Welcome to the OB anesthesia rotation! This guide provides information regarding the operation of the Stanford OB Anesthesia Service. Please review it before you start the rotation and refer to it while you are on the service.

* The section on commonly used techniques starts on page 14.
Background Information
The annual delivery rate in the Johnson Center for Pregnancy and the Newborn is over 5000, with a cesarean delivery rate of just under 30%. Slightly less than half of the patients are private community patients, about a third are Stanford Women's Clinic (SWC) patients (i.e., the University service), and the remainder are San Mateo County (SMC) patients. Stanford patients receive care from Stanford OB residents under the supervision of Stanford Fetal-Maternal Medicine or OB faculty. SMC patients also are on the teaching service working under the direction of four or five obstetricians; these individuals either work exclusively for San Mateo County or are private practitioners working part-time for that service. Approximately 70-75% of women receive regional analgesia during labor. Most obstetricians at Stanford allow patients to choose their form of analgesia and do not wait for a specific cervical dilatation to be reached.

General Philosophy of the Unit
Our philosophy aims to combine quality medical care with a compassionate, non-rigid approach to patients and their families. The delivery suite consists of Labor/ Delivery/ Recovery rooms that allow women having normal deliveries to remain in one location throughout labor. We allow the spouse or support person/s to remain with the patient while we perform regional anesthesia. One person is permitted in the cesarean section room during placement of regional blocks and during surgery, although an additional person may be allowed if all caregivers consent. If general anesthesia is required, the "significant other" may come back into the room after anesthetic induction to watch the birth, provided a hospital staff member (NOT a member of the anesthesia team) can be delegated to look after him or her. While the presence of a family member during general anesthesia is not always appropriate or comfortable for the caregivers, it is important to some couples and is generally permitted by other local hospitals. A prenatal class explaining anesthesia options and procedures at Stanford is given two evenings per month by one of the obstetric anesthesia fellows. Patients also receive our patient education booklet in English or in Spanish. You can use a similar format when explaining pain relief options and obtaining informed consent prior to regional blocks.

Resident Responsibilities and Work Shifts
There are 4 residents on each month and overnight call will rotate every 4th night. Each weekday, two residents should show up at 0700 (except on Monday, they go to conference first and then go to relieve the call person at 0800). These two residents stay until 4:30. The call resident comes in at 2:30. Between 2:30 and 4:30 there will be teaching and/or patient rounds conducted with all three residents. The post call person is not expected in until 0700 the next day.
On weekend days (Saturday and Sunday) and designated holidays (check to make sure) only the call person comes in and they come in at 0700. If all residents are in agreement, the weekend day shifts can turn over at 0800, but no later.

The first day of the rotation is always on Monday (except in July). Sometimes, if a person is coming or going to the ICU rotation, some residents will rotate onto OB later in the week. Those situations will be dealt with on an ad hoc basis.

On weekdays, the two daytime residents should be in the delivery suite after obtaining a narcotic box from LPCH pharmacy no later than 0700 to permit timely starts of surgical cases. Just as in the OR, we should be ready to start scheduled cases at 0730 (although the nurses and OB’s are often not ready then). On weekends, the elective Cesarean deliveries start at 0830.

Under the supervision of the attending anesthesiologist, the OB anesthesia resident is responsible for the routine and emergency anesthetic care of all patients in the Stanford Labor and Delivery Suite. This includes the provision of anesthesia for labor and vaginal deliveries, cesarean sections, postpartum tubal ligations, and other surgical procedures performed in the Delivery Suite. The Department of Neonatology assumes primary responsibility for neonatal resuscitation at Stanford. However, if the baby needs resuscitation, it is appropriate for you to initiate this while awaiting the arrival of the pediatric team. The anesthesia team is also responsible for care of post-cesarean section patients receiving spinal/epidural opioids for the first 16 to 48 hours depending on which drug was given.

**What Should I Do First?**

Your priorities generally should be:

1) Emergency cesarean sections or high risk deliveries, (e.g. twin or breech deliveries) or any antepartum or postpartum hemorrhage
2) Patients in active labor requiring analgesia for labor or delivery
3) Non-emergent cesarean sections
4) Other surgical procedures
5) Outpatient anesthesia consultations.

On arrival at the start of shift, immediately sign in and familiarize yourself with the patients on the activity board, pick up the phone and STAT OB pager, and obtain a report from the night team and the charge nurse. The prior evening you should have checked the schedule book at the front desk so that you are aware of any elective procedures. Try to be aware of all patients on the
labor floor. As soon as you are free in the morning, and again at the end of the day, make a point of reviewing all patients and their charts. It is not necessary to perform a full anesthetic consultation and write a note on all patients, although this should be done on patients in whom it is anticipated that anesthesia may be necessary. The goal is to avoid being totally unprepared for an emergency cesarean section in a patient who, for example, is massively obese and might present an intubation problem, or one in whom you might wish to order additional laboratory investigations. **Check with the nurse before you interview a patient regarding anesthesia options** - occasionally patients planning "natural childbirth" prefer not to discuss other options.

All patients attempting a vaginal birth after a cesarean section ("VBACs"), breeches, multiple gestations, versions, and PUBS (percutaneous umbilical cord blood sampling) procedures should have an anesthesia consult soon after admission because of the possibility that emergency anesthesia may be required.

**Faculty Coverage**
The faculty must be informed (preferably by you) about **ALL** cases, including "routine" epidural anesthetics, **before** you start the procedure. A dedicated attending is present in the hospital at all times to cover OB Anesthesia. In extreme emergencies (e.g., prolapsed cord, massive hemorrhage, persistent severe fetal bradycardia), when delay could prove disastrous to the mother or infant, you should start the case yourself and ask the unit clerk to initiate a STAT page for your attending. **Additional help from the OR or ICU anesthesia team can be obtained by initiating the emergency call protocol (see Management of Obstetric Emergencies: Policies and Procedures).** The unit clerk should be asked to call the hospital operator to page the OR or ICU anesthesia resident "STAT". Don't ask for Dr. ........ by name, even if you "know " that he/she is the OR call resident, as changes in assignment may have occurred and this does not signal to the operator that the emergency protocol is being activated.

