UNPLANNED CESAREAN SECTION IN PARTURIENTS WITH AN EPIDURAL CATHETER IN-SITU: HOW TO OBTAIN SURGICAL ANESTHESIA?

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CONTENT

- Urgency of Cesarean section
- Failure of labor epidural catheters
- Extending epidural analgesia
- Alternatives when epidural fails
URGENCY OF CESAREAN SECTION
- Multiple indications for CS
- Not every non-elective CS is an emergency
- Classification of urgency:

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Immediate threat to the life of woman or fetus</td>
</tr>
<tr>
<td>2</td>
<td>Maternal or fetal compromise, not immediately life threatening</td>
</tr>
<tr>
<td>3</td>
<td>Need for early delivery but no maternal or fetal compromise</td>
</tr>
<tr>
<td>4</td>
<td>Delivery is timed to suit the mother and maternity team</td>
</tr>
</tbody>
</table>
### Standard for best practice

<table>
<thead>
<tr>
<th>Category</th>
<th>Cat. 4 CS</th>
<th>Cat. 1-3 CS</th>
<th>Cat. 1 CS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS under RA</td>
<td>&gt;95%</td>
<td>&gt;85%</td>
<td>&gt;50%</td>
</tr>
<tr>
<td>RA to GA conversion</td>
<td>&lt;1%</td>
<td>&lt;5%</td>
<td>&lt;15%</td>
</tr>
<tr>
<td>Intra-operative pain</td>
<td>&lt;5%</td>
<td>&lt;15%</td>
<td>&lt;20%</td>
</tr>
</tbody>
</table>

The Royal College of Anaesthetists, 2012

### Decision-to-delivery intervals

- 30 min for cat. 1, 30-75 min for cat. 2
- Cannot be used as critical thresholds

NICE guidelines, 2011 update
FAILURE OF LABOR EPIDURAL CATHETERS
Many different definitions for epidural analgesia failure in literature!

