WHAT'S NEW FROM 2003?

Joy L. Hawkins, MD

Labor Analgesia

- Consent versus advanced directive
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- PCA fentanyl protocol
- Optimizing spinal medications
- Pros and cons of test dosing
- Optimizing local anesthetic requirements
- The "new" locals; ropivacaine and levobupivacaine
- Progress of labor issues

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- Oxytocin regimens and side effects
- Phenylephrine and fetal acidosis
- Prevention of pruritus
- Spinal anesthesia and severe preeclampsia

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- Anticoagulation; the ASRA Consensus Guidelines update

LABOR ANALGESIA

- In this day and age many patients arrive with extensive birth plans. How does the anesthesiologist respond when the patient's birth plan includes a prohibition against using labor analgesia "even if I am screaming for it"?[1] What are the medicolegal implications for consent? Consent is not a fixed decision, but one that may be changed at any time. Birth plans are to be considered as advanced directives, and as such, the patient may change her mind. However, it might be worthwhile to consult with your hospital attorneys and/or liability carrier.
- Several recent studies have shown decreased requirements for other forms of pain medication when acupuncture is used during labor.[2,3] If patients request this technique in labor, there may be credentialing issues unless acupuncture is already provided in your institution for pain management in other settings.
- A Canadian multicenter trial of patient-controlled intravenous fentanyl analgesia for labor has completed their work and published a protocol (attached).[4] The basic settings start at 50μg increment every 10 minutes with no basal rate.
- The minimum analgesic doses of fentanyl and sufentanil for *epidural* analgesia in the first stage of labor were determined to be 125μg and 21μg respectively, giving a sufentanil/fentanyl potency ratio of 5.9. The durations were equivalent at 85-93 minutes.[5]
- When a combined spinal-epidural technique is used, additives to the spinal dose can prolong and intensify the analgesia, making subsequent epidural analgesia more effective. The addition of 125μg morphine to a fentanyl/bupivacaine mixture did not prolong the duration of the spinal analgesia, but the group receiving morphine had fewer episodes of breakthrough pain requiring epidural top-ups, and they required fewer pain medications in the first 24 hours postpartum.[6] There was no difference in the incidence of side effects. Likewise, the addition of 100μg epinephrine significantly decreased the need for subsequent epidural analgesia, but at the expense of more motor block.[7]
- Minimizing motor block is an essential part of providing labor analgesia. So is safety. Several studies have shown that use of an epidural test dose (3ml 1.5% lidocaine with epinephrine) after initiation of a combined spinal-epidural technique significantly increases the degree of motor block for at least an hour.[8] Thus, the test dose should be avoided if ambulation is planned. Use of an epinephrine-containing test dose has been controversial in obstetrics anyway, due to its lack of sensitivity and specificity in the laboring patient and potential risk to the compromised fetus. Aspiration of a multi-orifice catheter, fractionation of the dose, and use of dilute solutions are also highly effective ways of preventing an adverse outcome.[9]
- Several studies have shown that patients with dystocia in labor have more pain and increased anesthetic requirements. Investigators determined the minimum local anesthetic concentration (MLAC) of bupivacaine in labor for parturients who eventually required cesarean delivery for dystocia compared to those who delivered vaginally.[10] Patients who later delivered vaginally required 30% less bupivacaine than those who eventually required cesarean delivery, indicating more intense pain related to dystocia.

