CURRENT CONTROVERSIES IN OBSTETRIC ANESTHESIA

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(* I have no conflicts to disclose. *)
GOALS & OBJECTIVES

Upon completion of this presentation, participants will be able to discuss how emerging research is changing clinical practice in obstetric anesthesia by challenging long-held teaching in the areas of:

1. Prevention and management of complications.
3. Use of newer medications.
“If physicians would read two articles per day out of the six million medical articles published annually, in one year, they would fall 82 centuries behind in their reading.”

WF Miser, 1999
TOPICS TO COVER

1. Preventing hypotension; pressors and fluids
2. Spinal anesthesia with severe preeclampsia
3. Combined spinal-epidural (CSE) versus Epidural
4. Impact of neuraxial analgesia on progress of labor
5. Epidural analgesia “causing” maternal fever
6. Impact of epidural analgesia on breast-feeding
7. Impact of epidural analgesia on chronic back pain
8. Validity of informed consent during labor
9. Use of recombinant Factor VIIa and interventional radiology techniques in life-threatening hemorrhage
Which pressor produces the best outcome for mother and baby when treating hypotension due to spinal anesthesia?

\[ \alpha \text{-agonists} \rightarrow \text{Phenylephrine} \]
CHOICE OF PRESSOR

Women having an elective C/S under spinal anesthesia were randomized to ephedrine or an α-agonist to support their blood pressure.

- The α-agonist provided closer control of maternal systolic pressure and less nausea and vomiting.
- Umbilical pH was higher and base deficit was less after the α-agonist.
- Uterine artery pulsatility by Doppler was similar in both groups.

Anesthesiology 2001; 95:307
CHOICE OF PRESSOR

- Women were randomized to receive ephedrine or phenylephrine during spinal anesthesia for cesarean.
- Phenylephrine produced the highest fetal pH (7.32 vs 7.20) and best Apgar scores.
- In the ephedrine group, pH fell with longer spinal to delivery intervals (more E given).

Br J Anaesth 2007;98:649
A study comparing various combinations of ephedrine and phenylephrine to keep maternal BP at baseline found umbilical arterial acid-base status and maternal hemodynamic stability were best with phenylephrine, worst with ephedrine:

- **100% ephedrine** → BE $-5$, pH 7.21, 48% < 7.2
- **100% phenylephrine** → BE $-2.3$, average pH was 7.29, and none were < 7.2

Anesth Analg 2008;107:1295
1. Should we avoid using high doses of $\alpha$-agonists?
2. What is the optimal BP we should target after regional anesthesia?
3. Should we allow BP to fall 20% before treating?

Women (n=75) receiving spinal anesthesia for elective cesarean delivery were randomized to receive enough phenylephrine to keep their blood pressure at either 100%, 90% or 80% of baseline.

(continued)
CHOICE OF PRESSOR

When BP was kept at 100% of baseline, mothers and infants had the best outcomes:

• the fewest episodes of “hypotension”
• the fewest episodes of maternal N&V
• the highest fetal umbilical pH values

Despite receiving the highest doses of phenylephrine (mean dose 1520 µg).

Br J Anaesth 2004;92:469
CHOICE OF PRESSOR

“Keep the pressure up and don’t spare the vasoconstrictors” (editorial)

- Ephedrine’s β activity may adversely affect the fetus by increasing its metabolic rate.
- Using α-agonists does not cause vasoconstriction, it returns status to normal.
- Maternal sensitivity to vasoconstrictors is decreased in pregnancy, especially the uterine arteries; this may also protect the fetus.

Br J Anaesth 2004;92:459
CHOICE OF PRESSOR

Using cord blood at delivery, does ephedrine cross the placenta and stimulate metabolism in the fetus?

- 104 women randomized to ephedrine (E) or phenylephrine (P) during elective CD under spinal.
- E crossed the placenta more readily than P
- E babies had ↓ pH and base deficit, ↑ lactate, glucose, epinephrine, nor-epi → more metabolic effects caused by β-adrenergic receptor stimulation
- Effects on fetal oxygen supply and demand favor P

Anesthesiology 2009;111:506
Will adequate IV fluid preload prevent maternal hypotension after spinal or epidural anesthesia for cesarean delivery?

No.
**CRYSTALLOID PRELOAD**

- Women randomized to 20ml/kg versus **no** preload had similar episodes of hypotension (55 vs 71%) after spinal for urgent cesarean.
  
