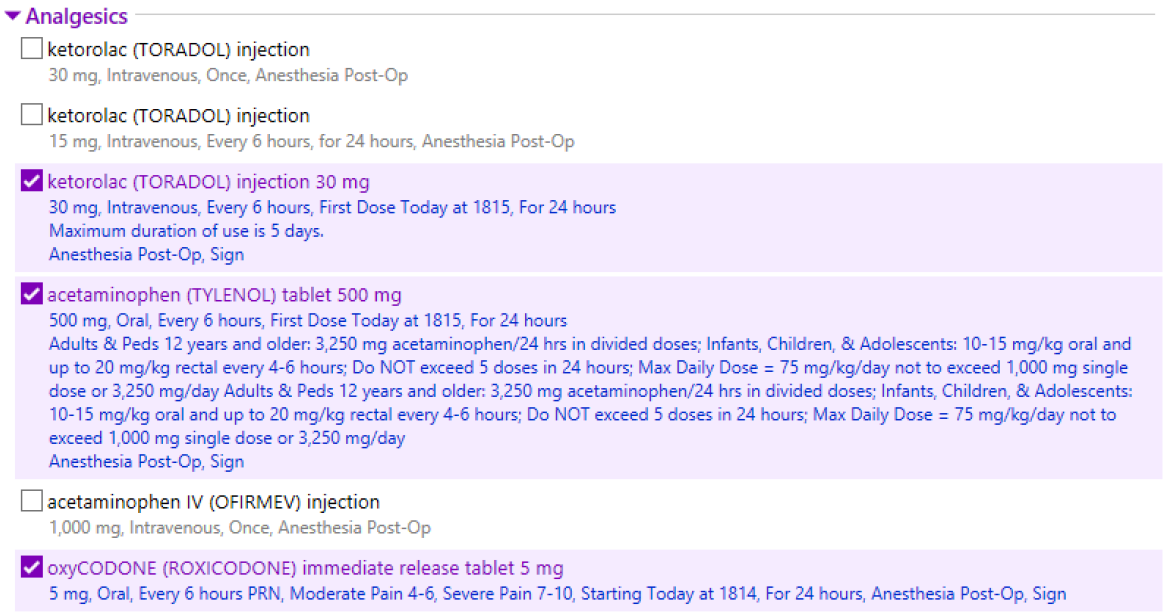
Enter standard PACU adult orders, add 30 mg Ketorolac and Ofirmev 1000mg once

Enter OB post spinal narcotics/Pain management orders:



Remember to fill out the dose and time of narcotic administration.

The duration of respiration monitoring per Society for Obstetric Anesthesia and Perinatology (SOAP) guidelines is dose and patient dependent. In healthy parturients who have received <50 mcg of PF Morphine IT no monitoring is required, if the IT dose is 50-150 mcg 12 hrs of respiratory monitoring after administration is required. In doses higher than 150 mcg or patients with morbid obesity or OSA, ASRA guidelines for respiratory monitoring for 24 hrs after administration will apply.



In cases when Ketorolac is contraindicated substitute PO Acetaminophen with 1 g Ofirmev Q8hrs x24 hrs. Keep the rest the same.

GENERAL ANESTHESIA FOR C-SECTION

Make sure to perform airway exam and have Glidescope in room. Pregnant patients are at significantly (10x) higher risk of having a difficult airway. Consider giving Bicitra as premed.

Rapid Sequence Induction:
- Propofol 1.5-2mg/kg
- Succinylcholine 1-2 mg/kg (duration prolonged in pregnancy)
- Fentanyl as needed after umbilical cord clamped
- lnhalationals (remember they contribute to uterine atony)
  - +/- Nitrous Oxide (after delivery favored by some)
- Pitocin 20-40units per liter of IV fluids immediately after delivery

Place patient in left uterine displacement, standard ASA monitors and begin pre oxygenating with good mask fit. Prior to beginning GA, the surgical team should be scrubbed and poised with knife in hand. As soon as airway is secure let them know so they can start. Make sure an LMA is immediately available as these patients are higher risk for being difficult airways.

Succinylcholine and nondepolarizing muscle relaxants do not cross the placenta.

Consider ketamine (1-2 mg/kg) or Etomidate (0.2-0.3) for induction if hemodynamically unstable.

Remember that inhalational anesthetics contribute to uterine atony. May need to switch to TIVA in case of uterine atony. Consider running 0.5 MAC of volatile agent and remifentanil or Propofol infusion to minimize this risk.

Standard PACU adult orders, no need to manage pain orders for 24 hrs, since OB team will order PCA

UTEROTONICS

Uterine atony may be treated with **Methergine** 0.2 mg IM (risk of HTN) and/or **Hemabate** 250 mcg IM (caution with asthma) q 15-20 min (max of 2 mg). These medications can be found in the refrigerator in the workroom. They should be kept cold and dark whenever not in use, as they are sensitive to light and heat. There is a blue cooler that should be taken in OR with these medications during every C/Section. Another medication to improve uterine tone is **Misoprostol**. The RN typically gives it PR. However, it can be given oral, buccal/sublingual or vaginally. The typical dose is 600-1000mcg.

RETAINED PLACENTA

Requires manual extraction of placenta, usually done in OR. May need GA or loading existing epidural catheter. Uterine relaxation may be achieved with 1-2 MAC of inhalational anesthetic or 50 -100 mcg IV Nitroglycerine. Sublingual Nitroglycerine spray 400 mcg/puff is available in OBOR 3 medication cart. Dose is 2 puffs and results are similar as with IV administration.

Drugs and Procedures

EPIDURAL BLOOD PATCH (EBP)

EBP is the only effective treatment for PDPH.

First, evaluate the patient and determine the likelihood of PDPH (if it is not positional it is not likely to be PDPH). Explain the risks, benefits and alternative treatments to an epidural blood patch and receive written consent for the procedure. EBP complications include transient back pain at site, radicular pain, transient bradycardia and facial nerve palsy. Keep the patient in a monitored setting (triage or recovery) with a nurse to assist you, and start an anesthesia record.

Usually the patient is placed in the sitting position, may use lateral position if headache is severe. General monitors should be placed. Sterile prep as usual for epidural with mask and scrub cap. It is recommended to perform the blood patch at a level caudad to the previous epidural since the blood tends to spread cephalad. Identify the epidural space in the usual manner, and meanwhile a second anesthesia provider will obtain 20cc of sterile autologous blood, which should be injected in 5 ml increments through the epidural needle until all the blood is given or the patient complains of discomfort. The headache is often relieved immediately from an increase in epidural pressure and subarachnoid space forcing CSF back into the cranium and restoring the cushioning effect on the brain. The patient should remain supine with a pillow below the knees (to eliminate lumbar lordosis and promote blood spread) for one to two hours. The patient should also be advised to avoid vigorous activity and heavy lifting for at least two days. If the first epidural blood patch is not effective a second one maybe placed the next day with up to a 98% success rate. If the patient already has a patent epidural catheter this may also be used as a conduit for the blood patch although there maybe an increased risk of infection with this route.

Prophylactic EBP has not shown to be effective: significant leak that is difficult to counteract and a lot of local anesthetic still in the epidural space that has somewhat anticoagulation effect, preventing the injected blood from clotting. There is some recent data that prophylactic blood patch may decrease the severity of the headache but confirmative studies are missing.

Neuraxial Blockade

Complications of Neuraxial Blockade

Table 1. Event Rates for Complications

Table 1. Event Rates for Complications

Outcome	Data Source	Number of Studies	Number of Patients	Number of Events	Percent	Individual Risk, 1 in	Per Million Number
Epidural hematoma	All studies	8	1,100,299	6	0.00055	183,383	5
	Larger, more recent studies	4	1,010,346	6	0.00059	168,391	6
Deep epidural infection	All studies	13	1,208,698	11	0.00091	109,882	9
	Larger, more recent studies	7	1,161,218	8	0.00069	145,152	7
Persistent neurologic injury	All studies	9	770,938	3	0.00039	256,979	4
	Larger, more recent studies	2	711,000	3	0.00042	237,000	4
Transient neurologic injury	All studies	15	987,218	254	0.02573	3,887	257
	Larger, more recent studies	3	902,484	163	0.01800	5,537	180
Transient + unknown injury	All studies	21	1,250,718	288	0.02303	4,343	230
	Larger, more recent studies	7	1,150,223	172	0.01500	6,690	150

Larger studies had more than 10,000 women, and more recent studies were published during or after 1990.

Wilhelm Ruppen, M.D., Sheena Derry, M.A., Henry McQuay, D.M., R Andrew Moore, D.Sc.; Incidence of Epidural Hematoma, Infection, and Neurologic Injury in Obstetric Patients with Epidural Analgesia/Anesthesia. *Anesthesiology* 2006;105(2):394-399.

Hematoma

- Often present with severe pain and/or muscle weakness or sensory deficits
- Consult neurosurgery immediately if progressive neurologic deterioration, best results if decompression occurs within 12 hrs
- Pregnancy is a hypercoaguable state, but be aware of administration of anticoagulants

The Society for Obstetric Anesthesia and Perinatology (SOAP)Consensus Statement on the Anesthetic Management of Pregnant and Postpartum Women Receiving Thromboprophylaxis or Higher Dose Anticoagulants

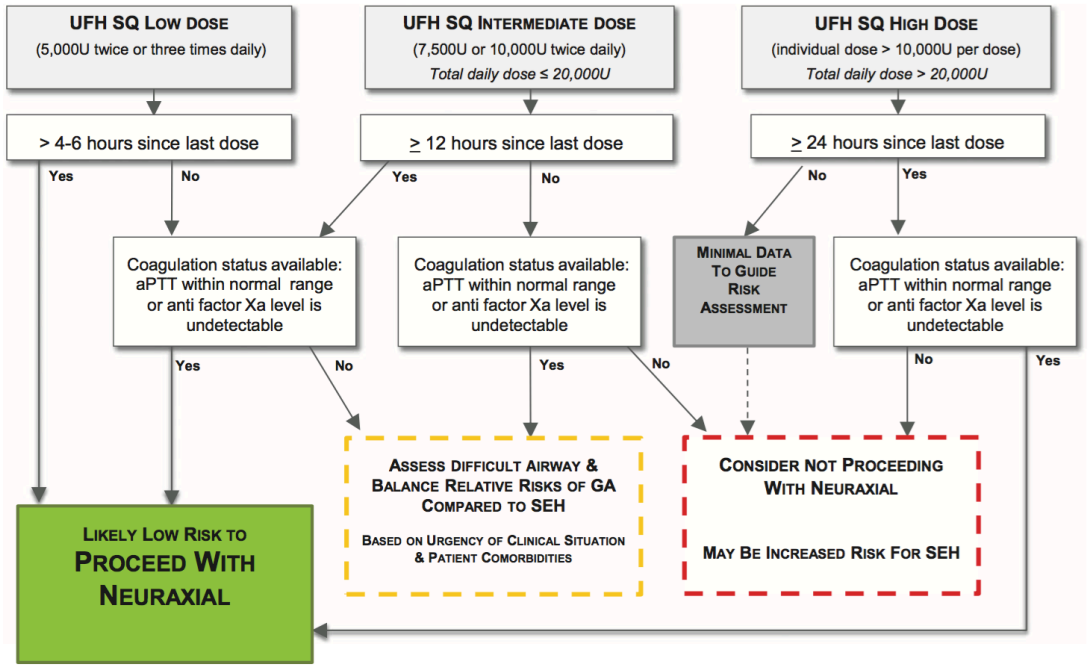


Figure 3. Decision aid for urgent or emergent neuraxial procedures in the obstetric patient receiving UFH. *Assume normal renal function, body weight > 40 kg, and no other contraindications to neuraxial anesthesia. aPTT indicates activated partial thromboplastin time; GA, general anesthesia; SEH, spinal epidural hematoma; SQ, subcutaneous; UFH, unfractionated heparin. Note: This SOAP consensus statement is not intended to set out a legal standard of care and does not replace medical care or the judgment of the responsible medical professional considering all the circumstances presented by an individual patient.