Failure of extension of epidural labor analgesia for CS, may be:
- inadequate block despite adequate time for onset or despite catheter manipulation
- need for replacement of epidural or conversion
- pain during surgery
- need to convert to GA
<table>
<thead>
<tr>
<th>Study &amp; year of publication</th>
<th>Pro-/retrospective &amp; studied period</th>
<th>n</th>
<th>Type of RA</th>
<th>Definition of labour epidural failure</th>
<th>Failure rate</th>
<th>GA conversion rate</th>
<th>Remarks</th>
<th>Elective vs emergency CS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paech et al., 1998</td>
<td>Prospective, 5 years</td>
<td>4624</td>
<td>All epidurals</td>
<td>Inadequate block for CS</td>
<td>1.7% of all epidurals</td>
<td>1.2%</td>
<td>Only 28% had pre-existing labour epidural at CS</td>
<td>No</td>
</tr>
<tr>
<td>Pan et al., 2004</td>
<td>Retrospective, 3 years</td>
<td>4190</td>
<td>63% epidurals, 37% CSE</td>
<td>Inadequate anesthesia necessitating replacement of epidural or conversion to another anesthetic technique for CS</td>
<td>7.1% of pre-existing labour epidurals</td>
<td>4.3%</td>
<td>41% had pre-existing labour epidural</td>
<td>No</td>
</tr>
<tr>
<td>Halpern et al., 2009</td>
<td>Prospective, 16 months</td>
<td>501</td>
<td>94% epidurals, 6% CSE</td>
<td>Primary: GA conversion rate, secondary: conversion to another anesthetic form or replacement of epidural in theatre</td>
<td>5.9%</td>
<td>4.1%</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Kinsella, 2008</td>
<td>Prospective, 5 years</td>
<td>5080</td>
<td>25% epidurals, 63% spinals, 5% CSE</td>
<td>Pre-operative: conversion to another anesthetic or failure to achieve a satisfactory block, intra-operative: unsatisfactory anesthesia requiring analgesia</td>
<td>GA conversion rate see next box, 13.7% rate of pain during CS with epidural top-up anesthesia, 8% (6.2) for epidural top-ups, 4.9% (4.1) for overall RA and 20% (14) for overall RA in cat. 1 CS</td>
<td>GA given in presence of labour epidural not topped up counted as converted RA rather than as primary GA. If these cases would have been counted as primary GA, then rates between brackets would be correct</td>
<td>Yes (only emergency considered)</td>
<td></td>
</tr>
<tr>
<td>Lee et al., 2009</td>
<td>Retrospective, 18 months</td>
<td>1025</td>
<td>12% epidurals, 88% CSE</td>
<td>Inadequate neuraxial blockade for CS in the presence of adequate time for onset of epidural anesthesia</td>
<td>1.7%</td>
<td>1.7%</td>
<td>Frequent use of CSE and early replacement of &quot;uncertain&quot; catheters in labour, repeat neuraxial anesthesia was not used, cases excluded when epidural injection-skin incision interval less than 15 min</td>
<td>No</td>
</tr>
<tr>
<td>Campbell and Tran, 2009</td>
<td>Retrospective, 3 years</td>
<td>895</td>
<td>All epidurals</td>
<td>Unsuccessful epidural top-up for CS utilizing surgical anesthetic concentrations of local anesthetics or no attempted top-up</td>
<td>13.4% inadequate epidural anesthesia -&gt; 10.9% after catheter pulled back 1 cm</td>
<td>4.4% (5.5% in general anesthesiologists, 1.2% in subspecialist obstetric anesthesiologists)</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Rafi et al., 2010</td>
<td>Prospective, 4 years</td>
<td>2273</td>
<td>Epidural + spinal (ratio unknown)</td>
<td>RA to GA conversion rate</td>
<td>See next box on GA conversion rate</td>
<td>4.8%, 8.1% for cat. 1 CS</td>
<td></td>
<td>Yes (only emergency considered)</td>
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</tbody>
</table>
# Determinants of Failure

<table>
<thead>
<tr>
<th>Anesthetic factors</th>
<th>Maternal factors</th>
<th>Obstetric factors</th>
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</thead>
<tbody>
<tr>
<td>- non-obstetric anesthesiologist</td>
<td>- higher BMI</td>
<td>- greater urgency of CS</td>
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<tr>
<td>- no ready availability of consultant backup for trainees</td>
<td>- associated comorbidity</td>
<td>- cervical dilatation &gt; 7cm</td>
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<tr>
<td>- epidural vs CSE</td>
<td>- increased height</td>
<td>- no previous CS</td>
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<tr>
<td>- drug regimens used</td>
<td>- younger age</td>
<td>- acute fetal distress as indication for CS</td>
</tr>
<tr>
<td>- history of opioid tolerance</td>
<td></td>
<td>- longer duration of surgery</td>
</tr>
<tr>
<td>- inappropriate block assessment</td>
<td></td>
<td>- higher gestational age</td>
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<tr>
<td>- previous failed epidural</td>
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<td>- obstetric preference to GA</td>
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<tr>
<td>- inadequacy of pre-op block</td>
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<td></td>
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<td>- increasing number of clinician administered boluses in labor</td>
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<td>- higher VAS in 2h pre-op, ≥ 2 episodes of breakthrough pain during labor</td>
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<td>- prolonged duration of labor analgesia</td>
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<td>- incorrect primary epidural placement</td>
<td></td>
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<td>- secondary migration of catheter</td>
<td></td>
<td></td>
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<tr>
<td>- suboptimal dosing of local anesthetics</td>
<td></td>
<td></td>
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<tr>
<td>- equipment problems</td>
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</tbody>
</table>
TESTING SENSORY BLOCK

- Total lack of standardization in block assessment
- Differential block at the rostral end of a neuraxial block
- Imperative to test the sacral roots!
- Cold testing to at least T4 absence of cold!
Initial successful conversion rate of epidural analgesia to epidural surgical anesthesia of 85.4% could be increased to 92.7% by pulling back the catheter ≈1cm.