- Many of us have become used to having our patients rate their pain on a 1-10 scale. What is an acceptable pain score for a laboring patient? A *post hoc* analysis of three studies found that when pain was rated 0-1 only 2% requested more medication. When rated 2-3, 51% of patients requested more medication, and when >3, 93% wanted additional medication.[11]
- Several studies have shown that ropivacaine and levobupivacaine are less cardiotoxic than bupivacaine (see the Complications section), and probably have less motor blocking potential.[12] However neither a randomized trial[13] nor a meta analysis of 23 controlled trials[14] have found any difference in mode of delivery or any other obstetric or neonatal outcomes between ropivacaine and bupivacaine used for epidural labor analgesia. In the randomized trial motor block was significantly greater in the bupivacaine group at 6 hours, satisfaction with mobility was higher in the ropivacaine group, and satisfaction with analgesia at delivery was higher with bupivacaine. So we come back to cost, with ropivacaine still about 4 times the cost of bupivacaine.
- The Friedman curve has long been used as the standard for labor progression. When patients were randomized to epidural analgesia or intravenous meperidine for labor analgesia, the active phase of labor was one hour longer in the epidural group compared with Friedman's original criteria.[15] Could prolonged ambulation alter that? Parturients were randomized to ambulate (avg. 64 minutes) or remain at bedrest after epidural analgesia.[16] There were no differences in length of labor or pain scores between groups, however the ambulatory group required less bupivacaine and less oxytocin and had a greater ability to void – a big source of patient satisfaction!
- From 5 trials at Parkland Hospital in Dallas, 2703 nulliparous patients were randomized to receive either epidural analgesia or intravenous patient-controlled meperidine for labor analgesia.[17] There was no difference in the incidence of cesarean delivery (10.5% vs 10.3%) but a slightly higher forceps delivery rate in the epidural group (13% vs 7%) and a longer duration of first stage (8.1 vs 7.5 hours) and second stages (60 vs 47 minutes) of labor. Pain scores were lower in the epidural group.
- Another institution used a similar study design to compare women with severe preeclampsia receiving epidural labor analgesia or IV PCA.[18] Cesarean delivery rates were similar between the two groups. Patients in the epidural group were more likely to require treatment for hypotension. Patients in the meperidine group had higher pain scores when questioned intrapartum and postpartum, and their infants were more likely to require naloxone (54% vs 9%).

CESAREAN DELIVERY

- There is much debate in the obstetric community over whether a woman should be able to choose an elective cesarean delivery without any "medical" indication. A cost analysis found vaginal delivery in nulliparous women would cost 15% less than elective cesarean delivery.[19] However if the woman required oxytocin costs were equal, and if epidural analgesia was used costs were 10% higher than an

elective cesarean delivery. Overall there was little impact on the cost of obstetric care.

- Which spinal anesthetic is most appropriate for cesarean delivery? A comparison of spinal ropivacaine (12 mg), levobupivacaine (8mg) and bupivacaine (8mg) – all combined with sufentanil 2.5μg – reported successful anesthesia for surgery in 87% (R), 80%(L) and 97%(B) respectively.[20]
- If your obstetricians were fast, a local anesthetic comparable to lidocaine would be attractive for spinal anesthesia. A series of studies using spinal chloroprocaine show promise.[21] Spinal chloroprocaine has similar onset and duration to lidocaine, similar sensory and motor blockade, and no signs of transient neurologic symptoms. It is hyperbaric to CSF without adding dextrose, and the addition of fentanyl enhances analgesia as it does with other local anesthetics.
- Shivering during spinal anesthesia for cesarean delivery is disturbing to the patient and can impair our ability to monitor blood pressure. Intravenous meperidine is effective but may not be desirable prior to delivery. The addition of 12-15 mg intrathecal meperidine decreased the incidence and severity of shivering without other side effects.[22]
- Various regimens of oxytocin have been described to prevent postpartum hemorrhage. A trial of high dose (80U/500ml over 30 minutes) versus low dose (10U/500ml over 30 minutes) oxytocin found patients in the high dose group required fewer additional oxytocics such as Methergine® or Hemabate®. This is important because of cost and side effects when these oxytocics are used. A 10 ml vial of oxytocin is $2, a 0.2mg amp of methylergonovine is $3, and a 0.25 mg amp of Hemabate® is $46! The incidence of hypotension was no different between the two groups.
- A randomized, double-blind comparison of treatment with ephedrine alone, phenylephrine alone, or a combination of the two during cesarean delivery under spinal anesthesia found use of phenylephrine alone resulted in the highest fetal pH values and the lowest incidence of maternal nausea and vomiting. There was no advantage to combining ephedrine with phenylephrine because it only increased nausea and vomiting!
- Although spinal anesthesia is an extremely popular method for cesarean delivery, several studies have shown that spinal anesthesia is associated with a higher incidence of fetal acidosis when compared to general anesthesia. A multivariate analysis of factors associated with fetal pH during cesarean delivery under spinal anesthesia found significant factors were: use of ephedrine, maximum decrease in systolic pressure, duration of hypotension and uterine-incision-to-delivery time.[23] Their conclusions were that ephedrine *should not* be used before delivery and that phenylephrine *should* be used to minimize the magnitude and duration of hypotension. How times have changed!
- Although neuraxial morphine produces excellent postpartum analgesia after cesarean delivery, side effects can be bothersome. A comparison of ondansetron and nalbuphine for prevention of itching found subsequent treatment for itching was requested by 25% of the nalbuphine patients, 50% of the ondansetron patients and 72% of the control group.[24] The cost of 4 mg ondansetron is ~$16 while the cost of 10 mg nalbuphine is ~$0.36.