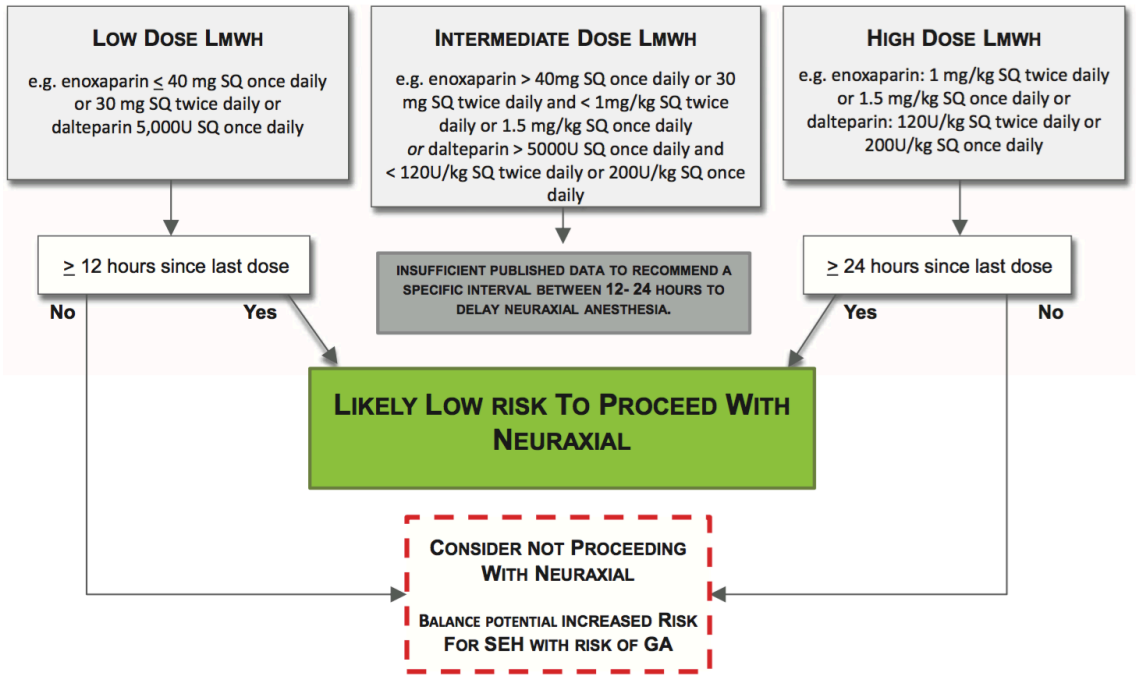


Figure 4. Decision aid for urgent or emergent neuraxial procedures in the obstetric patient receiving LMWH. *Assume normal renal function, body weight >40 kg, and no other contraindications to neuraxial anesthesia. GA indicates general anesthesia; LMWH, low molecular weight heparin; SEH, spinal epidural hematoma; SQ, subcutaneous. Note: This SOAP consensus statement is not intended to set out a legal standard of care and does not replace medical care or the judgment of the responsible medical professional considering all the circumstances presented by an individual patient.

However, in URGENT cases after administration of low or intermediate dose of UFH, with greater competing risks of general anesthesia compared to the risk of SEH from neuraxial blockade, the placement of neuraxial anesthesia without delay may be appropriate (Class IIa C-EO).

The following table is attached for reference of other anticoagulants, not addressed by the SOAP guidelines.

LOMA LINDA UNIVERSITY
MEDICAL CENTER

ANTICOAGULATION GUIDELINES FOR NEURAXIAL PROCEDURES AT LLUCH - OBSTETRICS

Guidelines to Prevent Spinal or Epidural Hematoma following Epidural or Spinal Procedures

ATTENTION! *WHEN CAN YOU SAFELY DO NEURAXIAL/PERIPHERAL NERVE PROCEDURES OR GIVE ANTICOAGULANTS*
Neuraxial routes include epidural and intrathecal infusions, implanted intrathecal pumps, and spinal injections.
OB Anesthesia ServicePager: 8500 ext: 51351, 52170

MEDICATION	PRIOR TO NEURAXIAL/NERVE PROCEDURE Minimum time between last dose of anticoagulant and spinal injection, neuraxial catheter PLACEMENT or REMOVAL	WHILE NEURAXIAL/NERVE CATHETER IN PLACE Restrictions on use of anticoagulants in patients with neuraxial catheters in place	AFTER EPIDURAL CATHETER REMOVAL Minimum time between neuraxial catheter removal and next anticoagulant dose
ANTICOAGULANTS FOR VTE PROPHYLAXIS			
heparin unfractionated 5000 units SQ q8 or q12 hr	**4-6 hrs and aPTT<40 sec**	**May be given BUT: -Must wait 4-6 hrs after catheter PLACEMENT before giving dose -Must wait 4-6 hrs after last dose before REMOVING catheter**	**1 hr**
heparin unfractionated 7500-10000 units SQ q12 hr or 24 hr dose<20,000	**>12hrs and aPTT<40 sec**	**CONTRAINDICATED while catheter in place: May NOT be given**	**1 hr**
Heparin unfractionated> 10000units SQ q12hr or 24 hr dose>20,000	**>24hrs and aPTT<40 sec**	**CONTRAINDICATED while catheter in place:May NOT be given**	**1 hr**
dalteparin (Fragmin) 5000 units SQ qday	**>12 hrs**	**-Must wait 12 hrs after catheter PLACEMENT or spinal injection before giving dose**	**4hrs**
enoxaparin (Lovenox) 40 mg SQ qday	**>12 hrs**	**May be given -Must wait 12 hrs after catheter PLACEMENT or spinal injection before giving dose -Must wait 12 hrs after last dose before REMOVING catheter**	**4 hrs**
enoxaparin (Lovenox) 30 mg SQ q12hr	**>12 hrs**	**May be given -Must wait 12 hrs after catheter PLACEMENT or spinal injection before giving dose -Must wait 12 hrs after last dose before REMOVING catheter**	**4 hrs**
fondaparinux (Arixtra) 2.5 mg SQ qday	**72 hrs (longer in renal impairment)**	**CONTRAINDICATED while catheter in place: may NOT be given**	**4 hrs**
rivaroxaban (Xarelto) 10 mg PO qday	**72 hrs (longer in renal impairment)**	**May not be given intrapartum**	**6 hrs**
apixaban (Eliquis) 2.5 mg PO bid	**72 hrs (longer in renal impairment)**	**May NOT be given intrapartum**	**6 hrs**
dabigatran (Pradaxa) 220 mg po qday	**72 hrs depending on renal function**		**6 hrs**

Reference: Horlocher TT et al. Regional anesthesia in the patient receiving antithrombotic or thrombolytic therapy. American Society of Regional Anesthesia and Pain Medicine Evidence-Based Guidelines (fourth edition). Reg Anesth Pain Med 2018; 43:263-309.
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Lisa Leffert, MD et al*SOAP taskforce. The Society for Obstetric Anesthesia and PerinatologyConsensus Statement on the Anesthetic Managementof Pregnant and Postpartum Women Receiving Thromboprophylaxis or Higher Dose Anticoagulants

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betrixaban (Bevyxxa) 80 mg po qday	**72 hrs**		**6 hrs**
URGENT CASES OR COMPETING RISKS OF DIFFICULT AIRWAY			
heparin unfractionated 5000 units SQ q8 or q12 hr	**<4-6 hrs**	**May proceed with greater competing risks of GA**	
heparin unfractionated 7500-10000 units SQ q12 hr or 24 hr dose<20,000	**<12 hrs**	**May proceed with greater competing risks of GA**	
enoxaparin (Lovenox) 40 mg SQ qday	**<12 hrs**	**May proceed with greater competing risks of GA**	
enoxaparin (Lovenox) 30 mg SQ q12hr	**<12 hrs**	**May proceed with greater competing risks of GA**	
dalteparin (Fragmin) 5000 units SQ qday	**<12 hrs**	**May proceed with greater competing risks of GA**	
AGENTS USED FOR FULL SYSTEMIC ANTICOAGULATION			
apixaban (Eliquis) 10 or 5 mg PO bid	**72 hrs (longer in renal impairment)**	**CONTRAINDICATED while catheter in place: may NOT be given**	**6 hrs (48 hrs after a traumatic puncture)**
dabigatran (Pradaxa) 75 - 150 mg PO bid	**72 hrs (longer in renal impairment)**		**6 hrs**
dalteparin (Fragmin) 200 units/kg SQ qday or 100 units/kg SQ q12hr	**48 hrs (longer in renal impairment)**		**4 hrs**
enoxaparin (Lovenox) 0.5-1 mg/kg qday	**24 hrs**	**CONTRAINDICATED while catheter in place: may NOT be given**	**4 hrs**
heparin unfractionated IV continuous infusion	**Stop infusion for 4-6 hrs aPTT < 40 sec**		**4 hrs**
fondaparinux (Arixtra) > 2.5 mg sq qday	**72 hrs (longer in renal impairment)**		**4 hrs**
rivaroxaban (Xarelto) 15 mg PO bid or qday; 20 mg PO qday	**72 hrs (longer in renal impairment)**		**6 hrs**

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warfarin (Coumadin)	**When INR < 1.5**	**CONTRAINDICATED while catheter in place: may NOT be given**	**4 hrs**
DIRECT THROMBIN INHIBITORS			
argatroban IV continuous infusion	**Stop infusion for 4 hrs aPTT < 40 sec**	**CONTRAINDICATED while catheter in place: may NOT be given**	**4 hrs**
bivalirudin (Angiomax) IV continuous infusion	**Stop infusion for 4 hrs aPTT < 40 sec**		**4 hrs**
ANTIPLATELET AGENTS			
Aspirin/NSAIDS	**May be given; no time restrictions for catheter placement or removal**		
abciximab (Reopro)	**48 hrs**	**CONTRAINDICATED while catheter in place: may NOT be given**	**6 hrs**
cilostazol (Pletal)			
dipyridamole er/asa (Aggrenox)	**7 days**		
clopidogrel (Plavix)	**7 days**		
eptifibatide (Integrilin)	**12 hrs (longer in renal impairment)**		
prasugrel (Effient)	**7 days**		
ticagrelor (Brilinta)	**7 days**		
tirofiban (Aggrastat)	**12 hrs (longer in renal impairment)**		
cangrelor (Kangreal)	**1 hrs**		
THROMBOLYTIC AGENTS			
alteplase (TPA) 2 mg dose for catheter clearance or doses for chest tube clearance	**May be given; no time restrictions for catheter placement or removal (Maximum dose 4 mg/24 hours)**		
alteplase (TPA) full dose for stroke, MI, etc or IV doses for IR procedures	**10 days**	**CONTRAINDICATED while catheter in place: may NOT be given**	**10 days**

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Infection (meningitis, epidural abscess)

-Predisposing factors indude immunosuppression, steroids, diabetes, infection, sepsis, extended duration of catheterization and faulty sterile technique.
-Epidural abscesses often present as localized back pain with associated fever and leukocytosis.
-Usual pathogen is *Staph. Aureus.*
-Consult neurosurgery immediately if progressive neurologic deterioration.
-It is our department's policy to use sterile technique including mask and surgical cap while placing a neuraxial block.
- Use Chlorhexidine for prep x2, always use alcohol swap to clean vials before drawing medications
- Limit family members and staff present in the room

Backache

- Localized back pain after epidural/spinal anesthesia is common (almost 44%) but usually of limited duration (48 hrs)
- Generalized back pain is less likely to occur and is probably due to flattening of the normal lumbar curvature secondary to muscle relaxation and lumbar ligament stretching.
- Duration of surgery (regardless of type of anesthesia) correlates with incidence of postop back pain.
- An older formulation of 2-chloroprocaine was associated with a chemical backache when given epidural, possibly secondary to hypocalcemic tetany of paraspinous muscles (chelation of calcium by EDTA). The newest formulation of 2-chloroprocaine is contained in a brown bottle and does not contain EDTA or Na bisulfite (preservative used in previous formula which caused neurotoxicity intrathecally).