The OB Attending should also be present for all cesarean sections, removal of retained placenta under anesthesia, breech or multiple deliveries (see special section), and any other surgical procedure. Unless performing a case elsewhere, the attending should also be present during initiation of an epidural anesthetic. If difficulties or complications arise (either anesthetic or obstetric) during the course of an anesthetic, **call your attending**. Failure to involve the attending often results in patient and obstetrician complaints and medico-legal liability that otherwise might have been avoided. The attending **must** sign the pre-anesthetic note, the anesthesia record, and the post-anesthetic note. Arrange with him/her in advance how this should be organized during the night.
Of special note: Residents should place themselves on the electronic medical record as personal, but **residents should not sign the record**. Only the attending can sign the record. The resident may finalize the record, but the record cannot be finalized until after it is signed and only attendings can sign.

**Beepers/Availability**

Make sure one of the residents is carrying the resident phone and OB Stat pager at all times. However, do not rely on this as the only means of contacting a resident. Make sure that you are carrying a functioning pager at all times and that its number is written on the communications board in the Delivery Suite. Do not leave the immediate vicinity of the Delivery Suite for at least 30 minutes after initiating a regional anesthetic or 20 minutes after administering a local anesthetic bolus injection. It is best if you advise the unit clerk and the nurses caring for your patients if you plan to leave for more than a brief period.

**Be Prepared!**

Emergencies can develop with frightening rapidity in OB and you must be prepared to administer anesthesia safely with minimal notice. General or major (surgical) regional anesthesia is not initiated in the Labor/Delivery-Recovery rooms, as they do not have anesthetic gases or full monitors.

**Check the anesthetic equipment in ORs A, B and C at the beginning of each shift and before the start of each case.** Set up the room again immediately after each case. In both rooms, a functioning laryngoscope and a size 7 (and 6) endotracheal tube over a stylet should be prepared, and propofol (vial only) with syringe ready, succinylcholine, atropine, phenylephrine, ephedrine, pitocin, 2% lidocaine with epi and bicarb, and reglan/ranitidine (combined) should be drawn up in syringes and locked in the second drawer of the blue anesthesia cart. The phenylephrine should only be in a concentration of 100 mcg/ml. No “hot” neo should ever be left in a syringe. We have ready made syringes now so this should never be an issue. An IV infusion with a blood pump should be left hanging in both rooms and an emesis basin with material for starting IVs left in the drawer of the anesthesia cart. **All drugs and infusions should be labeled with the time and date and should be used or discarded and replaced every 24 hours** (except in the case of the pre-made syringes—as long as the seal is not broken, they can be kept until expiration date). Equipment for jet ventilation, the difficult airway cart, and resuscitation equipment in the top drawer of each block cart should be checked on a daily basis.

**DO NOT DRAW UP LARGE NUMBERS OF DRUGS SUCH AS NONDEPOLARIZING**
RELAXANTS, REVERSAL AGENTS, AND NARCOTICS AND LEAVE THEM IN THE ANESTHESIA CART. These drugs are not necessary to start an emergency case and should be drawn up only when needed to avoid waste and syringe swaps.

Conditions necessitating procedure/presence in OR A, B or C:
- Cesarean sections
- Cesarean sections
- Breech deliveries
- Multiple gestation deliveries
- Removal of retained placenta under anesthesia
- Difficult forceps delivery
- Severe fetal distress
- Other surgical cases

Orientation - Where is everything?
On Day 1 of the rotation, familiarize yourself with the location and contents of the following:
- Difficult airway cart—know how to set up the video Mac blade and fiber scope.
- Jet ventilator
- Anesthesia workroom
- Level 1 rapid fluid infuser, with cordis and arterial / CVP lines ready
- Malignant hyperthermia kit (you will need to request more dantrolene from the pharmacy for a full-blown case). Also in this box are the materials for treating a bupivacaine overdose.
- Crash carts, one across from room 8 and the other across from the ORs
- Portable oxygen and suction
- Resuscitation bags and masks in the hallways

Anesthetic equipment, most drugs, the blood warmer and Bair Hugger are located in the anesthesia work room, the OR cupboards, or the hallway outside the ORs. Some drugs are kept with nursing supplies in the Pyxis in the medication room between the ORs or in the refrigerator there (e.g., methergine and hemabate) or may have to be obtained from the LPCH pharmacy.

The OB anesthesia technician assigned to the Delivery Suite should check equipment and restock supplies twice daily. The technician should also be paged in emergencies to provide additional help, e.g. setting up lines etc. If no OB anesthesia technician is working, emergency help can be obtained from the General OR.
Narcotic and Drug Control and Documentation
Each resident should collect a narcotic box from the LPCH pharmacy at start of shift and secure this to one of the OB-OR anesthesia carts or to the plate in the anesthesia work room. Narcotic boxes should be obtained from, and returned to, the pharmacy after each shift. Thiopental and other controlled drugs required for the standard set-up in each OR should be replaced each 24 hours by the arriving resident at 7 a.m. Be prepared to reconcile your narcotic sheet each time you turn it in.

All anesthesia carts and the workroom MUST be kept locked at all times unless in actual use. Emergency drugs must be locked in the drawer of the OR anesthesia cart and changed each 24 hours. Please date and initial all drugs.

When adding opioid to epidural infusions, document on the anesthesia record the total amount of opioid injected into the bag and return all unused narcotics to the pharmacy.