  *Anesthesiology* 1993;79:262

- Women randomized to 10, 20, or 30ml/kg crystalloid preload had a similar incidence of hypotension and ephedrine use. *However*, COP decreased significantly after larger volumes.
  
  *Anesth Analg* 1996;83:299
PREVENTIVE TECHNIQUES

• A Cochrane Systematic Review of spinal anesthesia for cesarean included 75 trials and 4624 women. No intervention eliminated the need to treat hypotension. However, the incidence is reduced by:
  • Administering IV fluids (RR 0.78 for crystalloids and 0.68 for colloids)
  • Ephedrine or phenylephrine use (RR 0.51 or 0.27)
  • Lower limb compression (RR 0.69)

CD002251, online October 2006
PRELOAD OR CO-LOAD?

Two studies compared colloid preload to co-load with similar conclusions:

• No differences in the incidence of hypotension or pressor doses.
• No differences in neonatal outcomes (Apgar scores or gases).
• Cardiac output and stroke volume increased with preload but not co-load; increase was not sustained past 10 minutes.

Randomized comparison of crystalloid (1.5L) and colloid (0.5 or 1L) preload:

• All increased cardiac output (supra-sternal Doppler flow measures)
• No difference in hypotension
• No difference in pressor dose
• No difference in neonatal outcome

COLLOID or CRYSTALLOID?

After crystalloid or colloid 1L co-load parturients were monitored with suprasternal Doppler flow:

- No difference in cardiac output
- No difference in phenylephrine dose
- No difference in newborn outcomes.

Anesth Analg 2011;113:803
PRELOAD REGIMENS

1. Crystalloid or nothing
2. Crystalloid or colloid preload
3. Crystalloid preload or co-load
4. Colloid preload or co-load
5. Crystalloid or colloid co-load

No regimen prevented hypotension; have pressors available and use them.

Anesth Analg 2011;113:677 (editorial)
Is spinal anesthesia for cesarean delivery safe and appropriate for women with severe preeclampsia?

Yes.
SPINALS IN PREECLAMPSIA

- Women with severe preeclampsia (BP ≥160/110) were compared to healthy women having spinal anesthesia for C/S.
- Severely preeclamptic patients had less hypotension than healthy women (17% vs 53%), despite receiving less fluid preload and a larger dose of spinal bupivacaine.

Anesth Analg 2003;97:867
SPINALS IN PREECLAMPSIA

Is the decrease in hypotension due to preeclamptic factors or a smaller uterus?

• During spinal anesthesia for cesarean, preeclamptic patients had less hypotension (RR 0.6) and required less ephedrine (10 mg vs 16 mg) than parturients with preterm pregnancies.

Anesth Analg 2005;101:869
In a randomized trial, spinal and epidural anesthesia were compared in severely preeclamptic patients; there were no clinically significant differences.

- Hypotension was more frequent with spinal (51 vs 23%), but duration was short (≤ 1 min).
- There was more ephedrine used with spinal (6 vs 0 mg), but hypotension was easily treated.
- Neonatal outcomes were similar in both groups.

Anesth Analg 2005;101:862
Is CSE analgesia less successful than epidural analgesia? No, there are pros and cons for both techniques.

Are complications more common after CSE than epidural analgesia? No.
CSE versus CLE

In a retrospective review of 12,590 neuraxial labor analgesia blocks:

<table>
<thead>
<tr>
<th></th>
<th>CLE</th>
<th>CSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall failure rate</td>
<td>14%</td>
<td>10%</td>
</tr>
<tr>
<td>Inadequate analgesia</td>
<td>8.4%</td>
<td>4.2%</td>
</tr>
<tr>
<td>Needed replacement</td>
<td>7.1%</td>
<td>3.2%</td>
</tr>
<tr>
<td>Wet tap</td>
<td>1.4%</td>
<td>0.8%</td>
</tr>
</tbody>
</table>

CSE versus CLE

A retrospective review of 6497 neuraxial blocks for labor (30% CSE and 70% CLE) found no difference in labor outcome, accidental dural puncture or PDPH.

• Quality of analgesia was better with CSE, fewer catheters needed replacement and there was less urinary retention.

• Pruritus, paresthesia and back pain were more common with CSE.

Int J Obstet Anesth 2008;17:15
CSE versus CLE

A Cochrane Review of 19 trials and 2658 women found no differences in any major variable:

- Maternal satisfaction
- Mobilization in labor
- Modes of delivery and newborn outcome
- PDPH or blood patch
- Hypotension

Conclusion: No difference between the techniques.