Headache

- Post Dural Puncture Headache (PDPH) is secondary to CSF leak through a dural tear and associated cerebral vasodilatation (to compensate for decrease in CSF component of intracranial volume).
- PDPH is positional (from traction on intracranial dura), occipital/frontal, +/- radiation to neck, +/- ocular disturbance (CN VI traction), +/- hearing loss, +/- N/V and varies in severity. It usually starts within 7 days after dural puncture (depending on the size of the needle) but it may occur immediately (most probably pneumocephalus).
-Incidence of PDPH ranges from 0.3% for 24 G to 0.7% (22G) pencil point spinal needles.
- Incidence after unintentional dural puncture (UDP) with 17G epidural needle is 57%
- Incidence of PDPH after epidural placement without obvious wet tap is l to 3%.
- Some studies suggest that keeping needle bevel parallel to dura fibers might decrease incidence of PDPH.
- PDPH is the 2nd most common cause of litigation in obstetric anesthesia.
- 50% PDPH resolve spontaneously in 5 days and >90% by 10days.
- The incidence of PDPH is highest in young female patients, low BMI, h/o previous PDPH or recent headache. Migraines however are not associated with increased PDPH risk.
- If PDPH is mild, first-line treatment is IVF, bed rest and caffeine. Caffeine is given as single 300mg oral dose. Avoid caffeine if the patient has a history of seizures or PIH. The caffeine effect is transient andwill wane as the caffeine wears off.

- If conservative treatment has failed or patient has a severe HA suspicious of PDPH an epidural blood patch should be offered. 70-75% of patients experience relief after one treatment and 98% of those who require a second treatment are relieved of their headache.
- Prophylactic epidural blood patch (EBP) is controversial. Neuraxial Morphine may decrease the rate of PDPH.
- Headache post neuraxial block may also be due to contamination of CSF with betadine prep solution, current recommendations are to use Chloroprocaine x2 for prep.

Pneumocephalus and air embolism

- Occurs with use of air-filled syringe to identify epidural space.
- Pneumocephalus may occur if air is introduced into subarachnoid or subdural space.
- Patients complain of immediate headache +/- neck, shoulder and/or back pain. A LOC and seizures may also be seen.
- Air embolism is possible if air is entrained into the epidural vasculature.

Neurologic Injury

- Paresthesias are commonly seen with neuraxial block placement but permanent trauma to spinal cord or nerve roots is rare. However the needle should be immediately withdrawn/repositioned in the event of a paresthesia to avoid the risk of nerve injury.
- Keep in mind that although the adult spinal cord usually terminates at Ll or L2 it may extend as far as L3, so be wary of using high interspaces.
- In most adult patients the distance from skin to epidural space is 4 to 6 cm however in a thin patient it may be close to 3cm.
- Anterior Spinal Artery syndrome has been described with epidural catheter placement (secondary to direct compression or induced vasospasm), and symptoms resolve with withdrawal of catheter. Hypotension by itself may also cause anterior cord ischemia.
- All local anesthetics in sufficient concentrations are neurotoxic.
- Cauda equina syndrome (bowel/bladder dysfunction with perineal sensory loss and LE weakness) has been reported with continuous spinal anesthesia w/ hyperbaric lidocaine. The FDA recalled small spinal microcatheters from the U.S. Market in 1992 and intrathecal use of Lidocaine is no longer supported.
- Transient Neurologic Symptoms (TNS) has been seen after usage of spinal lidocaine. It is characterized by postoperative (within 24 hours) development of bilateral aching pain or dysesthesia of buttocks with radiation to sacral dermatomes. Symptoms usually resolve within a week. TNS occurs rarely with spinal bupivicaine. There is an increased incidence of TNS with certain patient positions (e.g. lithotomy) that involve stretching of spinal nerve roots.

Broken or Knotted Epidural Catheter

Allow anesthetic to wear off before attempting to withdraw a potentially knotted catheter to prevent nerve injury. Hold the catheter close to the skin, then use slow steady pressure taking care not to break it. Placing the patient in the lateral position (vs. sitting) may ease the catheter withdrawal.

**Withdrawing a catheter through a needle may cause shearing of the tip **

-Management of a broken epidural catheter is usually just observation since the portion

of catheter left is covered by fibrous tissue eventually and innocuous, however a neurosurgical consult is required if neurologic deficits/symptoms are present.

Systemic Toxicity

- Rare, in a study of 30,000 epidurals incidence of seizures was 0.01%
- Using epidural test doses and not exceeding the toxic level of local anesthetics has greatly reduced the incidence of systemic toxicity.
- If suspect local anesthesia toxicity the Intralipid is stored in the OR supply room on top of the refrigerator.
- Below is a checklist that has been taken from 2012 ASRA publication on how to manage patient with local anesthetic systemic toxicity (LAST).

The Pharmacologic Treatment of Local Anesthetic Systemic Toxicity (LAST) is Different from Other Cardiac Arrest Scenarios

- ❑ **Get Help**
- ❑ **Initial Focus**
  - ❑ **Airway management:** ventilate with 100% oxygen
  - ❑ **Seizure suppression:** benzodiazepines are preferred; **AVOID propofol** in patients having signs of cardiovascular instability
  - ❑ **Alert** the nearest facility having **cardiopulmonary bypass** capability
- ❑ **Management of Cardiac Arrhythmias**
  - ❑ **Basic and Advanced Cardiac Life Support (ACLS)** will require adjustment of medications and perhaps prolonged effort
  - ❑ **AVOID vasopressin, calcium channel blockers, beta blockers, or local anesthetic**
  - ❑ **REDUCE individual epinephrine doses to <1 mcg/kg**
- ❑ **Lipid Emulsion (20%) Therapy** (values in parenthesis are for 70kg patient)
  - ❑ **Bolus 1.5 mL/kg** (lean body mass) intravenously over 1 minute (~100mL)
  - ❑ **Continuous infusion 0.25 mL/kg/min** (~18 mL/min; adjust by roller clamp)
  - ❑ Repeat bolus once or twice for persistent cardiovascular collapse
  - ❑ Double the infusion rate to 0.5 mL/kg/min if blood pressure remains low
  - ❑ **Continue infusion** for at least10 minutes after attaining circulatory stability
  - ❑ Recommended upper limit: Approximately 10 mL/kg lipid emulsion over the first 30 minutes

Total/High Spinal

- Obstetric patients have engorged epidural veins which reduce spinal CSF volume and predispose to high cephalad extension of spinal block.
- If patient is experiencing upper extremity numbness and SOB but vital signs are stable, reassure the patient, treat hypotension and ensure adequate oxygenation/ventilation. Put patient in reverse Trendelenburg position, use a folded pillow to keep the head higher than the spine
- If total spinal is suspected (hypotension, apnea, LOC), establish an airway and support the cardiovascular system with fluids/vasopressors

Subdural Injection

- Subdural space is a potential space between the dura and arachnoid, and it extends from S2 to the 3rd ventricle.
- Incidence of subdural injection is 0.1 to 0.8%.
- It presents as a slow patchy sensory, motor block with increased cephalad spread (during an attempted epidural placement). There may be associated SOB and hypotension.
- Previous back surgery or previous dural puncture at the same level are predisposing factors.

Hypotension

- Primary cause is efferent sympathetic blockade (with spinal anesthesia, sympathetic block exceeds sensory block by 2 – 6 dermatomes.
- IV fluid loading may prevent or blunt hypotension, however do not delay neuraxial block to allow time for fluid bolus
- Studies have shown that pre-emptive IM ephedrine or phenylephrine reduce spinal anesthesia-induced hypotension during Caesarean section.
- Single shot spinal causes more hypotension than titrated epidural analgesia.
- Chronic HTN predisposes to decreased SVR, blunted compensatory increase in CO, and relative hypovolemia but in practice pre-eclamptic patients experience less hypotension.
- Studies have shown that pre-emptive IM ephedrine or phenylephrine gtt reduce spinal anesthesia-induced hypotension during Caesarean section.
- Historically ephedrine was preferred medication because of its limited alpha properties (therefore less likely to decrease uteroplacental perfusion). Recent studies have shown that phenylephrine actually does not decrease uteroplacental perfusion and causes less fetal acidosis than ephedrine. Ephedrine crossed the placental barrier more readily and causes increase in the fetal metabolic rate, resulting in fetal metabolic acidosis
- Current practice is fluid co-loading at the time of neuraxial block placement and Phenylephrine gtt started immediately after spinal block placement and titrated to effect

Bradycardia/Cardiac Arrest

- With sympathetic block there is unopposed vagal influence on SA node and carotid baroreceptors are blocked so there is no increased heart rate in response to hypotension.
- If cardioaccelerator fibers (Tl-T4) are blocked, bradycardia results.

Respiratory Effects

-Minimal effects on TV, RR and minute ventilation are seen but VC, ERV and max inspiratory & expiratory pressures can be decreased.
-Abdominal and intercostal muscles (responsible for forceful exhalation/cough) are often blocked, but the diaphragm and accessory muscles of inspiration are usually intact.

