Epidural/Spinal Blocks in the Obstetric Patient

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Disclosure

I have no financial relationships with manufacturers of pharmaceuticals or devices.
Which type of block is best for Labor analgesia?

Which is best for Cesarean Delivery?

- Lumbar epidural
  - Benchmark for labor analgesia
- Combined spinal-epidural
- Spinal
  - Single shot (or serial injections)
    - Most frequent anesthetic for cesarean
    - 65-80% elective CS; 45-60% urgent-emergent CS
  - Continuous spinal anesthesia

Epidural and Combined Spinal-Epidural

About 80% of women in US get epidural anesthesia during labor

A growing percentage of those are actually combined spinal-epidural blocks (CSE)

CSE:
1) Epidural needle placed into epidural space
2) Small bore spinal placed through epidural needle
3) Epidural catheter placed through epidural needle
## CSEA Advantages

- Rapid onset of SA analgesia 
  + flexibility of continuous epidural analgesia.
- Improved quality of analgesia and maternal satisfaction.
- CSF in the hub of the spinal needle helps confirm correct epidural needle placement.
- Needle-through-needle technique allows for very small gauge spinal needle and very low incidence of post dural puncture headache (PDPH).

## CSEA Concerns

4 major concerns of potential complications of CSEA

- Epidural catheter migration through dural puncture hole
- Increased drug leakage through the dural puncture hole
- Infectious complications
- Contamination of CSF with metal particles from damaged spinal needle

Studies have shown that each of these complications do not occur with any greater frequency than regular epidural anesthesia

CSEA Concerns

The most common complications of CSEA technique for labor analgesia include:

- Pruritus
- Maternal Hypotension
- Fetal Heart Rate Changes

Etiology of hypotension after subarachnoid opioid administration is unclear
  - sudden onset of analgesia
  - rapidly decreasing catecholamine levels in maternal blood

Hypotension generally minimal and easily treated.

Labor Progress and Complications Are Identical Between CSE and LE

In a direct comparison study of CSE vs LE

No statistical difference between groups

- Mean block-to-delivery times
- Accidental Dural Puncture
- Intravascular catheter
- Failed epidural
- Post dural puncture headache
- Epidural blood patch

Norris et al. 2002, Anesthesiology 95:913
Does Intrathecal Sufentanil Cause Fetal Bradycardia?

300 women in labor.
3 groups (by initial dose)

**EPD group: epidural**
- 12.5 mg of bupivacaine +
- 12.5 mcg of epinephrine +
- 7.5 mcg of sufentanil
  volume of 10 mL

**BSE group: spinal (CSE)**
- 2.5 mg of bupivacaine +
- 2.5 mcg of epinephrine +
- 1.5 mcg of sufentanil

**SUF group: spinal (CSE)**
- 7.5 mcg of sufentanil

Analgesia maintained in all groups with PCEA
- bupivacaine 0.125% +
- 1.25 mcg/mL epinephrine +
- 0.75 mcg/mL of sufentanil
  (bolus, 4 mL; lockout, 15 min).

Continuous FHR monitor
-15 min to +60 min from start of analgesia

Van de Velde et al. 2004, Anesth Analg. 98:1153
Maternal-Fetal Complications

CSE (BSE and SUF) had significantly less motor block but greater pruritus than epidural (EPD)
No differences in APGAR or umbilical cord gases.