Cochrane Database Syst Rev 2007;CD003401
CSE versus CLE

Does CSE lead to FHR decelerations?

• Laboring patients with intrauterine pressure catheters (IUPC) were randomized to CSE or CLE.
• After CSE there was ↑ uterine tone (OR 3.5)
• ↑ tone predicted FHR abnormalities (OR 18.6)
• Both outcomes were ↑ in CSE vs. CLE
• The faster the onset of pain relief, the higher probability of ↑ tone and ↓ FHR.

Obstet Gynecol 2009;113:41
Is there evidence that neuraxial analgesia for labor increases cesarean delivery rate in spontaneously laboring patients?

Not in modern practice.
PROGRESS OF LABOR

A natural experiment...in one year the use of epidural analgesia for labor increased from 1→84%. There was no change in:

• overall C/S rate
• rate of C/S for dystocia
• instrumental delivery rate
• duration of first stage of labor

Second stage duration (pushing) was increased by 25 minutes.

Am J Obstet Gynecol 2001; 185:128
242 nulliparous women were randomized to IV PCA fentanyl or epidural for analgesia:

- No difference in cesarean or forceps delivery rate.
- In the **epidural** group, second stage was 23 minutes longer *but* pain and satisfaction scores ↑.
- In the **IV PCA** group, there was more maternal nausea and sedation and more need for active newborn resuscitation or naloxone.

Anesth Analg 2004;99:1532
PROGRESS OF LABOR

2703 nulliparous women were randomized to epidural analgesia or IV meperidine. There was no difference in cesarean delivery rate. However, patients in the epidural group had:

• Increased oxytocin use.
• Longer second stage (~13 minutes) of labor.
• More forceps deliveries (13 vs 7%).
• More fevers**.

Anesthesiology 2004;100:142
A systematic review of seven randomized controlled trials involving 2962 nulliparous women compared low dose epidural infusions with parenteral opioids:

Conclusions:
1. Epidural infusions with low concentration local anesthetics are unlikely to increase the risk of cesarean section in nulliparous women.
2. Although epidural analgesia is associated with an ↑ risk of instrumental vaginal delivery (ie forceps, vacuum), operator bias cannot be excluded.

3. Epidural analgesia is associated with a longer second stage of labor (mean 15 minutes) and ↑ oxytocin requirements, but the importance of these is unclear as maternal analgesia and neonatal outcome may be better with epidural analgesia.

BMJ 2004;328:1410
When a woman has severe pain in early labor, will use of neuraxial analgesia adversely impact the progress of her labor?

No.
EARLY ANALGESIA

750 nulliparous women, spontaneous labor, < 4cm were randomized to receive spinal fentanyl (ITF) or IV hydromorphone for analgesia.

• Pain scores were lower after ITF (2 vs 6).
• Rates of C/S were no different (18 vs 21%).
• Time to complete dilation (duration of first stage of labor) was 90 minutes shorter in the ITF group.
• Newborn outcome (Apgar < 7) was worse after parenteral narcotic.

NEJM 2005;352:655
EARLY ANALGESIA

• Randomized controlled trial of 449 term, nulliparous women: early epidural < 3cm dilation versus late epidural when > 4cm.
• Mean dilation was 2.4 vs 4.6 cm at placement.
• Rates of cesarean were no different (13 vs 11%).
• Labor was 42 minutes shorter in the early group.
• Women preferred early epidural analgesia.

Am J Obstet Gynecol 2006;194:600
806 nulliparous women undergoing induction of labor who requested analgesia < 4cm were randomized to CSE or IV/IM hydromorphone:

- No difference in cesarean rates (33 vs 32%).
- No difference in non-reassuring FHR tracings or newborn outcomes.
- Pain scores were lower with CSE (1 vs 5)
- Labor was shorter with CSE (41 min)

Obstet Gynecol 2009;113:1066
12,793 nulliparous patients were randomized to early (1.6cm) or late (5.1cm) epidural PCEA.

- No difference in duration of labor (11.3 vs 11.8 hours after analgesia)
- No difference in cesarean rate (23.2% vs 22.8%)

Anesthesiology 2009;111:871
EDITORIAL: “No longer should a patient be made to feel guilty about her wish for pain relief early in labor, powerless in her choices or conflicted about the consequences of such a choice….What a concept – pain relief of real pain when requested. We all should now feel comfortable supporting this position for the patient in labor.”

