Anaesthesia for Caesarean Delivery: Epidurals and Spinals: Magic Mixtures to Ensure Success

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Conflict of Interest

• Holder of the “Baxter UZLeuven Anaesthesia Research Chair 2012 – 2014”
• Holder of the “Noble Gas Research Fund” supported by Air Liquide.
• Received financial support of the following companies for either research, consultancy or lectures:
  – AstraZeneca.
  – Glaxo Smith Kline.
  – Airliquide.
  – BBraun.
  – Baxter.
  – Abvie.
  – Smiths Medical.
  – Kimberley Clarck.
• Currently involved in multicenter trials initiated by the following pharmaceutical companies:
  – MSD, Air Liquide
Single shot spinal or CSE

- Two important issues:
  - Hypotension.
  - Quality of Anaesthesia.
Spinal anaesthesia: hypotension.

% of patients without hypotension.

- Terclani et al.: 46%.
- Jouppila et al.: 100%.
- Karinen et al.: 23%.
- Rout et al.: 50–60%.

% of patients with hypotension.

Consequences of hypotension.

- Maternal discomfort:
  - Nausea and vomiting.
  - Failure to cooperate.
- Complications of treatment:
  - Pulmonary edema.
  - Hypertension.

- Fetal acidosis – worse fetal outcome.
  - Reduced utero-placental perfusion.
  - Impaired fetal oxygenation.
Failure – inadequate anaesthesia

- 0.5 – 6% complete failure rate.
  - Defined as the need for an alternative anaesthetic technique.
- Much higher partial failure rate: 5 – 25%.
  - Defined as the need for intravenous or inhalational additional analgesia.
6% failure rate
Local Anaesthetic

Spread: Posture x baricity.
The Effect of Posture and Baricity on the Spread of Intrathecal Bupivacaine for Elective Cesarean Delivery.

Hallworth, Stephen; Fernando, Roshan; Columb, Malachy; Stocks, Gary

- 150 patients.
- 6 groups.
- Hypo--; iso--; hyperbaric.
- Sitting vs right lateral.
- CSE technique.

- Sensory spread.
- Motor block.
- Hypotension.
- Ephedrine use.
The Effect of Posture and Baricity on the Spread of Intrathecal Bupivacaine for Elective Cesarean Delivery.

Hallworth, Stephen; Fernando, Roshan; Columb, Malachy; Stocks, Gary

Table 1. Patient and Obstetric Data

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>33.7 (3.4)</td>
<td>32.8 (4.4)</td>
<td>31.7 (4.7)</td>
<td>32.3 (5.4)</td>
<td>33.6 (4.0)</td>
<td>32.8 (4.4)</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>72.7 (15.8)</td>
<td>77.0 (16.2)</td>
<td>79.4 (16.2)</td>
<td>75.1 (12.8)</td>
<td>75.0 (10.5)</td>
<td>77.0 (16.2)</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>159.4 (10.5)</td>
<td>159.8 (8.2)</td>
<td>162.0 (6.7)</td>
<td>161.4 (7.0)</td>
<td>162.5 (6.0)</td>
<td>159.8 (8.2)</td>
</tr>
<tr>
<td>Gestation (wk)</td>
<td>38.0 (1.2)</td>
<td>38.2 (0.8)</td>
<td>38.0 (1.8)</td>
<td>38.2 (0.8)</td>
<td>38.5 (0.9)</td>
<td>38.2 (0.8)</td>
</tr>
<tr>
<td>Nulliparous/Multiparous</td>
<td>9/16</td>
<td>12/13</td>
<td>7/18</td>
<td>5/20</td>
<td>10/15</td>
<td>12/13</td>
</tr>
<tr>
<td>Time from spinal injection to supine (s)</td>
<td>114.6 (21.8)</td>
<td>125.1 (28.5)</td>
<td>129.7 (34.0)</td>
<td>131.9 (46.6)</td>
<td>108.6 (28.5)</td>
<td>125.1 (28.5)</td>
</tr>
<tr>
<td>Time from spinal injection to surgical incision (min)</td>
<td>22.4 (4.5)</td>
<td>23.6 (6.5)</td>
<td>24.4 (5.4)</td>
<td>21.5 (2.9)</td>
<td>24.4 (9.1)</td>
<td>23.6 (6.5)</td>
</tr>
<tr>
<td>Uterine incision to delivery (s)</td>
<td>135.6 (190.5)</td>
<td>90.2 (37.9)</td>
<td>99.1 (65.0)</td>
<td>85.0 (42.8)</td>
<td>90.0 (42.5)</td>
<td>90.2 (37.9)</td>
</tr>
<tr>
<td>Spinal injection to surgical end time (min)</td>
<td>61.9 (14.1)</td>
<td>65.3 (14.4)</td>
<td>66.0 (16.2)</td>
<td>62.8 (15.6)</td>
<td>62.6 (17.3)</td>
<td>65.3 (14.4)</td>
</tr>
<tr>
<td>APGAR 1 min</td>
<td>9 (9-9)</td>
<td>9 (9-9)</td>
<td>9 (9-9)</td>
<td>9 (9-9)</td>
<td>9 (9-9)</td>
<td>9 (9-9)</td>
</tr>
<tr>
<td>APGAR 5 min</td>
<td>10 (10-10)</td>
<td>10 (10-10)</td>
<td>10 (10-10)</td>
<td>10 (10-10)</td>
<td>10 (10-10)</td>
<td>10 (10-10)</td>
</tr>
<tr>
<td>Umbilical artery pH</td>
<td>7.30 (0.03)</td>
<td>7.31 (0.05)</td>
<td>7.30 (0.05)</td>
<td>7.33 (0.04)</td>
<td>7.31 (0.04)</td>
<td>7.31 (0.05)</td>
</tr>
</tbody>
</table>

Results are expressed as mean (SD), median (interquartile range), or number as appropriate.
The Effect of Posture and Baricity on the Spread of Intrathecal Bupivacaine for Elective Cesarean Delivery.