<table>
<thead>
<tr>
<th>Data Related to Nonreassuring Fetal Heart Rate, Uterine Hyperactivity, Maternal Hypotension, and Ephedrine Treatment</th>
<th>Epid</th>
<th>CSE</th>
<th>CSE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EPD</td>
<td>BSE</td>
<td>SUF</td>
</tr>
<tr>
<td></td>
<td>group</td>
<td>group</td>
<td>group</td>
</tr>
<tr>
<td></td>
<td>(n = 100)</td>
<td>(n = 98)</td>
<td>(n = 98)</td>
</tr>
<tr>
<td>Nonreassuring fetal heart rate (%)</td>
<td>11</td>
<td>12</td>
<td>24*</td>
</tr>
<tr>
<td>Uterine hyperactivity (%)</td>
<td>2</td>
<td>2</td>
<td>12†</td>
</tr>
<tr>
<td>Tocolysis (%)</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Hypotension (%)</td>
<td>31</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td>Ephedrine treatment (%)</td>
<td>7</td>
<td>29†</td>
<td>12</td>
</tr>
<tr>
<td>Ephedrine (mg)</td>
<td>0 (0–0)</td>
<td>0 (0–5)</td>
<td>0 (0–0)</td>
</tr>
</tbody>
</table>

Results are presented as mean ± 1 SD, median (interquartile range), or as % of group total.
* P < 0.05 versus epidural (EPD) groups; † P < 0.05 versus bupivacaine + epinephrine + sufentanil (BSE-) and EPD-groups; ‡ P < 0.05 versus (SUF-) sufentanil and EPD-group.

Cochrane Review of CSE

Nineteen trials (2658 women)
26 outcomes in two sets of comparisons:
   CSE versus traditional epidurals
   CSE versus low-dose epidural techniques

However, of the 52 analyses:
   9 included none of the studies
     i.e. were not measured in any study
   16 included only a single study
   3 included only 2 studies
   24 included more than 2 studies

Simmons et al. 2007, Cochrane Database Syst Rev. 2007 CD003401
Cochrane Review of CSE

Only Differences Identified Were:

CSE versus traditional epidural analyses:
- Need for rescue analgesia (CSE favored)
- Urinary retention (CSE favored)
- Pruritus (EPID favored)

CSE versus low-dose epidurals analyses:
- Speed of onset of effective analgesia (CSE favored)
- Urinary retention (CSE favored)
- Pruritus (EPID favored)
- Clinically non-significant lower UA pH (EPID favored)

Cochrane Review of CSE

No differences between CSE and epidural for
- Maternal satisfaction
- Mobilization in labor
- Modes of birth
- Incidence of post dural puncture headache
- Blood patch
- Maternal hypotension

Not possible to draw any conclusions regarding
- Maternal respiratory depression
- Maternal sedation
- Need for labor augmentation
Cochrane Review of CSE

AUTHORS' CONCLUSIONS:

There appears to be little basis for offering CSE over epidurals in labor with no difference in overall maternal satisfaction despite a slightly faster onset with CSE and less pruritus with epidurals.

Simmons et al. 2007

Continuous Spinal Anesthesia

The limitation of single subarachnoid bolus dose of local anesthetic was recognized in the early 1900s.

In 1940 Lemmon first described a method of giving continuous spinal anesthesia.

Continuous spinal anesthesia via intrathecal epidural catheters tempered by the high incidence of PDPH, esp. in OB patients.

Planned epidural can convert to CSA after accidental dural puncture.

In 1987 Hurley described use of a 32-gauge spinal catheter inserted through a 26-gauge needle in laboring patients.
Advantages

Continuous spinal anesthesia has many potential advantages over epidural anesthesia in the obstetrical population.

- Less local anesthetic
- CSF return helps confirm intrathecal placement and increases the chance of a successful block.
- A rapid onset of sensory analgesia
- Subarachnoid opioids.
- Spinal may be option even in some patients where epidural not possible.

Disadvantages

- Potential difficulty of placing the catheter
- High incidence of postdural puncture headache with large diameter needles
- Infection
- Nerve trauma
- Risk of misadventure with catheter
  - Label clearly to avoid confusion with epidural catheter
  - Alert all caregivers and patient
  - Don’t leave L&D with catheter in place
  - Discontinue soon after delivery
Planned CSA

If CSA is desirable except for the PDPH
And if small dural puncture has a low rate of PDPH
Would CSA with a small bore catheter have the advantages of CSA but with low rate of PDPH?