Preoperative Consultations
Most scheduled C-Section patients come for a preoperative anesthetic consultation the day before surgery and are admitted on the morning of surgery. A preoperative anesthesia note should be written at that time on the special Preoperative and Postoperative Record and attached to the patient's chart. High-risk patients already in the hospital (usually in the antepartum unit on F2) are seen before the day of surgery. San Mateo County patients and some others may be seen on the morning of surgery, as language problems or travel arrangements may make arranging an anesthetic consultation in advance problematic. Patients should receive instructions regarding oral intake and information regarding options for postoperative analgesia at the preoperative visit. If the patient is not seen in advance and speaks English, a telephone call the night before surgery may be helpful.

High Risk Consultations
These are done by, or in conjunction with, the fellow and/or faculty. A long-term anesthetic plan is formulated after meeting with the OB team. After the consultation note is written, a copy will be placed both in the patient's chart and in the red folder at the front desk. Most high risk patients are seen by a fellow in the high risk clinic on Wednesday afternoon. Most discussions about these patients will take place once a month during the MFM/Anesthesia Lunch. As a resident, you should attend this meeting if possible.
Documentation

Good recording keeping is essential for excellent patient care, particularly when shifts change and care is transferred to another member of the anesthesia team. In addition, in the current litigious climate we are particularly vulnerable in the OB area. This mandates maintaining records that are both adequate and legible. Finally, regulations for hospital accreditation and reimbursement for services mandate the same standards for obstetric patients as for surgical patients. Minimal requirements include:

- Pre-anesthesia note with all vital signs and a pain score
- Physician attestation that the patient has provided informed consent
- Signed anesthesia record (the anesthesia attending only should sign the electronic chart)
- Appropriate teaching physician documentation
- Post-anesthesia note indicating immediate recovery from the anesthetic with either "no complications", or complications as noted. Post-anesthesia notes must NOT be signed in advance!

If the electronic medical record is not working it is acceptable use the special pre- and post-anesthetic record (with a hatched black and white border. The immediate post-anesthesia note should be written on this sheet when the catheter is removed and should include information regarding recession of analgesic block. Please also document on the anesthesia record that you have removed the catheter with tip intact. Information regarding the patient's comfort, time and mode of delivery, and the condition of the neonate should also be recorded in the appropriate spaces on the front sheet of the labor anesthesia record. Ideally, a delayed anesthesia note documenting presence or absence of complications should be written in the patient's chart whenever possible, either by the team at the end of night shift or by the day team.

NOTE. It is your responsibility to maintain the anesthetic record for a labor block as this documents our continuing care, even when we are not in the patient's room continuously. Vital signs (pulse, B.P) should be checked and recorded every 5 min for 30 min after the initial block or a refill, and at least every 15 min thereafter for as long as the block is functioning. These will be entered into medical record separate from our record, but you still need to pay attention to them and make sure they are being measured. A pulse oximeter should be placed for 30 min after initiation of the block and whenever the patient is unstable. The same monitoring is required with continuous epidural infusions. The nurse will assist in monitoring the patient and, in addition, will maintain her own obstetric records. You should see the patient on average every hour and note that in the chart. With the electronic medical record initiate an OB check. Note any abnormalities of fetal heart rate and action taken (e.g., change in position, fluids, ephedrine) and pain scores.
Suggested protocols for epidural infusions and PCEA settings are available (see "OB Anesthesia Techniques"). Patients receiving infusions should be evaluated at intervals by the anesthesiologist. The quality and efficacy of analgesia (including pain scores), sensory level of the block and the physician administered boluses and treatment of any side effects (e.g. hypotension) should be recorded on the anesthesia record.

**Obstetrician Communication**

Obstetric problems can develop in patients with regional anesthesia either unrelated, or related, to the anesthetic. Therefore, (as per ASA guidelines) before initiating regional analgesia for labor, the obstetrician must be contacted to evaluate the patient, concur with the planned anesthetic, and remain readily available to deal with any obstetric complications that may arise. The patient should have been examined within a reasonable period prior to the block (at least the last few hours) to evaluate fetal and maternal condition and the progress of labor. The consultation with the obstetrician can be made by telephone by the nurse and the examination of the patient can be delegated to the nurse or midwife by the obstetrician. If the anesthesiologist is concerned about maternal or fetal condition, it is appropriate to request that the obstetrician be in attendance in the hospital before the anesthetic is started. In such situations, it is preferable for the anesthesia faculty to request the attendance of the obstetrician rather than the resident.

Family practitioners deliver some patients at Stanford. As the privileges of these individuals do not include all obstetric procedures (e.g., cesarean sections), they must have an obstetrician acting as their back up. Before initiating regional anesthesia for labor for patients of family practitioners, the back-up obstetrician must be contacted to ensure that they concur with the planned anesthetic and are available in the event that obstetric problems arise. The family practitioner usually makes appropriate arrangements in advance. Anesthesia for cesarean section (epidural, spinal, or general) should not be initiated until the obstetrician is actually present in the Delivery Suite. When private obstetricians are not in-house, the in-house Stanford obstetric team assumes temporary care of their patients when they develop complications that require immediate cesarean section or other action.
**Removal of Epidural Catheter by R.N.**

If you are unavailable (e.g. in a cesarean section), the L and D nurse may remove the epidural catheter if she is certified to do so. If possible, she should bring the post-anesthesia note to you or the attending to countersign. **You must sign the post-anesthesia note within 48 hours.**

**Twin/Vaginal Breech Deliveries**

These and other complicated deliveries are conducted in Operative Delivery Rooms A, B, and C. The anesthesia team should be present to maintain or induce anesthesia and intervene as necessary e.g. to provide uterine relaxation for an internal version for a second twin or for an entrapped head during a breech delivery. A cesarean section is often performed when difficulties occur with the second twin (malpresentation, fetal distress).