- Two articles and an editorial re-examine the use of spinal anesthesia for cesarean delivery in patients with severe preeclampsia.[25,26,27] One study compared severely preeclamptic patients (using strict definitions) with healthy patients having spinal anesthesia for cesarean delivery.[26] Despite receiving less fluid and a slightly higher dose of bupivacaine, the severely preeclamptic patients were 6 times less likely to become hypotensive (odds ratio 0.17)! In the accompanying editorial, the authors note that spinal anesthesia has advantages over general and epidural anesthesia in these patients and that use of smaller doses of local anesthetic (perhaps as part of a combined spinal-epidural anesthetic) might decrease the risk of hypotension even further.[27] Another study randomized severely preeclamptic patients having cesarean delivery because of nonreassuring fetal heart tracings to spinal or general anesthesia.[25] Although maternal hemodynamics were no different between the groups, they found spinal anesthesia was associated with a greater neonatal base deficit and lower umbilical arterial pH. Of note, hypotension was treated with ephedrine! Would acid-base status have been better if phenylephrine was chosen?

OBSTETRIC COMPLICATIONS

- The results of a multicenter randomized trial of tracheal occlusion to promote lung growth in fetuses with severe diaphragmatic hernia showed no benefit.[28] In fact, the trial was stopped early because of the unexpectedly high survival rate in the standard treatment group. Women underwent surgery at 22-27 weeks gestation and an EXIT procedure was performed at cesarean delivery to remove the tracheal clip. Survival at 90 days was identical. As noted in an accompanying editorial, the good news is that survival was 75% in these severely affected fetuses.[29]
- Two case reports deal with fetal monitoring during surgery.[30,31] In the first[30], a woman underwent a series of 5 ECTs from 17-19 weeks gestation. Fetal heart tones were monitored before and after the first four procedures with no problems noted. Continuous fetal monitoring during the fifth ECT demonstrated a brief but severe deceleration to 60 bpm. A healthy baby was delivered at 38 weeks gestation. In the second report[31], a patient at 34 weeks gestation was under general anesthesia for cholecystectomy. While being prepared for surgery (but before skin incision), a severe persistent fetal deceleration was noted. An emergency cesarean delivery was performed with Apgar scores of 1/5/7 and pH 7.17/7.18. At delivery the cord was noted to be tightly coiled and twisted tight on itself. Luck? Coincidence?
- An important new document has been published by ACOG and AAP entitled *Neonatal Encephalopathy and Cerebral Palsy: Defining the Pathogenesis and Pathophysiology*. The report confirms that hypoxia during labor and delivery is not a significant cause in most cases of neonatal encephalopathy or cerebral palsy, accounting for less than 10%. It also states that an underlying event before labor was the primary factor for the adverse outcome in 70% of neonatal encephalopathy cases and contributory in another 25%. This is an important

medicolegal defense in cases of adverse neonatal outcome. It can be ordered from the ACOG web site at: www.acog.org.