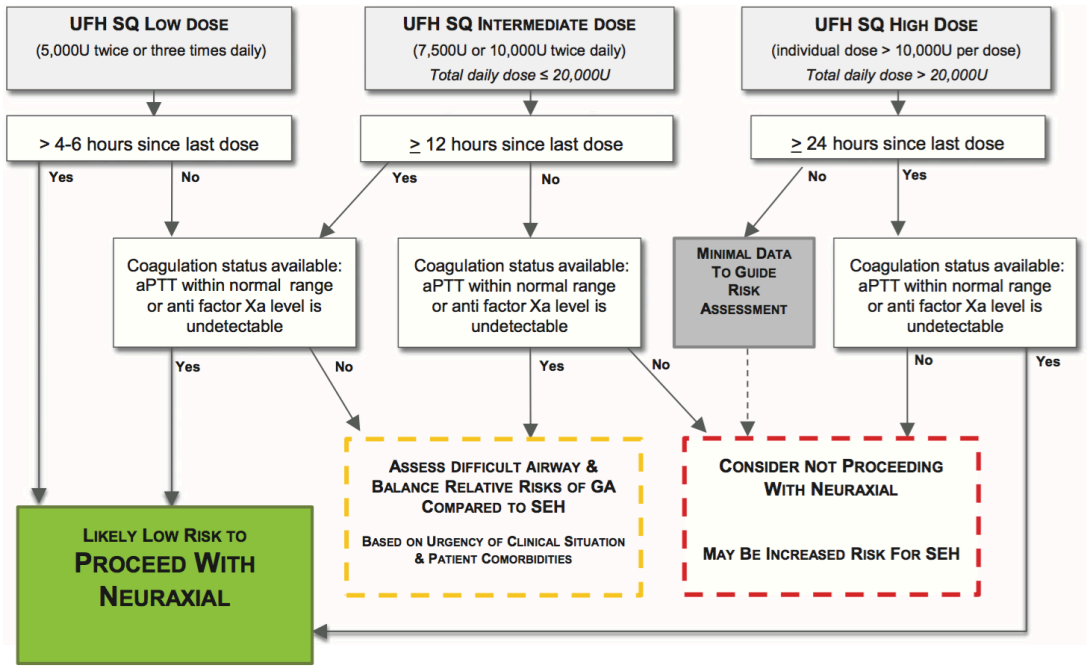
Anticoagulants and Neuraxial Blocks

Below are the most recent guidelines from SOAP and ASRA – 2018. Please refer to the full text article.

The Society for Obstetric Anesthesia and Perinatology Consensus Statement on the Anesthetic Management of Pregnant and Postpartum Women Receiving Thromboprophylaxis or Higher Dose Anticoagulants

Lisa Leffert, MD,* Alexander Butwick, MBBS, FRCA, MS,† Brendan Carvalho, MBBCh, FRCA, MDCH,† Katherine Arendt, MD,‡ Shannon M. Bates, MDCM, MSc,§ Alex Friedman, MD, // Terese Horlocker, MD,‡ Timothy Houle, PhD,* and Ruth Landau, MD,¶ the members of the SOAP VTE Taskforce

Regional Anesthesia in the Patient Receiving Antithrombotic or Thrombolytic Therapy: American Society of Regional Anesthesia and Pain Medicine Evidence-Based Guidelines (Fourth Edition)
Regional Anesthesia and Pain Medicine
April 2018 - Volume 43 - Issue 3 - p 263–309
doi: 10.1097/AAP.0000000000000763
Horlocker, Terese, T.; Vandermeuelen, Erik; Kopp, Sandra, L.; Gogarten, Wiebke; Leffert, Lisa, R.; Benzon, Honorio, T.



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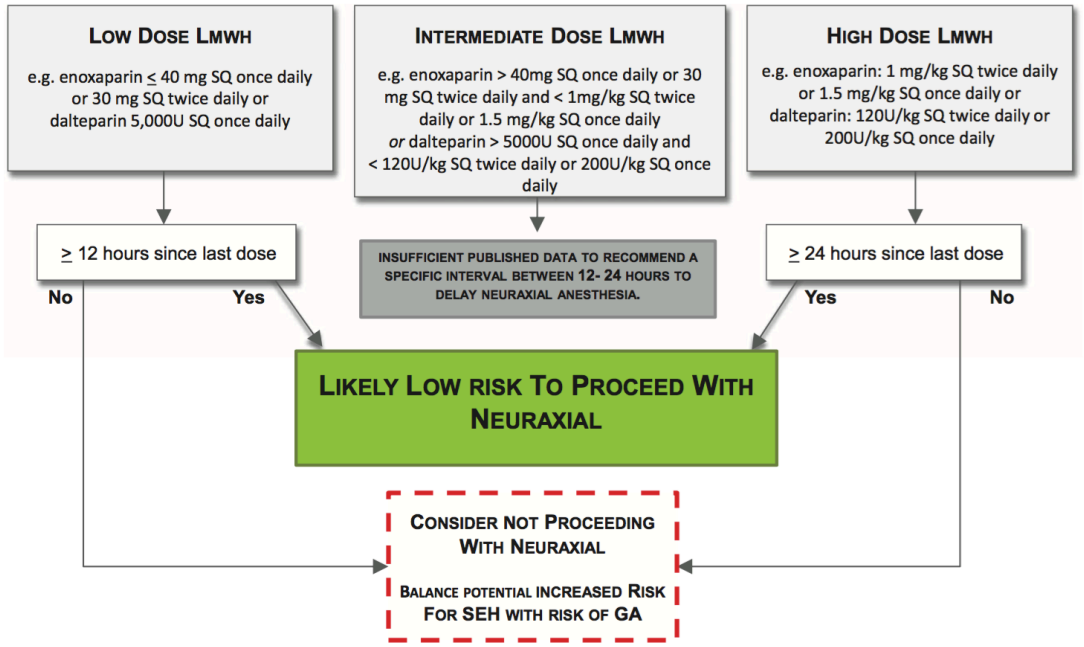

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Effects of Labor Epidural on Labor and Delivery

Neuraxial analgesia techniques are the most effective and least depressant treatment for labor pain. ACOG (American College of Obstetricians and Gynecologists) previously recommended to delay initiating placement of epidural until the cervix is dilated 4-5cm, however more recent studies demonstrated that early epidural analgesia does not increase the risk of cesarean delivery or prolong first stage of labor. Epidural are associated with 20-30 min longer second stage of labor.

Management of an Incomplete Epidural Block for C-Section

The incidence of intraoperative discomfort and visceral pain during epidural anesthesia is 10 to 50%. A T4 or T5 level should provide adequate analgesia for c-section however certain surgical manipulations such as exteriorization (uterus outside the body cavity), overstretching of the round ligament or rough handling of the viscera may overwhelm a good block. Furthermore, subdiapragmatic irritation by blood or amniotic fluid may cause chest and shoulder pain (C3-5). Treatment usually involves reassurance and possibly nitrous oxide (50%) and/or IV agents (ketamine, fentanyl, propofol) while closely observing the patient. If possible, wait for the umbilical cord to be clamped before giving the above. Supplementation by local infiltration is also an option. If this fails convert to GA.

Single Shot Spinal Anesthesia

- Controversial secondary to concern of high block
- Proposed mechanisms of high spinal block after failed epidural include:

(1) physical compression of the dural sac by fluid in the epidural space causing cephalad movement of intrathecal drugs
(2) leakage of epidural drugs into the dural pace through a dural tear
(3) anatomic aberration

Continuous Spinal Anesthesia

There have been no reported cases using this technique after a failed epidural for c- section but it may become a popular option if continuous micro spinal catheters make a come back in the future.

Replacement of Epidural Catheter

If large doses of epidural local anesthetics have already been given this option may not be a good idea since the risk of local toxicity is increased. Most case reports of total spinal after a failed epidural involved a large amount of local anesthetic administered epidurally

Supplemental Epidural/Caudal Injection

An option if there is sacral or thoracic sparing (versus a patchy block).

General Anesthesia

GA is associated with 2x higher maternal mortality rate than regional secondary to airway management. Consider awake intubation if difficult airway suspected (keeping in mind the local toxicity levels if an epidural has been in place).

Local Infiltrative Anesthesia

-Used most often as a supplement to inadequate intraoperative epidural anesthesia.

Obstetric Emergencies

Obstetric Emergencies

Labor epidurals should be encouraged in patients at high risk for operative delivery (TOLAC, multiple gestations, PIH, DM, cardiomyopathy, macrosomia, IUGR). Also it is a good idea to perform a pre-anesthetic evaluation on high-risk patients in case of emergent c-section.

Obstetric Hemorrhage

1. Genital Tract Lacerations
2. Uterine Atony – 90% of cases
   - -Most common cause.
   - -May be associated with placenta previa, placenta abruption or retained placenta.
   - -Risk factors include: multiple gestations, macrosomia, polyhydramnios, high parity, prolonged labor, excessive oxytocin use and chorioamnionitis.
   - -Treatment is utertonic drugs and/or uterine massage
     - -Oxytocin 40 U/L IV wide open.
     - -Hemabate 250 mcg IM (or intramyometrial) q 15 min to max of 2 mg (beware of bronchoconstriction).
     - -Methergine 0.2 mg IM (beware of HTN)
     - -If above treatment options fail arterial embolization or hysterectomy may be necessary.
     - -Limit inhalational anesthetics to prevent worsening of atony.
3. Placental Abruption
   - -Associated with HTN (chronic or PIH), PROM, previous abortion, high parity, tobacco or cocaine use, trauma and decompression of polyhydramnios.
   - -DIC associated 10% (amniotic debris forced into venous sinuses).
   - -If coags normal and vitals stable may use labor epidural.
4. Retained Placenta
   - -GA +/- NTG (50-100 mcg IV boluses) may be needed to provide uterine relaxation for manual extraction.
   - - NTG sublingual spray is a convenient alternative, dose is 2 puffs (800)mg, stored in OR3 Pyxis
5. Placenta Previa
   - -Risk factors include: prior placenta previa, uterine scar, advanced maternal age (AMA) and multiparity.
   - -Elective c-section usually, GA if hemodynamically unstable.
   - - Note increased incidence of irregular placentation associated with placenta previa 3%, 11%, 40%, 61%, and 67% with and one, two, three, four, five or more previous C/S.
6. Placenta Accreta
   - - Abnormal implantation of placenta in uterine wall.
   - - Risk factors include placenta previa, advanced maternal age and multiparity, previous uterine surgeries including thermal ablation and uterine artery embolozation
   - - Leading cause of emergent hysterectomy
   - - Consider GA for cesarean hysterectomy, CVL and arterial line prior to induction
   - - Usually done in main OR, OB will arrange for GynOnc surgeon on the team
   - - Consider T&C 10 units of PRBCs, 6units of FFP, 2 units Plts available in the OR

- Bring Oxytocin, Methergine, Hemabate, TXA in the OR, remember they are not available in main OR cart
- Consider ICU for postoperative care

7. Uterine Rupture
   -Usually separation of old incision
   -Increased incidence secondary to TOLAC (trial of labor after cesarean).
   - In the past there has been a concern about epidural analgesia masking the signs and symptoms of uterine rupture, however the first sign is fetal distress. Labor epidural is encouraged in these patients to avoid GA in case of emergent cesarean section.
   - Consider GA if hemodynamically unstable

Surgical intervention

- Intrauterine Balloon
- B-Lynch sutures
- Uterine Artery Ligation
- Hypogastric Ligation (experienced surgeon only)
- Hysterectomy