Am J Obstet Gynecol 2006;194:598
PROGRESS OF LABOR

ACOG Committee Opinion #339: Analgesia and Cesarean Delivery Rates

“Neuraxial analgesia techniques are the most effective and least depressant treatments for labor pain….more recent studies have shown that epidural analgesia does not increase the risks of cesarean delivery….the fear of unnecessary cesarean delivery should not influence the method of pain relief that women can choose during labor.”

Obstet Gynecol 2006;107:1487
GET THE EPIDURAL!
1. Are women who have labor epidural analgesia more likely to have an ↑ temperature? Yes.

2. Is it associated with increased rates of infection in the mother or neonate? No.

Below are highlights of studies published in the March issue of Pediatrics, the peer-reviewed, scientific journal of the American Academy of Pediatrics (AAP). To receive the full text of these studies and interview contact information, please contact the AAP Division of Public Relations.

EPIDURALS MAY AFFECT NEWBORNS

CHICAGO—Women who receive epidurals to ease labor pains may be increasing discomfort for their newborns, according to a study published in this month’s Pediatrics, the journal of the American Academy of Pediatrics. The new study says that epidurals can cause fevers in mothers during childbirth, which, in turn, causes doctors to test newborns for blood and tissue infections (sepsis), and to treat the newborns with antibiotics. The study’s authors come from Brigham and Women’s Hospitals and the Joint Program in Neonatology, Harvard Medical School, Boston. The authors looked at 1,047 women who received epidural analgesia for pain relief during labor. More than 14 percent of these women developed fevers during labor. Of the babies born to those 1,047 women, 34 percent needed an evaluation for sepsis, as compared to less than 10 percent of babies born to mothers who had no epidural. Newborns whose mothers had received an epidural were four times as likely to be treated with antibiotics because doctors were concerned about the possibility of sepsis. However, babies of women who received an epidural were not more likely to actually have infections, which was very rare in both groups. The authors conclude that women and their doctors should discuss the possible consequences of fever resulting from epidural use when deciding what method of pain relief to use during labor.
AAP NEWS RELEASE

“The new study says that epidurals can cause fevers in mothers during childbirth, which in turn, causes doctors to test newborns for blood and tissue infections (sepsis), and to treat the newborns with antibiotics.”

“However, babies of women who received an epidural were not more likely to actually have infections, which was very rare in both groups.”
AAP NEWS RELEASE

“The authors conclude that women and their doctors should discuss the possible consequences of fever resulting from epidural use when deciding what method of pain relief to use during labor.”

Pediatrics 1997
Epidurals linked to moms' fevers

Anesthesia-caused condition can prompt unneeded treatment for infants, study says

By Lindsey Tanner
Associated Press

CHICAGO — Epidural anesthesia, commonly used during childbirth, is strongly linked to fevers in mothers that may lead to unnecessary tests and treatment for their newborns, a study suggests.

Fevers in women undergoing labor can signal an infection that may be passed on to their babies, in whom it can be life-threatening. Newborns whose mothers had a fever of 100.4 or higher are routinely given blood tests and antibiotics as a precaution.

However, a new study supports previous research suggesting that epidural anesthesia can cause non-infectious fevers that pose no risk to newborns.

The study, published in the March issue of the journal Pediatrics, found that babies whose mothers had epidurals were no more likely than other newborns to have infections.

Newborns who are thought to have sepsis, or a bacterial infection, typically have their blood drawn and are given antibiotics intravenously for two days, or until the tests results are available, said Dr. Ellice Lieberman, a Boston epidemiologist who conducted the study with colleagues at Brigham and Women's Hospital.

This may prolong their stay in the hospital, unduly upset their parents and expose the child to pain and other risks, the researchers wrote.

Antibiotics, in rare cases, can cause side effects such as kidney damage or hearing loss in newborns, Lieberman said. Overuse of antibiotics also can lead to drug-resistant forms of bacteria.

Such concerns led the Elk Grove Village, Ill.-based American Academy of Pediatrics, which publishes the journal, to issue new guidelines for preventing sepsis.

Lieberman and colleagues studied 1,047 women who received an epidural — a spinal injection to numb the lower body — and 610 who did not. Fourteen percent of the women in the epidural group developed fevers during labor, compared with just 1 percent of the others.
Epidurals lead to more infant tests

Babies also get antibiotics more often

By Marilyn Elias
USA TODAY

The newborns of women who get epidurals to ease labor pain are four times more likely than other babies to undergo blood tests for infection and treatment with IV antibiotics, shows a study out Monday.