- Clinical chorioamnionitis has been linked with cerebral palsy in term infants (OR 3.8), particularly among children with quadriparesis (OR 9.7).[32] Another study found a protective effect of magnesium sulfate (loading dose plus infusion for 24 hours) given to mothers with preterm delivery at < 30 weeks gestation.[33] Mortality at 2 years and cerebral palsy in survivors were both reduced by 17% in the magnesium group, although these were not significantly different. Gross motor dysfunction was significantly reduced. Importantly, no serious adverse effects were observed.
- A series of 55 parturients admitted to the ICU after severe postpartum hemorrhage were evaluated with troponin levels and ECGs.[34] Elevated troponin levels and ECG signs of ischemia were seen in 51% of patients. Multivariate analysis identified low blood pressure, tachycardia and use of catecholamines as predictors of cardiac ischemia. The authors recommended "rigorous" correction of hypotension and tachycardia, even though these are young otherwise healthy women.
- Uterine artery embolization continues to be a mainstay of treatment for severe postpartum hemorrhage. Two cases of life-threatening amniotic fluid embolization complicated by DIC were treated successfully by uterine artery embolization, avoiding hysterectomy.[35]
- Management of trial of labor after previous cesarean delivery (VBAC) continues to be debated. The role of obesity in the decision to attempt a vaginal delivery versus an elective cesarean delivery has become a major one. One study retrospectively stratified women by weight.[36] The rate of successful vaginal delivery was 82% for women weighing less than 200 pounds, 57% in women weighing 200-300 pounds, and 13% in women weighing over 300 pounds. In addition, the infection rate was 39% in the obese women versus 6% in the "lean" group. Another study did a cohort analysis of women with BMI > 40 and one prior cesarean delivery.[37] Overall, 51% of women delivered vaginally. The infection rate was higher in the group delivering vaginally (25% vs 8%) and costs were similar, i.e. vaginal delivery did not result in reduced costs.
- A disturbing study of stillbirth rates in subsequent pregnancies after cesarean delivery found the absolute risk of unexplained stillbirth at 39 weeks was 1.1 per 1000 women. Without a prior cesarean the risk was 0.5 per 1000.[38] The *unexplained* stillbirth rate was twice as high as stillbirth due to uterine rupture.
- The Term Breech Trial found a substantial reduction in adverse neonatal outcome with cesarean versus vaginal delivery, leading ACOG to recommend *against* any vaginal breech deliveries except a second twin, and to recommend *for* application of external cephalic version whenever possible.[39] A further analysis of data from the trial to determine which factors were associated with adverse perinatal outcome found that labor augmentation, birth weight less than 2.8 kg and longer second stage (pushing) all increased risk.[40]
- Several recent reports have re-evaluated our treatments used in severe preeclampsia. An extremely large randomized double-blind trial enrolling 10,141 women to receive magnesium sulfate or placebo for preeclampsia found

eclampsia was reduced from 1.9% in the control group to 0.8% in the magnesium group.[41] A meta analysis of 21 trials of hydralazine for treatment of severe hypertension in pregnancy does not support hydralazine as first line treatment.[42] An *in vitro* study of human umbilical arteries found vasodilatory effects with nitroglycerin > nicardipine = hydralazine.[43] Fenoldopam (which might be used to support renal function in preeclampsia or to treat hypertensive emergencies) constricted umbilical arteries only at supratherapeutic concentrations.