UTEROTONIC AGENTS FOR POSTPARTUM HEMMORRHAGE

Agent	Dose and Route	Contraindications	Side Effects	Notes
Oxytocin	20-60 U/L intravenous infusion	None	Decreased systemic vascular resistance and hypotension with bolus intravenous doses Free water retention	Short duration of effect
Methylergonovine (Methergine)	0.2 mg IM	Hypertension Preeclampsia Coronary artery disease	Thromboembolic sequelae? Severe nausea and vomiting Arteriolar constriction	Long duration of action May be repeated once after 1 hr
15-Methylprostaglandin $F_{2\alpha}$ (Hemabate)	250 µg IM or IU	Reactive airway disease Pulmonary hypertension Hypoxemic patients	Bronchoconstriction Shivering Temperature elevation Diarrhea	May be repeated every 15 min up to 2 mg
Misoprostol (Cytotec)	800-1000 µg per rectum	None	Shivering Temperature elevation Diarrhea Nausea/vomiting	Off-label use

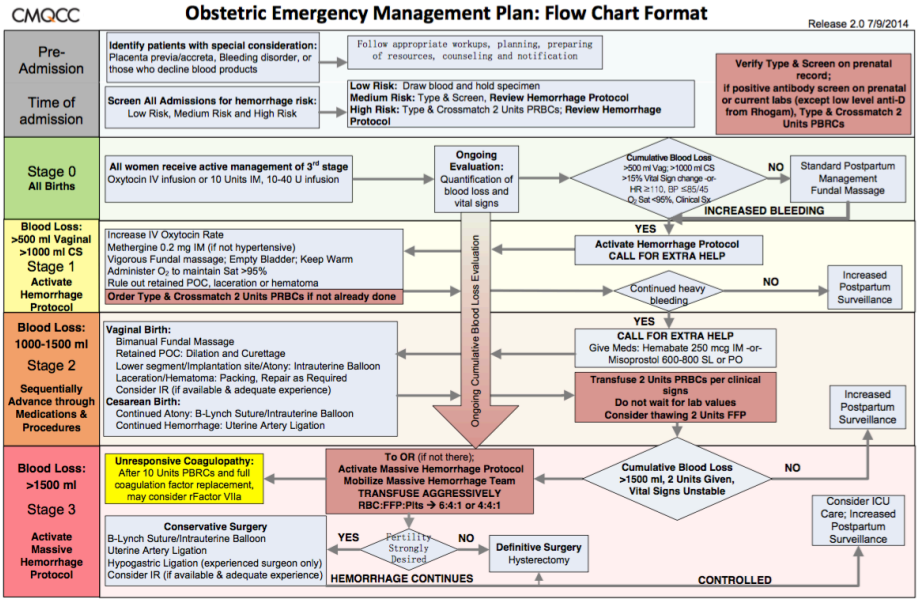
CMQCC
CALIFORNIA MATERNAL QUALITY CARE COLLABORATIVE

Obstetric Hemorrhage Emergency Management Plan: Table Chart Format

version 2.0

	Assessments	Meds/Procedures	Blood Bank
Stage 0	**Every woman in labor/giving birth**		
Stage 0 focuses on risk assessment and active management of the third stage.	• Assess every woman for **risk factors** for hemorrhage • Measure **cumulative quantitative blood loss** on every birth	**Active Management 3rd Stage:** • **Oxytocin** IV infusion or 10u IM • **Fundal Massage**- vigorous, 15 seconds min.	• If **Medium Risk:** T & Scr • If **High Risk:** T&C 2 U • If **Positive Antibody Screen** (prenatal or current, exclude low level anti-D from RhoGam):T&C 2 U
Stage 1	**Blood loss: > 500ml vaginal or >1000 ml Cesarean, or VS changes (by >15% or HR ≥110, BP ≤85/45, O2 sat <95%)**		
Stage 1 is short: activate hemorrhage protocol, initiate preparations and give Methergine IM.	• Activate OB Hemorrhage Protocol and Checklist • Notify Charge nurse, OB/CNM, Anesthesia • VS, O2 Sat q5' • Record **cumulative** blood loss q5-15' • **Weigh** bloody materials • Careful inspection with good exposure of vaginal walls, cervix, uterine cavity, placenta	• **IV Access:** at least 18gauge • Increase IV fluid (LR) and **Oxytocin** rate, and repeat **fundal massage** • **Methergine** 0.2mg IM (if not hypertensive) May repeat if good response to first dose, BUT otherwise **move on** to 2nd level uterotonic drug (see below) • Empty bladder: straight cath or place foley with urimeter	• **T&C 2 Units PRBCs** (if not already done)
Stage 2	**Continued bleeding with total blood loss under 1500ml**		
Stage 2 is focused on sequentially advancing through medications and procedures, mobilizing help and Blood Bank support, and keeping ahead with volume and blood products.	**OB back to bedside** (if not already there) • **Extra help**: 2nd OB, Rapid Response Team (per hospital), assign roles • VS & **cumulative** blood loss q 5-10 min • Weigh bloody materials • **Complete evaluation** of vaginal wall, cervix, placenta, uterine cavity • Send additional labs, including DIC panel • If in Postpartum: Move to L&D/OR • Evaluate for special cases: -Uterine Inversion -Amn. Fluid Embolism	**2nd Level Uterotonic Drugs:** • **Hemabate** 250 mcg IM or • **Misoprostol** 800 mcg SL **2nd IV Access** (at least 18gauge) Bimanual massage **Vaginal Birth:** (typical order) • Move to OR • Repair any tears • D&C: r/o retained placenta • Place intrauterine balloon • Selective Embolization (Interventional Radiology) **Cesarean Birth:** (still intra-op) (typical order) • Inspect broad lig, posterior uterus and retained placenta • B-Lynch Suture • Place intrauterine balloon	• **Notify Blood Bank of OB Hemorrhage** • **Bring 2 Units PRBCs to bedside, transfuse per clinical signs – do not wait for lab values** • Use blood warmer for transfusion • Consider thawing 2 FFP (takes 35+min), use if transfusing > 2u PRBCs • Determine availability of additional RBCs and other Coag products
Stage 3	**Total blood loss over 1500ml, or >2 units PRBCs given or VS unstable or suspicion of DIC**		
Stage 3 is focused on the Massive Transfusion protocol and invasive surgical approaches for control of bleeding.	• **Mobilize team** -Advanced GYN surgeon -2nd Anesthesia Provider -OR staff -Adult Intensivist • **Repeat labs** including coags and ABG's • Central line • Social Worker/ family support	• **Activate Massive Hemorrhage Protocol** • Laparotomy: -B-Lynch Suture -Uterine Artery Ligation -Hysterectomy • Patient support -Fluid warmer -Upper body warming device -Sequential compression stockings	**Transfuse Aggressively** Massive Hemorrhage Pack • Near 1:1 PRBC:FFP • 1 PLT apheresis pack per 4-6 units PRBCs **Unresponsive Coagulopathy:** After 8-10 units PRBCs and full coagulation factor replacement: may consult re rFactor VIIa risk/benefit

OBSTETRIC EMERGENCY MANAGEMENT PLAN: FLOW CHART FORMAT



California Maternal Quality Care Collaborative (CMQCC), Hemorrhage Taskforce (2009) visit: www.CMQCC.org for details

This project was supported by funds received from the State of California Department of Public Health, Center for Family Health; Maternal, Child and Adolescent Health Division

Classification of Hypertensive Disorders in Pregnancy

1. Gestational HTN
2. Preeclampsia
   -without severe features
   -with severe features
3. Chronic hypertension
4. Chronic HTN with superimposed preeclampsia

PREECLAMPSIA

Without severe features

-BP greater than 140/90 and proteinuria (>300 mg/day, protein-creatinine ratio ≥ 0.3, or 1+ on urine dipstick) – after 20 weeks of gestation

With severe features

-BP greater than 160/110 and proteinuria > 30 mg/day

In the absence of proteinuria every new onset of HTN and new onset of any of the following:

- Oliguria or elevated serum creatinine
- Pulmonary edema
- Cerebral or visual symptoms
- Epigastric or RUQ pain
- Thrombocytopenia
- Impaired liver function
- HELLP syndrome – hemolysis, elevated liver enzymes, low platelets

MANAGEMENT OF PREECLAMPSIA

(1)) Prevention of seizures

$MgSO_4$ 4 – 6 gm IV bolus over 20 min followed by 1-2gm/hour infusion

Therapeutic level 4-6 mg/dL

Magnesium overdose:

Loss of DTR, prolongation PQ interval and widening of QRS occurs at 10 mEq/L, Respiratory arrest occurs at 15, asystole occurs at 20

Caution in patients with renal disease as Mg is renally excreted

In case of overdose treat with

Calcium chloride

Mechanism of action: CNS depressant, inhibits release of acetylcholine at NMJ, decreasing sensitivity of the motor end plate to Ach (thereby potentiating effects of nondepolizing and depolarizing musle relaxants), mild vasodilator and uterine smooth muscle relaxant.

Associated with neonatal depression and hypotonic

(2) Control of HTN

First line medications (ACOG)

Labetalol
Hydralazine
Nifedipine

Second line medications
Nicardipine infusion
Esmolol infusion
Sodium nitroprusside
Clevidipine

TREATMENT OF ACUTE HYPERTENSION- Table from Chestnut Chapter 36 TABLE 36-4

Medication	Onset of Action †	Dose
Labetalol	5-10 min	20 mg IV, then 40-80 mg every 10 min up to maximum dose of 220 mg IV
Hydralazine	10-20 min	5 mg IV every 20 min up to maximum dose of 20 mg IV
Nifedipine	10-20 min	10 mg PO every 20 min up to a maximum dose of 50 mg
Nicardipine	10-15 min	Initial infusion 5 mg/h, increase by 2.5 mg/h every 5 min to a maximum of 15 mg/h
Sodium nitroprusside ‡	0.5-1 min	0.25-5.0 µg/kg/min IV infusion

(3) Decision about timing and route of delivery
(4) Postpartum surveillance

LABOR EPIDURAL (if not contraindicated) is advantageous secondary to improved uteroplacental perfusion (decreases catecholamines) and blunting of maternal BP during painful contractions.

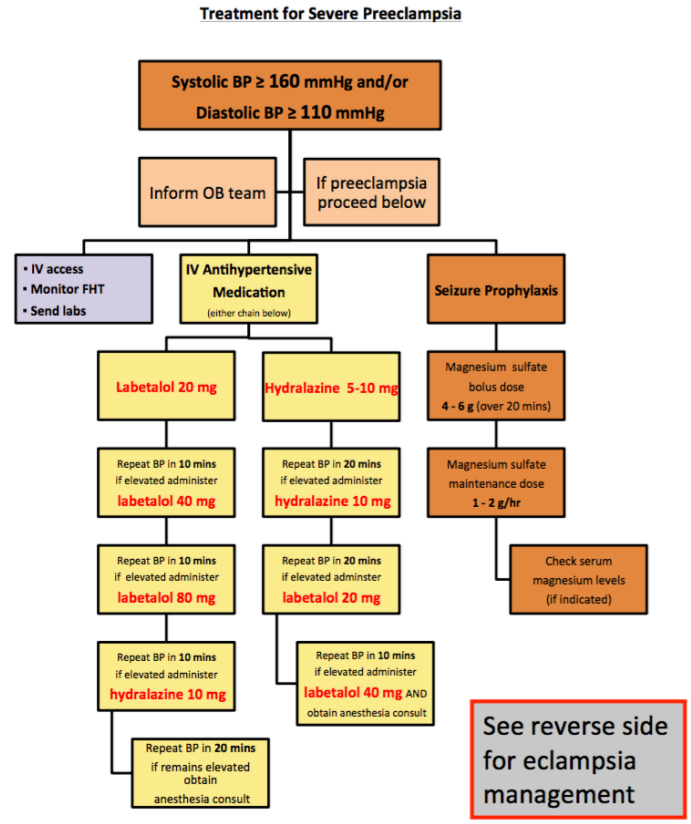
CESAREAN SECTION

Spinal anesthesia in patients with significant preeclampsia used to be controversial secondary to possible profound hypotension (and uteroplacental perfusion is already decreased). Recent studies have not confirmed it, on the contrary hypertensive patients are experiencing less if any hypotension.