Babies are no more likely to have infections if their mothers choose epidurals. But the anaesthetic raises women’s temperatures during labor, so doctors feel compelled to rule out serious blood infections in their babies, says Ellice Lieberman, obstetrician and gynecologist at Harvard Medical School.

Blood tests on newborns, often done in the intensive care unit, can be traumatic to baby and parents. Antibiotics may be given as a precaution before results are in, Lieberman says. But very few infections are found. Her study of 1,637 new mothers at Brigham and Women’s Hospital, reported in Pediatrics, shows when women got epidurals:

- 34% of their babies had blood tests for infection.
- 15% of their newborns received IV antibiotics.
- Only 3 out of 356 babies tested had infections.

The current standard for screening babies — maternal temperatures over 100.4 — might be too low for women getting epidurals, Lieberman says. More study is needed, she says, to see if different criteria can protect newborns while reducing the large number of healthy babies getting blood tests and antibiotics.

This byproduct of epidurals “should be discussed by doctors and women. Women should know the babies do fine, but they’re more likely to get evaluations and antibiotics.”

National surveys show 27% of U.S. women hospitalized for childbirth choose epidurals — about 1 million women in 1994, the latest year available.
A comparison of maximum temperature in women who delivered before epidural analgesia was available (1% usage) and after it was available (83% usage) found the incidence of maternal temperature > 38°C increased from 0.6% to 11%, a twenty-fold increase.

Obstet Gynecol 2001;98:763
EPIDURALS AND FEVERS

A randomized comparison of CSE analgesia versus non-pharmacologic pain relief examined changes in maternal temperature.

- All women receiving CSE increased their temperature and 14% developed fever.
- No cases occurred in the control group.
- No maternal or neonatal infections occurred.

Br J Anesth 2011;107:762
EPIDURALS AND FEVERS

Why are epidurals associated with fevers?

- Selection bias: epidurals are used more often in long labors with prolonged rupture of membranes and more cervical exams
- No sweating below the sympathectomy
- No hyperventilation with contractions
- Increased shivering

Does CLE ↑ inflammatory mediators? Do parenteral opioids suppress febrile responses?
A study of the association between markers of maternal inflammation and onset of term spontaneous labor found:

- Interleukin-1 and tumor necrosis factor-α rose within 48 hours of labor
- Interleukin-6 showed no effect.

Am J Obstet Gynecol 2011;204:223
A cohort study of 8299 singleton term pregnancies calculated the risk of neonatal encephalopathy due to maternal fever (temp > 37.5), neonatal acidosis (pH < 7.2) or both.

- Maternal fever → risk was 1.9%, OR 8.1
- Neonatal acidosis → risk was 2.8%, OR 11.5
- Both fever and acidosis → risk 12.5%, OR 93.9

Am J Obstet Gynecol 2008;198:49
Does the use of epidural analgesia for labor adversely affect breast-feeding?

Probably not, but the verdict is still out.
BREAST-FEEDING

What is in the lactation literature?

“…recommend a reduction in the use of epidural analgesia to enhance breastfeeding.”

J Human Lactation 1996;13:131

“Women who had epidurals were less likely to fully breastfeed their infant in the few days after birth and more likely to stop breastfeeding in the first 24 weeks.”

Int Breastfeeding Journal 2006;1:24
Two studies have correlated epidural fentanyl doses with ↓ rates of breast-feeding. Women who received > 150 μg fentanyl during labor had more difficulty with feeding on postpartum day 1 and at 6 weeks.

However, we know that including fentanyl in the epidural improves analgesia and ↓ motor block.

Recommendation: Avoid boluses of fentanyl if possible and provide more intervention and education by lactation consultants for high risk women.

BJOG 2005;112:927    Anesthesiology 2005;103:1211
BREAST-FEEDING

Multiparous women who had breast fed previously and planned to with this baby as well received fentanyl-containing epidural analgesia.

- >95% were breast-feeding at 6 weeks.
- Median maternity leave was 1 year.
- 69% received postpartum lactation counseling and support.

Does the use of spinal or epidural analgesia for labor increase the incidence of back pain in parturients?

No, but childbirth does.
BACK PAIN

A survey of women during pregnancy found:

• 69% had back pain.
• 58% said pain disturbed their sleep and interfered with daily activities.
• 30% had stopped at least one activity.
• Only 32% had told their caregiver, and only 25% of caregivers prescribed treatment.