The anesthesia team should be present in the OR throughout the active part of a breech delivery and during the delivery of both twins until the patient is stable post-delivery. If the patient is transferred to the OR far in advance of the anticipated delivery, **and mother and fetus are stable,** it may be appropriate to place monitors and obtain baseline vital signs and then leave temporarily until delivery is close. The pulse oximeter and BP cuff can be put on a slower interval during this period to minimize annoyance to the patient from alarms while she is pushing. If the anesthesia team wishes to interrupt their presence in the OR, they should communicate this and their whereabouts to the obstetric team and nurse and remain immediately available in L&D. They should ask the nurse to call them shortly before delivery is anticipated.

On rare occasions, a long (>1 hour) interval elapses between the delivery of the first and second twin. It may be appropriate to leave the OR briefly in this circumstance to provide anesthesia care elsewhere provided the patient is stable and this is communicated to, and agreed upon, by the obstetric team.

An operative anesthesia record (separate from the epidural record) should be maintained during presence in the OR, with any discontinuity of presence clearly indicated.

**Postpartum Tubal Ligations**

These are performed in L&D by arrangement with the attending anesthesiologist, the obstetrician, and the nursing staff. Our usual practice is to perform these immediately after delivery only if the patient has a functioning regional anesthetic or if she agrees to have a regional anesthetic (usually spinal). Although it is not known with certainty when the risk of aspiration
decreases after delivery, we usually defer general anesthesia for a period of 6 hours. Remember also that in the immediate postpartum period the patient's condition may be unstable. All patients should be evaluated for hypovolemia, anemia, infection, etc and the operation performed only if the mother's (and baby's?) condition is acceptable. If the anesthesiologist and nursing staff are occupied with emergency cases or, L&D is busy, then PPTLs should be scheduled for the earliest available time the following day. PPTLs are not usually performed after 11 p.m. However, we try to accommodate surgeons' requests for PPTLs in the evenings and on weekends. Always verify with your attending before agreeing to do a PPTL. Epidural catheters can be left in situ overnight so that they can be used for surgery the next day. If a PPTL is anticipated for a patient with an labor epidural in-situ, then the catheter should be checked after delivery and, if necessary, re-taped securely. The patient and the nursing staff on the postpartum ward should be alerted to the risk of catheter displacement. Inspect the catheter carefully before injecting drug for surgery.

There is a very high fall-out rate after 12-24 hours.

**Epidural Blood Patches**

If a patient who has left the hospital calls to report a post dural puncture headache, she should be seen in the Delivery Suite (not in the ER) by the anesthesia resident and attending. An arrangement has been made to perform epidural blood patches (EBP) on discharged obstetric patients in the Johnson Center (usually on L&D). The patient is treated as an out patient and no hospital charge is issued, provided the nursing staff is not asked to perform more than occasional observations of the patient. Before scheduling an EBP, the charge nurse on L&D should be contacted to arrange a convenient time and place to perform it. The nurse can be asked to put the patient in a hospital gown and supply a consent form. The patient is usually kept for one to two hours after the procedure and is then discharged. Appropriate documentation should be made in the chart. Patients are followed either by the team who perform the EBP or by the daytime OB anesthesia team.
Neonatal Resuscitation
The pediatric team is officially responsible for neonatal resuscitation. However, you should be prepared to assist if you are first on the scene or if the pediatrician is clearly having problems intubating. Your first priority is the anesthetic care of the mother.

Quality Assurance
A QA form is to be completed on each case in which a complication or unexpected adverse event occurs. Such events are to be communicated to one of the OB anesthesia faculty and recorded in the complications book in the anesthesia workroom (top drawer in cabinet on right of door).

Infection Control
• **Wash your hands before and after each patient contact!**
• Caps, mask and sterile gloves are worn by the operator (and other personnel standing close by) for all regional blocks.
• Remove loose jewelry and watches
• Drugs for epidural or spinal use should not be carried around in your pocket where contamination can occur and organisms can incubate at body temperature
• Return to narcotic box sufentanil syringes if the contents are not used immediately.
• If in doubt about the sterility of a drug or needle, throw it out.
• Infusion bags of local anesthetic are not sterile - swab with alcohol wipe prior to injecting opioid.

Attendance at Lectures and Grand Rounds
Obstetric anesthesia residents are **expected** to attend regular Monday morning Grand Rounds and Tuesday or Wednesday resident lectures unless clinical duties preclude this. It is the responsibility of the residents on the service to coordinate coverage during these times with the other residents and the fellow/attending so that each resident has similar opportunities to attend. The resident on call on Sunday night covers OB until the end of Monday morning Grand Rounds. Even if the attending agrees to cover the service, the resident should leave their pager number on the communications board if additional help is required. Residents should return to L&D immediately after the lecture finishes.
Research
Ongoing research studies may involve your patients. We expect your cooperation in these ventures. The anesthesia fellows are primarily involved in such studies and will explain any special procedures. If you come across a patient who may be eligible for a clinical research study, please inform the OB anesthesia fellow at the earliest opportunity. (For studies involving patients undergoing elective cesarean section, consent for research studies is often needed when the pre-operative evaluation is performed the day before surgery.) If in doubt, call or speak to the OB anesthesia fellow or attending for advice.

Education
Residents on the rotation are expected to read an up-to-date textbook and some current literature. A list of recommended books and some handouts are available. Also review the difficult intubation protocol and view the ASA patient safety videotape (in the attending call room) on "The Difficult Airway - II: The Cricothyroid Membrane." Didactic teaching sessions will take place as permitted by clinical activity. The residents should also attend Journal Club organized by the OB anesthesia fellows.