Consider invasive monitoring (aline, cvl) if severe disease.
GA is indicated in cases of coagulopathy, fetal distress with no pre-existing epidural and

patient refusal of regional. Important considerations:
(1) airway edema
(2) exaggerated HTN response to intubation, REMEMBER: Most common cause of death from preeclampsia is intracranial hemorrhage, pretreat with Labetalol or NTG
(3) prolonged neuromuscular blockade if $MgS0_4$ given
(4) risk of pulmonary edema

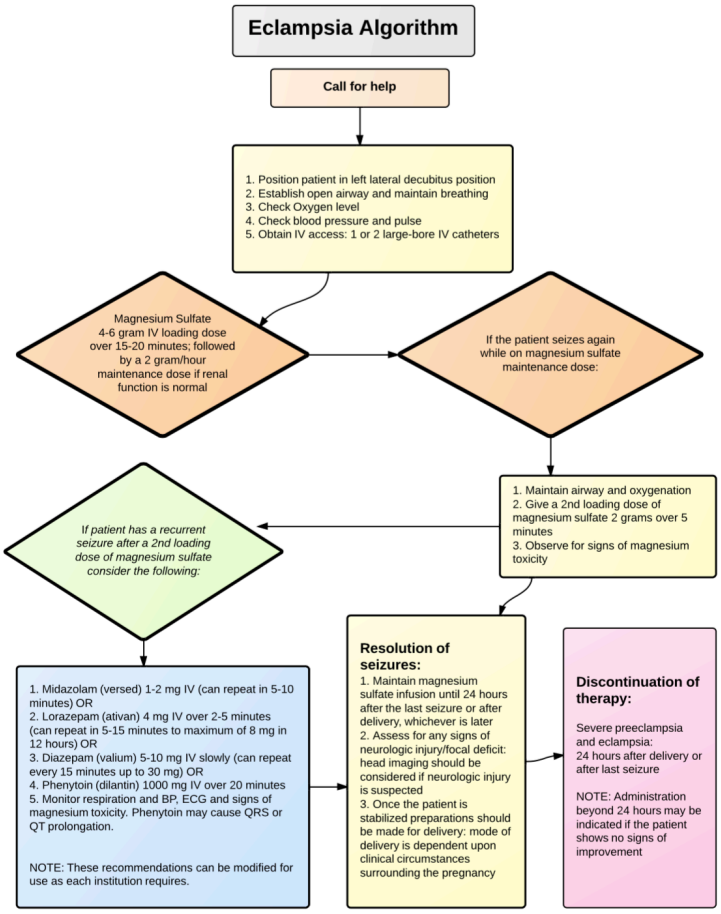
Appendix B: Sample Treatment of Severe Preeclampsia Algorithm



Emergent therapy for acute-onset, severe hypertension with preeclampsia or eclampsia. Committee Opinion No. 514. American College of Obstetricians and Gynecologists. Obstet Gynecol 2011;118:1465–8

ECLAMPSIA

New onset of seizures or unexplained coma during pregnancy or the postpartum period in a woman with signs and symptoms of preeclampsia and without a preexisting neurologic disorder.
The mechanism of eclamptic seizures is unknown.
Mortality 1% in the developed world, 15%(developing world



Embolism

Venous Thromboembolism

- 5 – 10 times increased risk during pregnancy (1 –2 /1000)
- Source is often pelvic or LE veins (decreased venous return secondary to gravid uterus)
- Pregnancy is a hypercoaguable state, patients with preeclampsia have even greater risk
- Sx: if PE, presents as sudden onset SOB, tachypnea, chest pain, tachycardia, hypoxia and normal CXR.
- Dx: V/Q scan, spiral CT, angiography or MRA
- Tx: ABCs, thrombolysis, LMWH, embolectomy (rare)

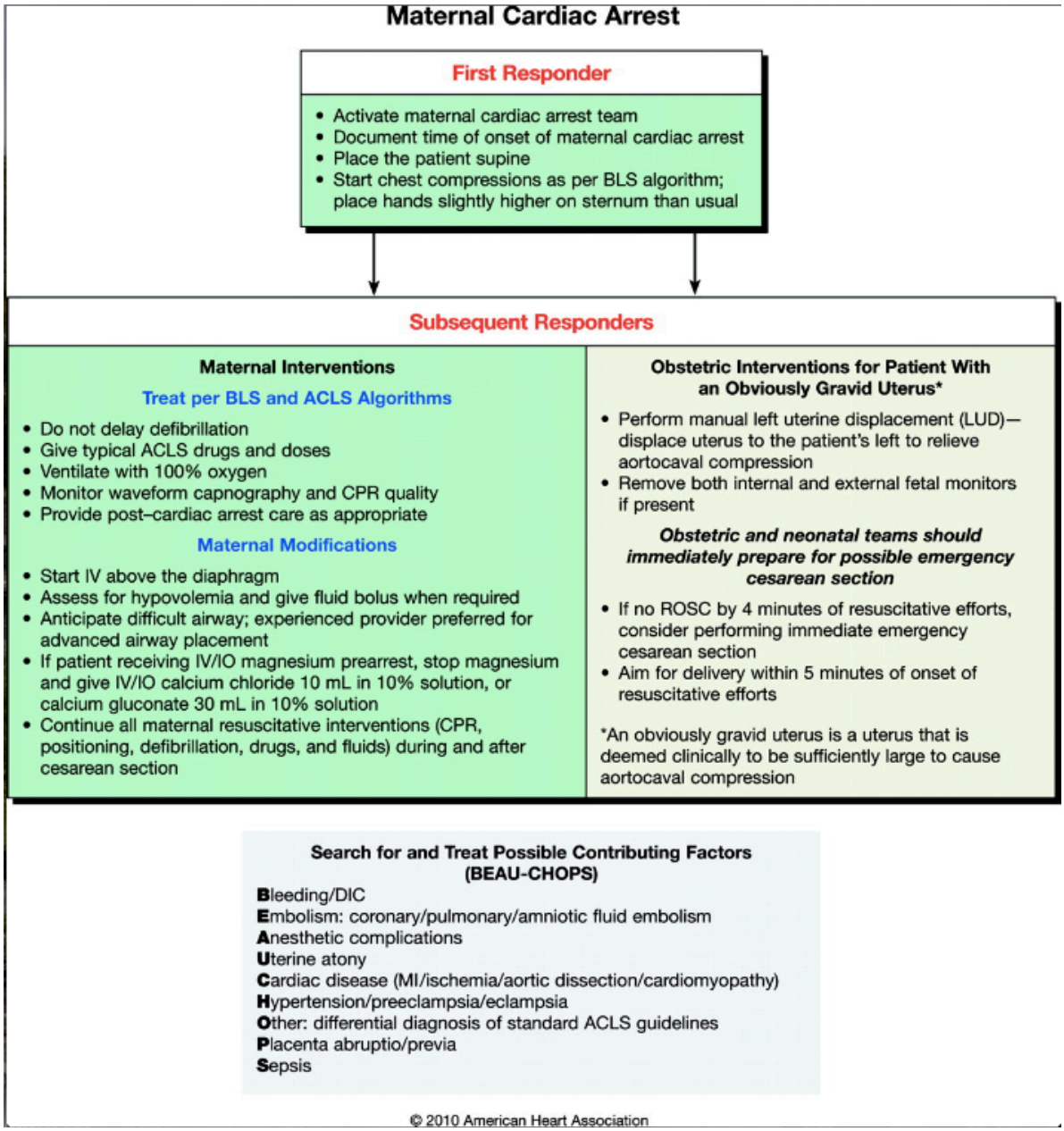
Venous Air Embolism

-Usually occurs intraoperatively
-Sx: see above, if small amount of air there may be no symptoms and it resolves spontaneously
-Dx: sudden decrease in $ETC0_2$ and desaturation, precordial Doppler or TEE
-Tx: ABCs, flood surgical field, d/c nitrous oxide, 100% Fi02, left lateral tilt, IVF or vasopressors to increase RV preload and displace air into pulmonary vasculature for removal by dispersion, aspiration of air from RA (cvl), hyperbaric 0_2 therapy (compresses air bubble size)

Amniotic Fluid Embolism

- Maternal death secondary to sudden cardiac arrest, hemorrhage from coagulopathy or ARDS/Multiorgan failure
-Risk factors include: AMA, multiparity, fetal death, trauma, uterine overdistension and use of uterine stimulants
-Sx: respiratory distress, cardiovascular collapse, ALOC, cyanosis, hemorrhage
-Dx: diagnosis of exclusion (autopsy)
-Tx: ABCs, supportive, maintain oxygenation, correct coagulation abnormalities, re-establish uterine tone and maintain cardiac output.

Maternal Cardiac Arrest



Airway Problems in Pregnancy

Airway complications are leading cause of anesthesia related maternal mortality with many deaths attributed to substandard care

Difficult airway

Pregnant patients often have difficult airways secondary to weight gain, enlarged breasts, upper airway edema, prolonged pushing time. Missed intubations is much more common in the pregnant patient population, approximately 1in 503. Pregnant patients are at increased risk of aspiration therefore, rapid sequence or awake intubations with smaller ETTs should be used if GA is required. If a patient appears to have a potentially difficult airway and is at risk for c-section consider an early placement of a labor epidural which could be used for operative anesthesia. Pregnant patients are prone to rapid desaturation secondary to a decrease in FRC (20-30%) and an increase in oxygen consumption. Consider "ramping" (a wedge of blankets underneath the upper back) a patient with a potentially difficult airway even if a regional anesthetichas been planned since converting to GA may be necessary. Foam wedges of different size are available in OR 3 wall cabinets.

Awake fiberoptic intubation has the benefit of maintaining muscle tone making it easier to identify structures. If there are no contraindications an anticholinergic such as glycopyrrolate (does not cross the placenta) should be given to decrease secretions.

Know the location of Glidescope and C-Mac tower prior to each cesarean section under GA.