Obstet Gynecol 2004;104:65

Document pre-existing back pain in your preop evaluation!
BACK PAIN

Why do some parturients choose not to receive an epidural?

• 23% Desire for “natural” childbirth
• 20% Fear of back pain
• 17% Told by their obstetrician it was “too late” (all were in labor at least 90 minutes longer)
• 10% Fear of needle or side effects
• 0% Lack of pain
• 33% received information on labor analgesia from family, friends, or magazines despite the fact that all had prenatal care.
Over 600 nulliparous women were randomized to receive IV meperidine or epidural analgesia for labor. Six months later, 83% replied to a questionnaire:

- 50% reported backache in meperidine group
- 48% reported backache in epidural group

Br J Anaesth 2002;88:466
Is informed consent of any value in the actively laboring patient? Will it protect me? Will she remember anything I tell her? Yes, yes and yes!
INFORMED CONSENT

• Laboring patients do remember your discussion, so mention risks and document on your record or a consent form.
• Recall is not hindered by pain or opioids.
• Written materials improve recall by 50%.
• Include the common problems: falls in blood pressure, temporary back soreness, patchiness or inadequate analgesia that require replacement, headache.

Anesth Analg 2011;112:912
Women were surveyed 2 months after an epidural for uncomplicated vaginal delivery.

- They did not feel that pain, anxiety or previous opioids interfered with their ability to comprehend information during consent.
- They considered all epidural-related complications important to disclose, especially the most serious ones, even if the risk was low.

Can J Anaesth 1997;44:918
INFORMED CONSENT

Legal cases addressing the adequacy of anesthetic consent given during labor have not even *speculated* that consent obtained during the stress of labor would be inadequate.

Three factors support implied consent in labor:

1. information given to the patient
2. lack of objection by the patient
3. cooperation given during the procedure

Anesthesiology 1990;72:211
Should Factor VIIa (NovoSeven®) be used in life-threatening postpartum hemorrhage?

Yes, except perhaps after amniotic fluid embolism.
FACTOR VIIa (NovoSeven®)

A series of 12 cases used recombinant factor VIIa for life-threatening postpartum hemorrhage. The authors recommend its use before resorting to hysterectomy in cases of intractable PPH.

• At their hospital, the cost of one dose of rFVIIa = 50 units PRBC = an embolization procedure = 2 days of ICU treatment. Cost effective??

Br J Anaesth 2005;94:592
FACTOR VIIa
(NovoSeven®)

A registry identified 97 women who received Factor VIIa to treat obstetric hemorrhage.

- Median blood loss before treatment was 6L
- 70% had clinical coagulopathy, 5 later died
- 80% improved after 1 dose, 14% failed therapy
- Few adverse events: 4 thromboembolism, 1 rash

Obstet Gynecol 2007;110:1270
FACTOR VIIa

• During AFE, high circulating tissue factor concentrations can combine with VIIa to form intravascular clots.

• A review of 44 cases of AFE compared those who received VIIa to those who did not.

• Death or permanent disability were more common when VIIa was given (RR 2.2) compared to full recovery.

Anesthesiology 2011;115:1201
Are interventional radiology techniques helpful in preventing and treating life-threatening postpartum hemorrhage?

Yes, but how to best use them is still controversial.
A retrospective review of 100 consecutive cases of arterial embolization for postpartum hemorrhage:

- 11% overall failure rate
- 24% failure for accreta or percreta
- Predictors of failure: higher EBL and more than 5 units of PRBC transfused.
- Success rate was > 90% for failed vessel ligation or secondary postpartum hemorrhage.

*Obstet Gynecol 2009;113:992*
A patient with 3 prior cesareans presented with bleeding at 26 weeks. By MRI there was placenta percreta invading the bladder.

Balloon catheters were placed into both iliac arteries and inflated during an uneventful C-hyst.

7 hours postop she developed a pulseless left foot, could not receive thrombolysis, and required thrombectomy of a large iliac clot in the O.R.

Am J Obstet Gynecol 2007;197:470
INTERVENTIONAL RADIOLOGY

A case report of a Jehovah’s Witness parturient with placenta accreta describes use of IR as part of multi-modal management:

• Optimize Hct with iron and erythropoiten.
• Place balloon catheters prior to the O.R.
• Plan immediate hysterectomy and inflate balloons if blood loss is excessive.
• Have cell saver capability if patient accepts.

Smart parents have an answer for everything.

Well, son, the reason daddies can’t have babies is because someone has to drive mommies to the hospital.