The following protocols, procedures, and miscellaneous items will be made available:

1. OB Anesthesia Techniques
5. ASA Guidelines for Regional Anesthesia in Obstetrics.
6. ACOG Committee Opinion on Emergency Deliveries.
7. ACOG Committee Opinion on Tubal Sterilization.
9. Recommended reading.
Commonly Used OB Anesthesia Techniques

The following "recipes" are provided as a guide to techniques currently in use at Stanford. The goal of these suggestions is to keep women comfortable with as light as block possible. They should be view only as a guide, not as an algorithm. For example, the majority women having an epidural before 3 cm can be made comfortable with a small dose of local anesthetic. However, sometimes women ask for epidurals when labor is beginning to progress or labor is dysfunctional in some way and they may need more than the recommended dose of drug. The guidelines do not preclude use of other drugs, doses or approaches. They provide a baseline from which to practice and then adjust as needed for the clinical situation. The important thing is not to leave the room until the woman is comfortable and satisfied with her block.

Epidural Block For Labor Analgesia

Epidural blocks are performed at any stage in labor in our unit. The technique varies depending upon the stage of labor, the parity of the patient and the speed of progress of labor. Newer techniques using infusions of very dilute solutions of local anesthetics combined with opioids provide excellent analgesia while maintaining motor power. The spontaneous delivery rate with these techniques is high, as patients can usually push well during the second stage of labor. Dense surgical perineal analgesia is often not present for delivery with these techniques, but mild discomfort is usually well tolerated by patients who desire a normal vaginal birth. Obviously, some patients require denser analgesia and treatment must be individualized.

1. **Block initiated at < 3 cm cervical dilatation:**
   - **Test Dose:** No routine lido + epi test dose given unless blood seen in catheter. [The whole first dose is a test dose. The risk of intravascular toxicity with incremental injection is very low, and analgesia will not result if the catheter is IV. Observe for spinal block after 1st increment. Lido/epi test dose increases motor block, temporarily slows contractions, and has low sensitivity and specificity in labor]
   - **Bolus:** 10-12 ml 1/8% (0.125%) bupivacaine + sufentanil 10 µg (or fentanyl 50-75 µg) given in two increments 3-4 min apart. If pain scores are low start with 10 ml of
bupivacaine. If the women is in extreme pain start with 15. Often little local is needed at this point and you want to limit motor block early on. However, some women require more. The key is to stay in the room and give more local until the woman is comfortable.

- **Continuous infusion**: 1/16% bupivacaine + sufentanil 0.3-0.4 µg/ml or fentanyl 2 µg/ml at 12-15 ml/h. [Higher infusion rates provide much better sacral analgesia.]

- **PCEA**: Now used routinely. Solution of 1/16% bupiv + opioid (see above). Current settings used:
  - Continuous infusion: 8-15 ml/h (most use 12 ml/hr)
  - Bolus: 10-12 ml (most use 12)
  - Lockout: 12 min (it takes the pump almost 8 minutes to get the dose in).
  - Air sensitivity: OFF
  - 1 hour maximum: 3-4 boluses*.
  - Instruct patient to request physician evaluation and bolus if no relief after 2 self-administered boluses within 40 min.

*N.B. Ineffective analgesia is often due to inadequate hourly max leading to "lockout"

- **Rescue Meds**: Supplement with bolus of bupivacaine ± opioid (e.g. 7 to 10 ml of 0.125% bupivacaine 10 ml, or 7 to 10 ml of 0.25% bupivacaine) and increase infusion rate and hourly maximum if necessary. If the patient still does not become comfortable with one additional supplement (not explained by rapid labor progress), suspect intravascular placement and consider giving an epinephrine-containing test dose. If negative, treat with a large dose of 0.25% bupivacaine or consider changing the catheter. It might not be functioning.

2. **Block started at 3-8 cm cervical dilatation in primips or multips with slow labor**:

- **Test Dose**: usually not given, see above in (1).

- **Bolus**: 15-20 ml 1/8 % bupivacaine + sufentanil 10 µg or fentanyl 50-75 µg given in two increments. [If the patient is extremely uncomfortable, 0.25% bupivacaine may be necessary to initiate the block, as in (3) below. Alternatively, consider intrathecal sufentanil/fentanyl as part of a CSE (combined spinal/epidural) technique as in (5)]

- **Continuous Infusion**: Solution as above in (1) at 12-15 ml/h

- **PCEA**: as in (1)
• **Rescue Meds**: As in (1). Higher concentrations of bupivacaine in the infusion are rarely needed and should be avoided unless analgesia is unsatisfactory, because of the increased degree of motor block and risk of forceps delivery. **Ropivacaine** may cause less motor block and is less toxic than bupivacaine, but is less potent. Appropriate ropivacaine concentrations appear to be 0.2% for bolus injection, with 0.1% for infusion. Similar volumes and added opioid as with bupivacaine.

3. **Block started at ≥ 8 cm dilatation with rapid labor progress**
   - **Bolus**: 10-12 ml of 0.25% bupivacaine (or 20 ml or more of 0.125% bup) + sufentanil 10 µg or fentanyl 50 µg. Administer bolus incrementally.
   - **Infusion**: as in (1) at 15 ml/h
   - **PCEA**: As in (1).
   - **Rescue Meds**: As in (1&2). If patient is extremely uncomfortable or almost completely dilated, 10-14 ml 1% lidocaine or 2% 2-chloroprocaine may be necessary to obtain a rapid onset of intense analgesia. We try to avoid these denser blocking agents in routine labors because of accompanying motor blockade. A CSE is often the best choice for these patients [see (5)].

4) **Block started at complete dilatation for imminent or operative vaginal delivery**: Lidocaine 1-1.5%, or 2-3% chloroprocaine, 12-15 ml given incrementally with the patient remaining sitting until adequate perineal anesthesia is obtained. Alternatively, use a CSE (see next section).