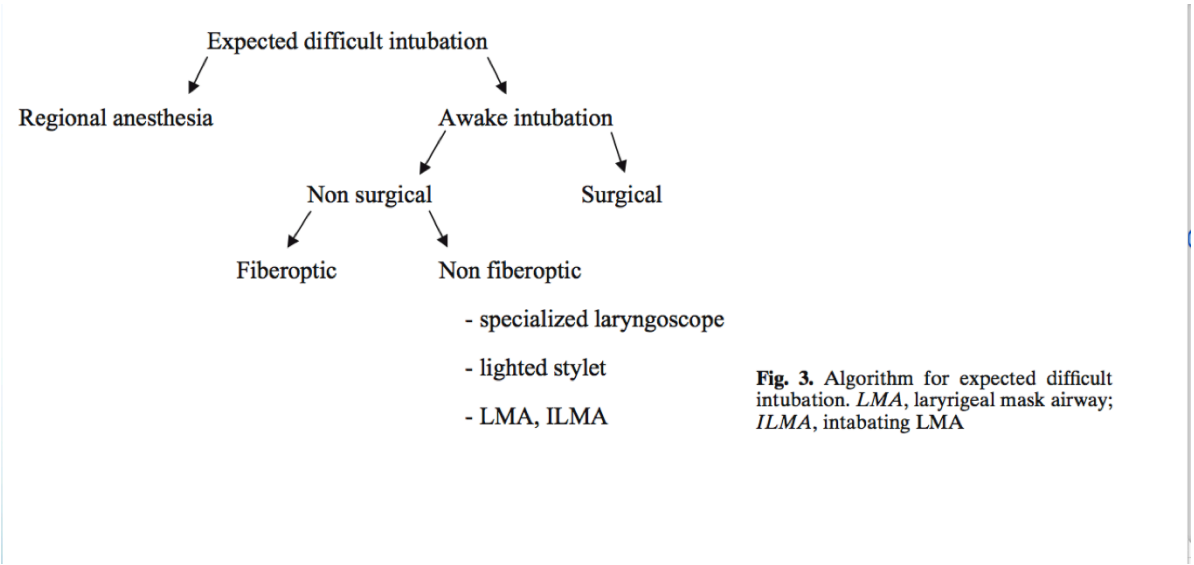


Fig. 3. Algorithm for expected difficult intubation. *LMA*, laryrigeal mask airway; *ILMA*, intabating LMA

If GA is required and the anesthesiologist cannot intubate the patient but can mask ventilate then mask ventilation with cricoid pressure should be used. If it is not possible to mask ventilate the patient as well, it is time to consider other options. First, call for help. LMAs are often used and although the pregnant patient has an increased aspiration risk it has been shown that LMA insertion is more successful without cricoid pressure. Alternatively, a LMA proseal can be used, which allows for passage of an orogastric tube. Another option is an intubating or Fast trach LMA. The classic LMA may also beused as a conduit for intubation but it is technically difficult and using a bougie or fiberoptic through the LMA may be more successful. Be aware that fundal pressure applied by the surgeons will increase regurgitation of abdominal contents.

If other measures have failed there is the option of a transtracheal jet ventilation (TTJV), which involves placing a large gauge IV catheter through the cricothyroid membrane. Allow for adequate exhalation by placing nasal trumpets and/or adjusting I:E ratio to reduce barotrauma. TTJV is a temporizing measure and is associated with serious complications such as subcutaneous emphysema, pneumothorax, and pneumomediastinum.

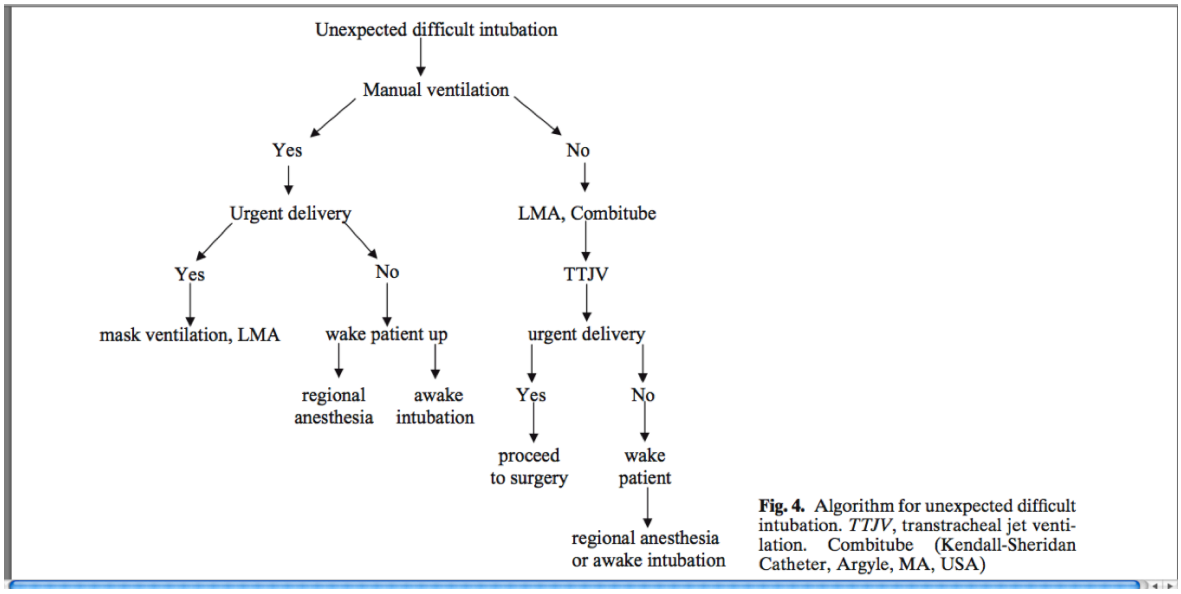


Fig. 4. Algorithm for unexpected difficult intubation. *TTJV*, transtracheal jet ventilation. Combitube (Kendall-Sheridan Catheter, Argyle, MA, USA)

Drug Abuse in Pregnancy

Anesthetic Implications of Drug Abuse in Pregnancy

Risk factors suggesting substance abuse in pregnancy include lack of prenatal care, history of preterm labor (PTL) and cigarette smoking. Some counties in California, including L.A., Riverside and Orange county, consider intrauterine fetal drug exposure a form of child neglect and abuse. San Bernadino County will not prosecute such cases. Reports of substance abuse are still submitted to Child Protective Services to start a file on the patient in case of future issues.

Cocaine

-Blocks re-uptake of norepinephrine, serotonin and dopamine.
-Pregnant women have an increased sensitivity to the cardiovascular effects, which may include hypertension, tachycardia, arrhythmias and myocardial infarction.
-Maternal complications: PTL, placental abruption, uterine rupture, cardiac dysrhythmias, cardiomyopathy, hepatic rupture, cerebral ischemia and death.
-It is readily transferred across the placenta by diffusion and causes vasoconstriction leading to uteroplacental insufficiency. Metabolites of cocaine can be found in fetal urine 72 to 96 hours after maternal ingestion. Acute intoxication can mimic preeclampsia, patients present with hypertension, headache, blurred vision and seizures.
-Anesthetic concerns: patients are at risk for acute or chronic multiorgan system dysfunction, thrombocytopenia, ephedrine-resistant hypotension, altered pain perception, hypertension – attempt to alpha block before beta blockade to avoid acute CHF. Avoid ketamine and etomidate (increased myoclonus).

Amphetamines

-Stimulate catecholamine release from presynaptic vesicles.
-Symptoms of acute intoxication are similar to those of cocaine (sympathetic stimulation)
-Chronic abuse leads to depletion of body stores of catecholamines.
-Maternal complications: intrauterine growth retardation (IUGR) and intrauterine fetal demise. Associated fetal anomalies include cardiac anomalies, cleft lip and palate, biliary atresia and intracranial bleed.
-Anesthetic concerns: severe hypotension possible with neuraxial blocks and response to vasopressors unpredictable (decreased catecholamine stores). Acute intoxication will increase MAC while chronic use will decrease MAC.

Opioids

-Effects on the fetus - increased risk of birth defects, including congenital heart defects and gastroschisis. Heroin is associated with spontaneous abortion, preterm delivery and fetal growth restriction
-Withdrawal symptoms usually occur 4 to 6 hours after last opioid intake and peak at 48 to 72 hours (restlessness, insomnia, mydriasis, tachycardia, tachypnea, HTN). Symptoms of withdrawal may be treated with clonidine, diphenhydramine or doxepin.
- ACOG issued a 2012 committee statement stating that buprenorphine should be considered a potential first line medication for pregnant opioid-dependent women. This was suggested because compared to methadone buprenorphine had less documented overdoses.
-Anesthetic concerns: prevent acute withdrawal and avoid opioid antagonists or agonist-antagonist combinations (e.g. Stadol or Nubain). Blood pressure may be labile during regional anesthetic and chronic opioid use is associated with cross-tolerance to anesthetics. Consider keeping a labor epidural for postoperative or post delivery pain control.

Remember to always discuss with the patient what their plan/intention for narcotic use is. Discuss different scenarios: labor analgesia, intraoperative or postoperative analgesia. Be

aware that pharmacy can provide local anesthetic solution without Fentanyl for epidural infusion. If no narcotics are requested by the patient you may order it. Be aware that you might have to increase infusion rates, watch for hypotension. Below is suggested algorithm for intrapartum management of women on Buprenorphine, adopted from UCSF.

Intrapartum Management of Women on Buprenorphine

Women on buprenorphine can generally have their labor managed like any other labor. Usual protocols for fetal monitoring and medical decision making should be applied.
The only exceptions to usual care may come when managing labor related and Cesarean section related pain.

Labor Pain

Women on buprenorphine may have a higher tolerance for opioids.

- Buprenorphine should not be discontinued in anticipation of labor. When a person is hospitalized for a reason other than addiction (e.g., labor) her hospital providers can legally order and dispense buprenorphine. Any hospital prescriber is allowed to do this.
- Epidural anesthesia for the management of labor pain is effective, appropriate and often preferred in this population.
- If opioids are used to manage pain, the provider can anticipate that the patient may require 30-50% higher doses than are typically needed.
- Providers should start with the usual dose of opioids used at their institution and, if that is not sufficient, increase the dose by 30%-50% with each dose until pain control is achieved.
    - Example protocol:
    - Fentanyl 50mcg IV for first dose (or 0.5-1mcg/kg).
    - Wait 5-10 minutes for effect.
    - If adequate analgesia is achieved, repeat at this dose at when pain returns.
    - If adequate analgesia not achieved, provide 75mcg IV.
    - Wait 5-10 minutes for effect.
    - If adequate analgesia is achieved, repeat at this dose when pain returns.
    - If adequate analgesia not achieved, provide an additional 25mcg and
    - In 30 minutes or when pain returns, provide 100mcg IV.
    - If doses greater than 100mcg are required, consult anesthesia and consider regional anesthesia.
- As with any other population, women in labor who are on buprenorphine should be involved in shared decision making conversations about pain management, and can be reassured that both an epidural and opioids are effective pain management strategies.

C-Section Pain

As with most C-sections, regional anesthesia is preferred over general anesthesia for women on buprenorphine. Spinal and epidural anesthesia are effective pain management strategies for C-section pain.

- Buprenorphine should not be discontinued in anticipation of C-section. When a person is hospitalized for a reason other than addiction (e.g. labor) her hospital providers can legally order and dispense buprenorphine. Any hospital prescriber is allowed to do this.
- Usual protocols for intraoperative pain can be used, with the caveat that higher doses of opioids may be required for optimal pain management.
- Because of the heightened fear of pain that may be experienced by women in this population, it can be useful to coach women through the experience, helping them identify the difference between the normal pressure and pulling felt during C-section and the pain that they fear.