- A very small study placed longterm lumbar epidural catheters in patients with severe preeclampsia.[44] Compared to a control group who received conventional treatments, obstetric indications for delivery were delayed in the epidural group by at least 3 weeks, and thus infants in that group had a higher body weight (2240 vs 1590 gms) and gestational age.
- Using high dose corticosteroid therapy (10 mg dexamethasone q 12 hours) for HELLP syndrome has become more common. A comparison of seven year periods before its routine use (given to 16% of patients for fetal lung maturity) and after (given to 90%) found several benefits: improved laboratory parameters (including platelet count), lesser degree of hypertension, less need for antihypertensive therapy, lower use of transfusions and reduced maternal morbidity.[45] Postpartum recovery was also shortened.

ANESTHETIC COMPLICATIONS

- Some of the first cases of cardiac arrest after ropivacaine have been reported now, accompanied by an editorial entitled *"Here we go again!"*. One case involved a lower extremity peripheral nerve block for surgery in which the patient received a total of 300mg ropivacaine and had a cardiac arrest one hour later.[46] The patient was successfully resuscitated using only ephedrine and atropine, and the surgery was performed under the regional anesthetic. In the second case, the patient arrested immediately after a lumbar plexus block.[47] This patient was also successfully resuscitated using only 2 mg epinephrine. In the accompanying editorial, the authors note that the dysrhythmias are different in these cases than was seen with bupivacaine (bradycardia, widening and asystole versus ventricular dysrhythmias) and that resuscitation was much simpler.[48]
- In an animal model of bupivacaine toxicity and cardiac arrest, dogs were treated with either lipid emulsion or saline during cardiac massage.[49] All dogs were resuscitated in the lipid group and none in the saline group. In an accompanying editorial, the authors speculate whether lipid in the form of propofol should be used as a "protective" sedative during placement of blocks and/or used for treatment should toxicity occur.[50] The answer was "not yet"!
- The association of epidural analgesia and hyperthermia remains concerning and poorly understood. Clearly, patients who receive epidural analgesia are more likely to have elevated temperature, although this is not associated with an increased infection rate.[51] This elevated temperature may be deleterious to the fetus. A study in rats found that hyperthermia during ischemia increased brain injury from that seen with ischemia during normothermia.[52] Others have

suggested that epidural-induced fever may put the newborn at increased risk of seizures and brain injury because of an inflammatory response and elevated IL-6 levels.[53] A recent excellent review and editorial may help anesthesiologists counsel patients, but the controversy is far from resolved.[54]

- We may finally have evidence for a technique to minimize postdural puncture headache after wet tap. After unintentional dural puncture during epidural placement, patients were randomized to epidural placement at another interspace, subarachnoid catheter placement with removal at delivery, and subarachnoid catheter placement with removal 24 hours after delivery.[55] The incidence of PDPH and need for blood patch was 81%, 31% and 3% respectively. Combining subarachnoid catheter placement for 24 hours with injection of saline into the CSF prior to removal of the subarachnoid catheter also seems to decrease PDPH.[56]
- A review of loss of resistance to air versus saline concluded that saline is superior based on reduction in: incomplete analgesia, venous air embolism, pneumocephalus, paresthesias (if 10ml is injected), and nerve root compression.[57] A recent case report documented severe immediate headache following wet tap with pneumocephalus seen on CT scan.[58]
- A scary case report described severe postural headache after CSE for labor.[59] Because of associated arm symptoms, an MRI of the cervical spine was done and initially read as negative. An epidural blood patch was performed, with improvement of the headache and arm symptoms, but shortly afterward a senior radiologist called and reported there was a cervical epidural hematoma present on the MRI! Fortunately there were no sequelae.
- ASRA published their updated consensus guidelines on *"Regional Anesthesia in the Anticoagulated Patient"*. These can be downloaded from www.asra.com. They include information on older and newer anticoagulants: dalteparin (the LMWH of choice in obstetric patients), fondaparinux, herbal medications, and the new long-acting platelet inhibitors. Of note in obstetric anesthesia, you should wait 24 hours after the last dose of dalteparin or high dose (1 mg/kg) enoxaparin before considering regional anesthesia.

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