Many providers thought so and microbore CSA started to gain popularity in early 1990’s

CES After Microbore Spinal Catheters

In 1991, Rigler et al. reported 4 cases of “cauda equina syndrome” after continuous spinal anesthesia with microbore catheters

3 used 5% lidocaine in 7.5% dextrose through a microbore catheter (28 G catheter through 22 G needle)

The authors suggested that microcatheters could be the cause and that the complication occurred because of maldistribution of large volumes of a hypertonic anesthetic solution around cauda equina roots.
Microbore Spinal Catheters

Using a transparent spinal canal model, Lambert and Hurley confirmed this hypothesis experimentally.

Considering this hypothesis, and after seven more cases of neurological deficits had been reported, the Food and Drug Administration ordered the suspension of the use of microcatheters in the United States on May 29, 1992.

CSA, Small Catheters, and CES

The drug in all 11 cases of reported CES with a 28-gauge catheter was 5% hyperbaric lidocaine in excess of 100 mg.

Subsequent investigations suggested that the slow flow rate through the 28-gauge catheter contributed to the pooling of hyperbaric, highly concentrated drug in the sacral area, resulting in neurologic injury.

As research continued investigators concluded that the catheters themselves were unlikely to be the direct cause of CES.
CSA, Small Catheters, and CES

FDA granted an Investigational Device Exemption in 1996 for a randomized, double-masked, multicenter study of labor analgesia and anesthesia designed to compare the safety of continuous spinal administration of sufentanil and bupivacaine, using a 28-gauge catheter, with continuous epidural administration, using a 20-gauge catheter.

Spinal Microcatheters

A Randomized, Double-masked, Multicenter Comparison of the Safety of Continuous Intrathecal Labor Analgesia Using a 28-Gauge Catheter versus Continuous Epidural Labor Analgesia


Anesthesiology February 2008
7 Medical Centers
429 Patients
322 in Spinal group
100 in Epidural group
7 Withdrew or excluded
Groups

- **Intrathecal** (322 subjects)
  - 28 G catheter placed via 22 G ramped Sprotte spinal needle
  - Initial dose: 5 mcg sufentanil
  - Infusion: sufentanil 1 mcg/ml 5-12 ml/hr (FDA limited to 1 drug)
  - Breakthrough pain: 1 ml 0.25% bupivacaine; max 7.5 mg/hr
  - Cesarean: 0.5% bupivacaine and morphine 0.15-0.2 mg

- **Epidural** (100 subjects)
  - Bupivacaine 0.125% + sufentanil 1 mcg/cc
  - Initial bolus 5+5 cc; infusion 8-15 ml/hr
  - Breakthrough pain: 0.25% bupivacaine; max 15 ml/hr
  - Cesarean: 0.5% bupivacaine and morphine 3-5 mg

**Pain Relief**

![Graph showing pain scores over time](image)

Pain score ≤1 at least once
Pruritus

Visual analog pruritus scores (mean SD). Pruritus scores were significantly higher in the continuous intrathecal group (CIT) versus the continuous epidural group (CEPI) for the first 180 min. * P < 0.05 between groups.

![Graph showing pruritus scores over time for CIT and CEPI groups.]