Intrapartum Management of Women on Buprenorphine

Post-Operative and Post-Partum Pain

- Buprenorphine should be continued post-partum. When a person is hospitalized for a reason other than addiction (e.g. labor) her hospital providers can legally order and dispense buprenorphine. Any hospital prescriber is allowed to do this.
- Pain after a vaginal birth may be adequately managed with NSAIDs, Ice packs, and other non-opioid strategies.
    - If pain is severe enough to require opioids, many women will respond well to usual doses of opioids, such as hydrocodone/APAP 5/325 or 10/500.
    - Some women will require more potent opioids at higher doses, such as oxycodone 5-10mg q 4-6 hours.
    - Providers should begin with the lower doses that are available at their institution and titrate up according to patient pain.
- Post C-section pain will typically require opioids.
    - In this case, lower dose options like hydrocodone/APAP 5-10/325-500 should be started initially.
    - If insufficient, the patient can be transitioned to oxycodone 5-10mg q 4-6 hours, titrated as needed for pain.

Breast Feeding

Women on buprenorphine should be encouraged to breast feed.

- Very little buprenorphine is found in breast milk.
- At the same time, breast feeding has been found to reduce the incidence and severity of neonatal abstinence syndrome, most likely because of the increased frequency of skin to skin contact, sucking, and holding.
- Women should receive education and lactation support.
- Neonates who are held frequently, kept in low-noise and low-light environments, and provided with frequent opportunities for suckling and feeding have lower rates and severity of neonatal abstinence syndrome. For this reason, rooming in with the mother is strongly encouraged for these newborns.

Discharge Planning

Women should continue buprenorphine after discharge. Buprenorphine therapy should be continued indefinitely, especially as the family embarks on a period of intense change, stress, and sleep deprivation. The post-partum period is a dangerous time to discontinue buprenorphine, with the risk of relapse increasing dramatically if the medication is discontinued.

- Prior to discharge, contact the patient's prenatal buprenorphine provider to confirm the plan for ongoing buprenorphine prescribing after discharge.
- If there will be a delay in re-establishing care with her buprenorphine prescriber, a provider with a DEA waiver, either on the hospital team or on her outpatient team, must write a prescription for enough buprenorphine to last until the follow up appointment. Because the discharge prescription is technically an outpatient prescription, it cannot be prescribed by clinicians who do not have a DEA waiver for buprenorphine prescribing.

Hallucinogens (LSD, PCP, psilocybin, mescaline)

-No evidence of physical dependence or withdrawal symptoms

-Activates sympathetic nervous system (fever, tachycardia, HTN, mydriasis)

-Maternal complications: IUGR, PTL, meconiurn

-Anesthetic concerns: increased risk of panic, exaggerated response to sympathomimetic drugs, inhibition of plasma cholinesterase (although of little clinical significance)

Solvent Abuse (toluene)

-Causes intense CNS stimulation and disinhibition

-Maternal complications include autonomic cardiac dysfunction, v fib, MI, CNS degeneration, ARDS, liver toxicity, IUGR and PTL.

Marijuana

-Active ingredient, THC, freely crosses placenta

-Intrauterine exposure to marijuana has not been proven to be teratogenic but some research suggests that it is associated with LBW and cognition impairment.
-If acute use, avoid drugs that may worsen tachycardia. Airway edema may be more significant.

Alcohol
- Teratogen and easily crosses the placenta
- Exposure is associated with pregnancy loss
- Fetal Alcohol Syndrome – IUGR, characteristic facial appearance (small palpebral fissure, flat midface with a short upturned nose, thin upper lip), mental handicap, genitourinary and cardiovascular abnormalities
- Acute withdrawal signs (start 6 - 48 hours after last drink) include tremor, HTN, tachycardia, arrhythmias, ALOC, nausea.
- Anesthetic concerns: regional ok if patient is cooperative and there is no coagulopathy or possibly neuropathy. Note these patients may have intravascular volume depletion. Hepatic dysfunction and heart failure may be associated. Greater risk of aspiration due to increased gastric secretions. Acute intoxication decreases MAC while chronic use increases MAC.

Tobacco
- Most common form of substance abuse during pregnancy.
- Acts on nicotinic Ach receptors and affect the release of catecholamines. Nicotine increases sympathetic tone.
- Withdrawal symptoms- irritability, headache, cough and insomnia.
- Effects on fetus- Low birth weight, fetal loss, placental abruption, SIDS. May protect against occurrence of preeclampsia.
- Anesthesia concerns- increased airway secretions and airway reactivity, impaired gas exchange.

FETAL ISSUE

FETAL HEART RATE MONITORING

Uterine Contractions

Normal is less than or equal to 5 in 10 minute window, averaged over 30 minutes.

Tachysytole: > 5 contractions in 10 minutes, averaged over 30- minute window. Should be qualified as to the presence or absence of associated FHR decelerations.

Fetal Heart Rate (FHR)

Bradycardia- baseline <110

Tachycardia- baseline >160

Variability- Fluctuations in the baseline FHR that are irregular in amplitude and frequency

Deceleration- Classified as late, early or variable

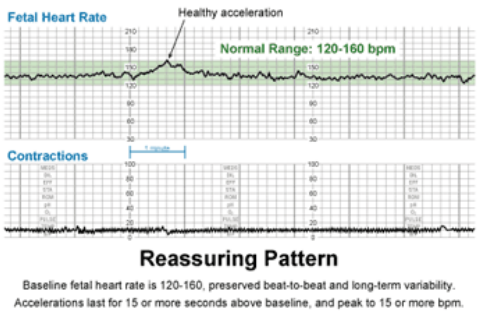
Prolonged deceleration- decrease in FHR from baseline that is ≥ 15 bpm, lasting ≥ 2 minutes, but < 10 minutes.

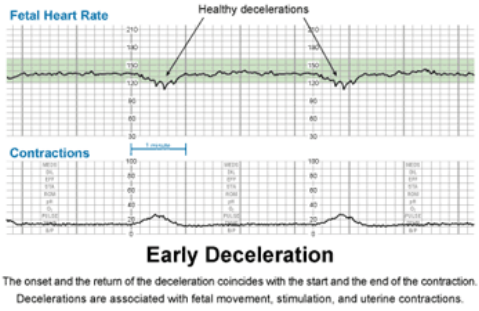
Sinusoidal fetal heart rate pattern- having visually apparent sine wave-like undulating pattern in FHR baseline with a cycle frequency of 3-5 min ≥ 20 min.

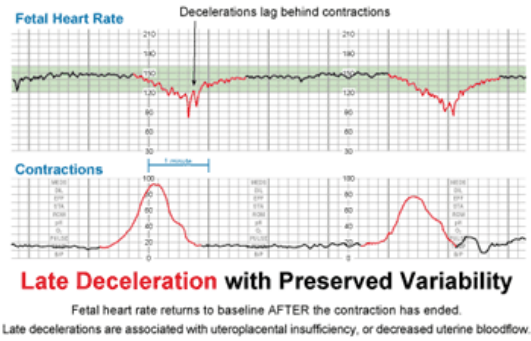
Late – Decrease in FHR associated with contraction. It occurs after the peak of the contraction. Etiology- uteroplacental insufficiency

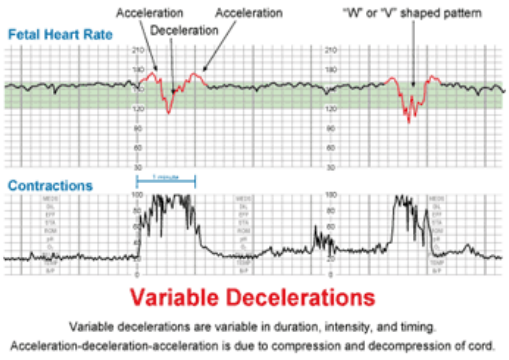
Early- Nadir of the deceleration occurs at the same time as the peak of the contraction. Etiology- Vagal nerve stimulation from fetal position

Variable- These decels are abrupt unlike with late and early which are gradual. Not necessarily associated with uterine contraction. Etiology- cord compression









Maternal/Fetal Medication Recommendations for Pregnancy and Lactation

Medication	Pregnancy Risk	Lactation Risk	Comment
Glycopyrolate	B	L3	Not transferred in breast milk
Atropine	C	L3	
Fentanyl	B	L2	No adverse effects reported via breast milk
Morphine	B	L3	Not transferred via breast milk
Mepridine	B	L2	L4 in neonates – don't use maternally
Thiopenta!	C	L3	No pediatric concerns in females at induction doses
Propofol	B	L2	No reported breast milk transfers
Etomidate	NIA		
Ketamine	NIA		
Rocuronium	NIA		
Succinylcholine	NIA		
Midazolam	D	L3	No problems with transfer in breast milk
Droperidol	C	L3	Observe breast feeding infant for sedation & dee. BP
Tylenol	B	LI	No reported transfer problems
Aspirin	CID	L3	C first trimester, D second & third trimester
Ketorolac	BID	L2	B first and second trimesters & D third trimester
Flumazenil	NIA		
Narcan	NIA		
Atenolol	C	L3	Rare transfer in breast milk with high maternal dose
Ondanset·on	B	L2	No reported breast milk transfer problems
Dantrolene	C	L4	No reported problems but caution urged
Albuterol	C	LI	No reported problems with lactation
Lidocaine	C	NIA	No reported lactation transfer
Bupivacaine	C	L2	No reported problems with transfer via breast milk
Clonidine	C	L3	May reduce milk production, hypotension in infants
Heparin	C	LI	No reported transfer in breast milk
Coumadin	D	L2	No reported transfer in breast milk
Phenobarbital	D	L3	Sedation has been reported in nursing infants
Pbenergan	C	L2	No rep011ed problems with transfer in breast milk
Lasix	C	L3	No reported breast milk transfer problems
Benadryl	C	L2	No reported breast milk transfer problems

Pregnancy Risk Levels

- A - Controlled studies; no risk demonstrated
- B - Animal studies; no demonstrated risk
- C - Animal studies demonstrate adverse risk
- D - Human studies demonstrate risk
- X - Strict contraindication

Lactation Risk Levels

- LI Safest
- L2 Safer
- L3 Moderately Safe
- L4 Hazardous
- LS Strict contraindication

Source: *Medications and Mothers Milk,* by Thomas Hale, PhD, 2000, Pharmasoft Medical Publishing

Commonly used Abbreviations

PROM – premature rupture of membranes
PPROM – preterm premature rupture of membranes
SROM – spontaneous rupture of membranes
AROM – artificial rupture of membranes
NSVD – normal spontaneous vaginal delivery
VAVD – vacuum-assisted vaginal delivery
SAB – spontaneous abortion
EAB – elective abortion
FHT – fetal heart tones
PTL – preterm labor
IOL – induction of labor
VBAC – vaginal birth after cesarean
TOLAC- trial of labor after c-section
GDM – gestatational diabetes
PIH – pregnancy-induced hypertension
PPH – postpartum hemorrhage
Miso – misoprostol
Terb – terbutaline
Pit – oxytocin (pitocin)
G's and P's – gravida and para (para is split further into term/preterm/aborted/living) **Vaginal exam** – % effacement / dilatation / station (e.g. complete / 7 / +1 or 60 / finger- tip / high)
NST – non-stress test
BPP – biophysical profile
CST – contraction stress test
EFW – estimated fetal weight
FHT – fetal heart tones
IUGR – intrauterine growth retardation