5) **CSE: Combined Spinal/Epidural**
   Alternative technique to epidural analgesia. It is ideal:
   - When rapid onset of intense analgesia is required, (e.g., in the multiparous or primiparous woman in rapidly progressing labor, complete dilation)
   - When no motor block is desired (i.e., in very early labor, when the patient wishes to ambulate, or when effective expulsive efforts are important)
   - For routine labor analgesia as an alternative to epidural
   - When loss-of-resistance is uncertain; spinal needle confirms correct placement
• In the technically difficult or uncooperative patient in whom a single shot spinal dose can be followed by placement of an epidural catheter when the patient is comfortable.

• Consider when redoing a failed epidural

**CSE Technique:** An initial dose of opioid + bupivacaine is administered via a long 26 gauge pencil-point needle introduced through the epidural needle. Rapid (within 6 min), profound analgesia results, lasting 90-120 minutes.

*Because these solutions are slightly hypobaric, THE PATIENT SHOULD BE PLACED HORIZONTAL, not in the usual head-up position, for about 30 minutes.*

• **Initial Labor Dose:** Intrathecal sufentanil 5 µg + bupivacaine 2 mg (0.8 ml of 0.25% plain) [dose range: IT Suf 2.5-7.5 µg and bupivacaine 1.25 - 2.5 mg. Use smaller doses in very early labor and larger doses close to delivery.]

• **Infusion/PCEA:** Started as in (1) unless delivery is expected within 60-90 minutes.

• **Monitoring:** FHR, BP as for epidural, SaO2 for first 30 min.

• **Test Dose:** not routinely given, as there is concern this may move the block up and result in an excessively high level. However, remember that the catheter has not been tested. If there is concern that the catheter might be intrathecal or intravascular, do not start an infusion until after a test dose has been given.

**Fetal bradycardia after CSE:** This may occur somewhat more frequently than after epidural, most often in patients with preexisting fetal stress and those in tumultuous labor. This technique is therefore best avoided when there are preexisting FHR abnormalities or a non-reassuring FHR. Alternatively, one should expect fetal bradycardia any time after adequate analgesia is delivered to the patient, no matter which technique is used.

The bradycardia may be due, in part, to uterine hypertonus resulting from diminution of beta-sympathetic tocolytic effect as epinephrine concentrations rapidly decline with the onset of analgesia. Immediately discontinue oxytocin, administer oxygen and additional IV fluids, give nitroglycerin (located in the block cart) either as the sublingual spray (2 puffs, repeated as necessary) or IV as intermittent 100 µg boluses until uterine tone diminishes or blood pressure decreases. If uterine hypertonus persists, terbutaline 0.25 mg SC may be necessary. Administer phenylephrine if hypotension is present.
USEFUL TIPS FOR LABOR ANALGESIA:

6) Bupivacaine in subanesthetic concentrations (1/12-1/16%) does not provide adequate analgesia without the addition of opioids. If opioids cannot be used, then 0.25% bupivacaine or levobupivacaine or (0.2% ropivacaine) should be used for the bolus and 0.125% for the infusion. Infusions more concentrated than 0.125% bupivacaine should not be used unless the anesthesiologist is in constant attendance throughout, as the consequences of unrecognized intravascular or intrathecal infusion of higher doses could be disastrous. Lidocaine and chloroprocaine are ineffective when given as dilute infusions for labor analgesia.

7) The total appropriate dose of opioid in labor has not been established. Doses of opioid as described do not result in neonatal depression. Conservative doses should probably be used with preterm fetuses.

8) If satisfactory analgesia is not obtained with the techniques described above, inject bupivacaine 0.25% (10-12 ml), or if the patient has received a large dose of an amide local anesthetic, 2% chloroprocaine. If there is no major improvement in analgesia, the catheter probably is in the wrong place and should be replaced.

9) If analgesia is good after top-ups but tachyphylaxis develops, requiring frequent re-injections of local anesthetic, exclude partial intravascular placement of the catheter. If you are convinced the epidural catheter is working well, try:
   • Adding low dose epi (1/400-800K) to the infusion.
   • Increasing the bupivacaine concentration to 1/12% or 1/8%
   • Adding low dose clonidine (15µg to each supplemental bolus and 10-15µg/h)
   • Adding bicarbonate 0.05 mEq/20 ml to the bupivacaine to decrease the degree of ionization of the local anesthetic and increase bioavailability. (Adding more than this minute volume of bicarbonate results in precipitation of bupivacaine).

“Walking Epidurals”

Patients can often walk to the bathroom with use of very dilute epidural local anesthetic solutions and with many CSE techniques. Appropriate supervision from a nurse, nursing
assistant or physician is essential. Before walking, it must be ascertained that the patient has adequate motor power (ability to support weight and do a partial knee bend of about 6") and does not become hypotensive when upright. Make sure catheter connection is secured well.

Anesthesia for Cesarean Section

Approximately 90-95% of cesarean sections at Stanford are performed with regional anesthesia. General anesthesia is usually reserved for emergency cesareans where there is acute fetal distress or maternal hemorrhage, or when regional block is contraindicated. Spinal anesthesia is used for elective cesareans, and emergent or non-elective cesareans where a rapid onset of block is desirable or acceptable. Epidural anesthesia is used for elective cesareans when a slower onset of block is preferred and for patients in whom a functioning catheter is already in situ. CSE should be considered if the duration of surgery is expected to last beyond that provided by spinal anesthesia (e.g. 4 previous CS).