Management by subspecialist obstetric anesthesiologist

EXTENDING EPIDURAL ANALGESIA
Test dose controversial

- Objective: to detect intrathecal (lidocaine) or intravascular (epinephrine, fentanyl) catheter misplacement
- But:
  - epidural catheter has already been used to provide labor analgesia
  - needs to be balanced against delay

! Confirm no blood is aspirated before top-up, ensure proper monitoring of mother and fetus, verify appropriate functioning of epidural catheter

! Slow administration of the top-up dose and incremental dosing is advised
WHERE TO INITIATE TOP-UP?

- **Delivery room vs. operating theatre**
  - ‘Saving Mothers’ Lives’ report 2011: top-up in delivery room
  - Survey on UK practice 2008: 68% gave full dose in delivery room, 12.5% initiated in delivery room, 15% waited till in operating theatre
  - Alternative?
Many possible combinations

Difficult to extrapolate from one study to another

Most studied local anesthetics: bupivacaine 0.5%, lidocaine 2%, chloroprocaine 3%, levobupivacaine 0.5%, ropivacaine 0.75%

Additives: epinephrine, bicarbonate, fentanyl

! No alkalinization with ropivacaine, levobupivacaine or bupivacaine
## EPIDURAL TOP-UP SOLUTIONS

<table>
<thead>
<tr>
<th>Study &amp; year of publication</th>
<th>n</th>
<th>Epidural top-up solutions compared</th>
<th>Sensory block</th>
<th>Conclusion</th>
<th>Remarks</th>
</tr>
</thead>
</table>
| Gaiser et al., 1998         | 30| A: pH-adjusted lidocaine 1.5% with epinephrine  
B: pH-adjusted 2-chloroprocaine 3% | Loss of cold to T4 | Mean onset time significantly shorter in chloroprocaine group (A 4.4, B 3.1 min) | No major differences in neonatal outcome |
| Lucas et al., 1999          | 90| A: bupivacaine 0.5%  
B: 50:50 mixture of bupivacaine 0.5% : lidocaine 2% with epinephrine  
C: lidocaine 2% with epinephrine | Loss of cold to T4 | No statistically significant difference in onset time | Without alkalinization |
| Lam et al., 2001            | 40| A: lidocaine 2% with epinephrine and fentanyl (LEF)  
B: lidocaine 2% with epinephrine and fentanyl, with bicarbonate (LEFB) | Loss of pinprick to T6 | LEB’s onset time almost twice as fast as for LEF (A 9.7, B 5.2 min) | Preparation times not taken into account.  
Maternal side effects and neonatal outcomes were similar |
| Sanders et al., 2004         | 45| A: ropivacaine 0.75%  
B: bupivacaine 0.5% | Loss of cold to T4 | No statistically significant difference in onset time.  
Significantly less analgesic supplementation in ropivacaine group. | Study was stopped prematurely. |
| Goring-Morris et al., 2006   | 68| A: bupivacaine 0.5%  
B: lidocaine 2% with epinephrine and fentanyl | Loss of touch to T7 | No clear statistically significant benefit in onset time | Study was stopped prematurely |
| Malhotra et al., 2007        | 112| A: levobupivacaine 0.5% with fentanyl  
B: levobupivacaine 0.5% with saline | Loss of cold to T4 and of touch to T5 | No statistical significance for onset times or quality of block.  
Adding fentanyl causes significantly more intra-operative nausea/vomiting | Patients received fentanyl containing labour epidural solution.  
Study was stopped prematurely |
| Allam et al., 2008           | 40| A: lidocaine 1.8% with epinephrine and bicarbonate (LEB)  
B: levobupivacaine 0.5% | Loss of cold to T4 and of touch to T5 | LEB’s onset time significantly faster (T5 and T4 resp A 7 and 7, B 14 and 11 min) | Pre- and intra-operative supplementation, maternal side effects and neonatal outcomes were similar.  
Intra-operative supplementation/pain in LEB group was 19%.  
Study was stopped when primary outcome reached statistical significance |
| Balaji et al., 2009          | 100| A: levobupivacaine 0.5%  
B: lidocaine 2% with epinephrine and fentanyl (LEF) | Loss of touch to T7 | LEB statistically faster onset time (A 15, B 10 min, preparation times included 18 and 15 min) and superior quality of block | Patients received fentanyl containing labour epidural solution. |
| Hong et al., 2010            | 61| A: lidocaine 2% with epinephrine and fentanyl  
B: lidocaine 2% with epinephrine and saline | Loss of cold and pinprick to T4 | No statistically significant differences in onset time to T4.  
Maximum levels of sensory block significantly higher in the LEF group.  
Significantly more visceral pain and supplantations in saline group. | Patients received fentanyl containing labour epidural solution.  
Intra-operative nausea more frequent in the saline group.  
Failure rate of top-up was 1.6%.  
Preparation times not compared. |
EPIDURAL TOP-UP SOLUTIONS