No Difference in Headaches or Neonatal Outcome

<table>
<thead>
<tr>
<th></th>
<th>CIT</th>
<th>CEPI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>322</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Any Headache</td>
<td>39 (12%)</td>
<td>4 (4%)</td>
<td>0.019</td>
</tr>
<tr>
<td>PDPH</td>
<td>29 (9%)</td>
<td>4 (4%)</td>
<td>0.103</td>
</tr>
<tr>
<td>Non positional headache</td>
<td>10 (3%)</td>
<td>0</td>
<td>0.159</td>
</tr>
<tr>
<td>Epidural blood patch</td>
<td>17 (5.3%)</td>
<td>2 (2%)</td>
<td>0.269</td>
</tr>
<tr>
<td>Fetal bradycardia</td>
<td>15 (4.6%)</td>
<td>2 (2%)</td>
<td>ns</td>
</tr>
<tr>
<td>Apgar, 1 min; median (range)</td>
<td>8 (0-10)</td>
<td>8 (3-9)</td>
<td>ns</td>
</tr>
<tr>
<td>Apgar, 5 min; median (range)</td>
<td>9 (0-10)</td>
<td>9 (6-10)</td>
<td>ns</td>
</tr>
<tr>
<td>Neonatal weight, mean (SD)</td>
<td>3499 (499)</td>
<td>3390 (497)</td>
<td>ns</td>
</tr>
<tr>
<td>Admission to newborn nursery</td>
<td>300 (92.3%)</td>
<td>92 (91%)</td>
<td>ns</td>
</tr>
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</table>
Delivery Outcome

<table>
<thead>
<tr>
<th></th>
<th>Intrathecal</th>
<th>Epidural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spontaneous Vaginal</td>
<td>253</td>
<td>79</td>
</tr>
<tr>
<td>Instrumental Vaginal</td>
<td>24</td>
<td>7</td>
</tr>
<tr>
<td>Cesarean Reg. Anes,</td>
<td>43</td>
<td>14</td>
</tr>
<tr>
<td>General Anesthesia</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Catheter Removal and Breakage

CIT catheter was **more difficult to remove**

<table>
<thead>
<tr>
<th>Catheters</th>
<th>IT</th>
<th>EP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficult to remove</td>
<td>26 (8.1%)</td>
<td>0</td>
</tr>
<tr>
<td>Moderately difficult to remove</td>
<td>22 (7%)</td>
<td>2 (2%)</td>
</tr>
</tbody>
</table>

(difference, 13%; 95% CI, -5.66% to 20.16%; $P < 0.001$)

One intrathecal catheter was broken inside of the patient's body during removal.
## Findings

**Intrathecal (28 G catheter, 22 G needle) vs Epidural:**
- Incidence of neurologic complication < 1%
- Better initial pain relief
- Higher maternal satisfaction
- Associated with a trend toward more PDPH
- More difficult to remove

**Substantially larger studies are needed**
rate of CES with earlier CIT catheters <11/10000 (< 0.1%).

Catheter manufacturer has no plans to complete the FDA submission process that would enable this catheter to be marketed in the United States.

## Braun Spinocath.

- 22 G catheter over 27 G Quincke point spinal needle
- 24 G catheter over 29 G Quincke point spinal needle
CSA with Small Bore Special Catheter

- CSA: catheter-over-needle (22- or 24-G Spinocath)
- 92 women, elective cesarean delivery
- Mean dose hyperbaric bupivacaine = 8.2 ± 1.8 mg.
- Incidence of hypotension = 30%
- CSA technique failed in 18 women (20%).
- Overall incidence of PDPH = 29%; (44% in 22-G catheter)
- Fraction of PDPH patients who required EBP = 18%


Wiley Spinal

23 G catheter over 27 G pencil-tip spinal needle
Continuous Spinal With 23 G Catheter

- Case series of 7 women receiving labor analgesia
- CSA: 23 G catheter over 27 G needle (Wiley Spinal)
- 1 PDPH. Treated successfully with EBP.
- 1 patient had Cesarean delivery, with CSA
- 1 patient had forceps assisted delivery


Now ~100 patients with 3% PDPH
Expect future studies comparing it to epidurals and single shot spinals

Summary

- Epidural is the standard for labor analgesia
- CSE has faster onset but is otherwise equivalent
- Spinal anesthesia is the standard for cesarean delivery
- Continuous spinal
  - Has many potential advantages
  - High rate of PDPH when large bore needle/catheter used
  - Technical difficulties, unavailability of microbore catheters
  - Newly available small bore catheters