Avoidance of Aortocaval Compression

All patients must be tilted to the left as soon as they are placed on the OR table to minimize the adverse effects of the supine position, i.e., a decrease in cardiac output of 30-50%. This is usually accomplished by placing a rolled blanket under the right hip, tilting the table, or a combination of the two methods. Check that the uterus is actually displaced by whatever method you are using! Left uterine displacement is essential regardless of whether the patient is having a regional or a general anesthetic. If intraoperative hypotension occurs, check the adequacy of left uterine tilt.

Prophylaxis Against Aspiration Pneumonitis

All patients receive iv ranitidine 50 mg and metoclopramide 10 mg prior to their surgery. The metoclopramide increases lower esophageal sphincter tone and in the case of spinal anesthesia, decreases nausea. The ranitidine will lower gastric pH in about 60 minutes time. This will help should the woman need intubation or extubation later and ranitidine will also decrease any reflux symptoms. Patients receiving general anesthesia should be given sodium citrate 30 ml p.o. 2 to 5 min before anesthesia. This drug has a short duration of action (20 minutes), so don't give it too early. In the elective situation, patients at
increased risk should receive ranitidine 150 mg p.o. the night before and the morning of surgery.

**Spinal Anesthesia for C/Section**

**Hypotension** is the major risk with this technique. Prophylaxis and treatment include all of the following:

- Hetastarch 500 ml + 1000 ml crystalloid in the 30 minutes or so before the block, or 1000 ml of crystalloid infused rapidly (with pressure bag) concurrent with and immediately after the block. Note that hetastarch stays intravascular for about 12 to 24 hours so it can be given way before the spinal and if given too early, does not need to be redosed. Rapid infusion of crystalloid is more effective than pre-loading with crystalloid, but less effective than colloid (hetastarch) given as a preload or postload. Preloading hetastarch has no effect on its efficacy.
- Left uterine displacement
- TEDS or other support hose to increase venous return. (This is as or more effective than crystalloid loading.) TEDS do not fit very obese patients well (the top slips down and forms a tourniquet around the thigh. Do not use TEDs in these women. You can use SCDs, they might be efficacious, but this has not been studied.
- Phenylephrine 50-100 µg boluses at the first sign of hypotension, repeated p.r.n.
  - Use enough phenylephrine to maintain blood pressure as close to baseline as possible (without exceeding the baseline the patient had just before the block).
- If there is some mild bradycardia and hypotension, ephedrine 10 mg will increase the blood pressure and the heart rate. However, limit the total dose of ephedrine to 10 to 20 mg. Ephedrine in larger doses is associated with neonatal acidosis. Alternatively, glycopyrollate 0.2 mg i.v. works well.
- Atropine 0.4 mg if significant bradycardia develops. Be vigilant for possible symptoms of a high-block or emergent total spinal anesthetic (following an epidural top-up if the catheter is in the subarachnoid space) as a cause for the bradycardia.
- Consider epinephrine in the event of severe hypotension or if the hypotension and bradycardia persist despite above measures.
Spinal Anesthetic Technique: Bupivacaine 12 mg. Use the 0.75% hyperbaric bupivacaine (1.6 ml) [range 11.25-12.75 mg, i.e., 1.5-1.7 ml] + 0.15 to 0.2 mg preservative-free morphine. Fentanyl 5-10 µg is usually added to intensify intraoperative anesthesia. (In urgent situations when time is precious, omit the opioid and use up to 15 mg bupivacaine.) Because no correlation has been demonstrated between patient height and weight and the level of block obtained, the dose of local anesthetic is not adjusted for patients in the normal range (5′-6′). Remember that intubation because of failed blocks is much more common than intubation for high blocks! A CSE is usually done if there is uncertainty about appropriate dosage or duration of the case.

Because the incidence of headache is little different with 22-G pencil point needles vs. 25-G, the larger size can be used in urgent or difficult procedures.

Epidural Anesthesia for C/Section
Ideal for patients in whom gradual onset of the block is desirable, or for routine cases. Fluid loading with 1000 ml crystalloid. Hespan or other colloid is not usually necessary in normal patients. Management of hypotension as above for epidural block. Metoclopramide 10 mg and Ranitidine 50 mg i.v. are also given.

Technique for Elective C/S (no existing epidural catheter or block):
• 2% lidocaine + epinephrine 1:200,000 + bicarbonate 1 mEq per 10 ml of lidocaine. Alkalinization with bicarbonate speeds onset and intensifies the block. Bicarbonate should not be added if a slow onset of blockade with the least possible risk of hypotension is the goal.
• Test dose, plus incremental injections to total initial dose of 20 ml.
• Average dose: 20-25 ml, but some patients will need up to 30 ml.
• Addition of fentanyl 50 to 100 mcg improves intraoperative anesthesia, decreases intraoperative nausea and shivering, and is safe for the fetus.
• Morphine 4 mg administered after delivery of the baby for postoperative analgesia.

Alternative techniques employ similar doses of 3% 2-chloroprocaine (more rapid onset, but short duration and potential antagonism of epidural opioids) or 0.5% bupivacaine, levobupivacaine, or ropivacaine (slower onset and less intense block - alkalinization with bicarbonate 0.05 mEq/20 ml and addition of fentanyl may help). Plain lidocaine is much
less effective than lidocaine with epinephrine and may need to be supplemented with chloroprocaine (to avoid potentially toxic doses of amide).

**Techniques for C/S in Patients with Functioning Epidural block Placed During Labor:**

In real emergencies, 20 ml of 3% chloroprocaine (alkalinized with bicarbonate 1 mEq/10 ml if desired) can be injected rapidly into a catheter known to be functioning satisfactorily (therefore, presumed not to be intravascular or intrathecal). This should give good anesthesia to start a cesarean section within 5 minutes. Bold and prompt action is necessary in these cases to avoid having to induce general anesthesia. It may be necessary to start injecting the drug as soon as it is clear that surgery is needed, doing so en route to the OR if necessary. In less urgent cases, lidocaine with epinephrine is usually administered, as above in (1).