- Meta-analysis of 11 RCTs
  - Lidocaine 2% + epinephrine ± fentanyl significantly faster onset than bupi- or levobupivacaine 0.5% or ropivacaine 0.75%
  - Adding fentanyl ➔ significantly faster onset but no effect on intra-operative supplementation
  - Ropivacaine 0.75% suggested for best quality epidural
  - Bupivacaine or levobupivacaine 0.5% least effective
  - LEB more reduction in onset time but study not included
  - No trials evaluating chloroprocaine 3%

Anesthesiologists may continue to argue about the best agent or mixture for extending epidural analgesia.

In practice, organizational and logistical factors can be more important than the local anesthetic solution used.

Chloroprocaine 3%, ropivacaine 0.75% and LEF seem the solutions of choice.

Bupivacaine and levobupivacaine should no longer be recommended.
ALTERNATIVES IF EPIDURAL FAILS
REPEAT EPIDURAL ANESTHESIA

- Has become less popular
- Frequency varies in literature from 1.7 to 19%
- Possible problems: local anesthetic toxicity, time delay, block reliability and quality
SINGLE-SHOT SPINAL ANESTHESIA

- Advantages and disadvantages

- Viable option, but success rate much lower than in elective CS ➔ no ‘routine’ practice

- Rapid sequence spinal anesthesia for cat. 1 CS as alternative to GA

- Bupivacaine 0.5% ± lipophilic opioid

- Dose reduction
CSE ANESTHESIA

- Overall failure rate lower in comparison with epidural analgesia
- Modulation of spinal dose, subsequent increments of epidural local anesthetic
- For real emergencies not recommended, onset of maximum sensory and motor block was significantly faster in SSS than in CSE, using hyperbaric bupivacaine 0.5% + fentanyl
GENERAL ANESTHESIA

- Higher morbidity and mortality risk → RA to GA conversion rate should be low

- Main indications: urgency of delivery, failure of RA, anticipated large blood loss

- Tracheal intubation after RSI! Protocol for difficult airway or failed intubation

- Thiopental, or: propofol, ketamine, etomidate, midazolam

- Succinylcholine, or: high-dose rocuronium

- Nitrous oxide, or: sevoflurane

- Remifentanil
CONCLUSION

- Epidural top-up with LEF solution for fast onset time or with ropivacaine 0.75% for good quality block
- Alkalization of LEF would further enhance onset times
- Chloroprocaine 3% fastest onset but not available
- Bilateral loss of cold sensation from S5 to T4
- Also organizational and logistical factors determine surgical readiness!
- Failing labor epidural: consider pulling back catheter first ➔ not successful: alternative neuraxial technique or GA
THANK YOU FOR YOUR ATTENTION