**N.B.** Many patients with an existing labor block will have a level of analgesia to pinprick that is quite high (often T6 or so). This does NOT mean that the patient has this level of anesthesia. The level of surgical anesthesia is best assessed with a nerve stimulator, light touch, or an Allis clamp. It is rare to obtain satisfactory surgical anesthesia in this circumstance without injecting an additional 15-20 ml of a surgical concentration of local anesthetic. Check both the upper and lower sensory levels; there should be no perception of any sensation on the lateral aspect of the foot (S1).

**CSE for C/Section**

Used when dose requirements or duration of surgery uncertain:

- **Technique:** as for labor CSE
- **Dosage:** The hyperbaric bupivacaine used for spinal anesthesia works well in the CSE technique. Although the patient sits up a little longer after the injection compared to the single shot spinal technique, the block will usually not settle lower in the time it takes to pass the epidural catheter. If this occurs and cannot be corrected by position change, injection of 5-10 ml saline will often move the block level cephalad. Normally, the same doses of IT bupivacaine and opioids as for the single shot spinal technique are used. However, if a smaller spinal dose is clinically indicated,(5 to 7.5 mg + IT opioids), then augmentation of the block may be required with 2% lidocaine with epinephrine via the
epidural to raise the block to T4.) When dosing the epidural catheter, remember that the mechanical effect of an epidural bolus may cause the block level to extend more than usual. Expect to supplement with epidural drug if the case is prolonged or a low spinal dose is used.

**General Anesthesia for C/Section**

**ENSURE THAT THE ATTENDING IS ALERTED AS SOON AS A CRASH CS HAS BEEN DECIDED.**

If possible, try to gain as much relevant information from the patient prior to anesthesia if an H&P has not been completed e.g. information about previous anesthetics, medical illness, allergies, MP assessment, last meal.

**DON”T FORGET TO ASSESS THE AIRWAY!**

The following standard technique is used:

- Make sure the anesthetic machine is set for monitoring a patient having a general anesthetic (ETCO2 – this MUST be turned on!!!, volatile agent, etc.)
- Left uterine displacement; bicitra 30 ml p.o., i.v. ranitidine and metoclopramide.
- Preoxygenation with at least four maximal breaths.
- Cricoid pressure, suction, good head and neck position.
- Make sure the surgeon is scrubbed and ready to start before you start, and double-check that the pediatrician is present or has been alerted.

**Be prepared to deal with difficult intubation (see algorithm for management of failed intubation).** Ensure a gum-elastic bougie is available

- Thiopental 4 to 6 mg/kg or propofol 2 to 2.5 mg/kg (or ketamine 2 mg/kg in severely hypotensive patients)
- Succinylcholine 1.5 mg/kg.
- After securing the airway, inform the surgeon that they may begin.
- Maintenance with 50:50 N₂O/O₂ + 0.75 to 1.0 MAC sevoflurane or isoflurane until delivery.
- After delivery:
  - Increase N₂O to 70% and decrease the potent inhalational anesthetic (sevoflurane or isoflurane) to 0.5 MAC.
• Give midazolam 2 mg i.v. for amnesia.
• Give fentanyl 200 to 300 mcg i.v. for analgesia.
• Small doses of vecuronium (1 to 2 mg), rocuronium (10 to 20 mg), or cis-atracurium (2 mg) provide muscle relaxation of appropriately short duration. Administer only after recovery from sux is evident by respiratory efforts, movement, or presence of twitch with nerve stimulator. If the patient is on magnesium, they usually don’t need more muscle relaxation with non-depolarizing muscle relaxants. However, if you do give muscle relaxants to someone on magnesium, use small doses and monitor NMB carefully with nerve stimulator.
• Ensure patient is fully awake and reversed before extubation.
• IV-PCA opioids for postop analgesia.

POSTOPERATIVE ANALGESIA
A signed order sheet must be completed for each patient receiving spinal/epidural opioids. Pay particular attention to the options for postoperative respiratory surveillance. Monitoring with hourly nursing checks is satisfactory for completely normal patients. However, if the patient is obese, has medical complications, is very sedated, has received other depressant drugs, has had periods of desaturation intra- or postoperatively, or has a history of sleep apnea, then continuous monitoring with a pulse oximeter is appropriate.

We will start using depomorphine sometime in the near future. It is just a long acting form of morphine and the side effects are the same as morphine. However, you need to make the orders last 48 hours, not 16.

We are using multimodal therapy including NSAIDs (if not contraindicated by patient sensitivity, bleeding or uterine hypotonia) and oral opioids (e.g., Percocet, Vicodin) in the immediate postanesthetic period in patients who are not nauseated or vomiting. Choose one option for the NSAIDs. Choose one oral opioid and choose both doses for that opioid. It is advisable to ask the obstetrician which oral opioid and NSAID protocol they prefer. Also choose the i.v. morphine option for rescue if the oral opioids do not provide adequate pain relief.

For patients who have general anesthesia or those that require more than a few doses of i.v. morphine post-operatively, order PCA morphine. Use a special PCA order sheet.
[NB: Ketorolac has a "black box" around it in the package insert, stating that it is "Contraindicated in pregnant or lactating patients." The plasma:breast milk ratios for ketorolac and ibuprofen are almost identical. Ibuprofen has probably given to more breastfeeding women than almost any other drugs with few, if any, reported side effects. It is hard to imagine that ketorolac would have any different effects or difference in milk levels than ibuprofen. This drug is probably as safe as ibuprofen for breastfeeding. We believe that the drug company for legal, not medical, reasons put this contraindication on the package insert. NSAIDs, including Ketorolac are on the American Academy of Pediatrics list of medications appropriate for breastfeeding mothers.