Hallworth, Stephen; Fernando, Roshan; Columb, Malachy; Stocks, Gary

Table 2. Anesthetic Data After Intrathecal Injection

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Median maximum upper sensory level*</td>
<td>T3 (T2-T4)</td>
<td>T3 (T2-T3)</td>
<td>T2 (T2-T3)</td>
<td>T2 (T2-T3)</td>
<td>T2 (T1-T2)</td>
<td>T2 (T2-T3)</td>
</tr>
<tr>
<td>Motor block grade†</td>
<td>4 (3-4)</td>
<td>4 (3-4)</td>
<td>4 (3-4)</td>
<td>4 (4-4)</td>
<td>4 (4-4)</td>
<td>4 (4-4)</td>
</tr>
<tr>
<td>Cervical block, n (%)‡</td>
<td>0 (0)</td>
<td>3 (12)</td>
<td>2 (8)</td>
<td>0 (0)</td>
<td>6 (24)</td>
<td>1 (4)</td>
</tr>
<tr>
<td>Failed sensory block (n)</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Failed motor block (n)</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Failed sensory and motor block (n)</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hypotension (%)§</td>
<td>48</td>
<td>44</td>
<td>64</td>
<td>72</td>
<td>76</td>
<td>80</td>
</tr>
<tr>
<td>Ephedrine use (mg)‖</td>
<td>7.4 (8.7)</td>
<td>7.7 (8.2)</td>
<td>10.1 (8.4)</td>
<td>10.1 (8.3)</td>
<td>12.5 (9.6)</td>
<td>14.6 (9.7)</td>
</tr>
<tr>
<td>Nausea &amp; vomiting (n)</td>
<td>9</td>
<td>6</td>
<td>7</td>
<td>11</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Intraoperative supplementation (n)</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Results are expressed as mean (sd), median (interquartile range), percent or number as appropriate.
* P = 0.015 (analysis of variance); † P = 0.011 (Cuzick’s trend); ‡ P = 0.032 (Bonferroni contrast analysis, adjusted for multiple comparisons); § P = 0.001 (Chi-square for trend); ‖ P = 0.004 (Cuzick’s trend test).
- Lateral position: baricity did not influence local anaesthetic spread.
- Sitting position: increasing block height with decreasing baricity.
- Hypobaric solutions: large variability and unpredictability.
- Hypotension increased with decreasing baricity.
Local Anaesthetic

Type & Dose
The ED$_{50}$ and ED$_{95}$ of Intrathecal Isobaric Bupivacaine with Opioids for Cesarean Delivery


Fig. 1. Overall anesthetic success (success$_{\text{operation}}$) ED$_{50}$ and ED$_{95}$ for isobaric intrathecal bupivacaine for cesarean delivery calculated from the logistic regression plot of probability of successful anesthesia versus dose of intrathecal bupivacaine. Probabilities of 0.05 and 0.95 were used to derive the ED$_{50}$ and ED$_{95}$, respectively. Success$_{\text{operation}}$ was defined as a successful initial sensory level (bilateral T6 sensory level to pinprick within 10 min of spinal) with no additional epidural anesthetic required during surgery.
**$ED_{50}$ and $ED_{95}$ of Intrathecal Hyperbaric Bupivacaine Coadministered with Opioids for Cesarean Delivery**


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Fig. 2. Logistic regression plot of anesthesia success: calculation of $ED_{50}$ and $ED_{95}$. The logistic regression plot of anesthesia success versus dose of intrathecal bupivacaine is shown. Probabilities of 0.5 and 0.95 were used to derive $ED_{50}$ and $ED_{95}$, respectively, for both the success of induction of regional anesthesia and the success throughout surgery.

<table>
<thead>
<tr>
<th>Success: Induction</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ED_{50} = 6.7 \text{ mg}$</td>
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<tr>
<td>$ED_{95} = 11.0 \text{ mg}$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Success: Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ED_{50} = 7.6 \text{ mg}$</td>
</tr>
<tr>
<td>$ED_{95} = 11.2 \text{ mg}$</td>
</tr>
</tbody>
</table>
ED$_{50}$ and ED$_{95}$ of intrathecal levobupivacaine with opioids for Caesarean delivery

L. Bouvet$^1$, X. Da-Col$^2$, D. Chassard$^2$, F. Daléry$^2$, L. Ruynat$^2$, B. Allaouchiche$^1$, E. Dantony$^{3,4}$ and E. Boselli$^1$

Fig 1 Probit regression of the probability of success of spinal anaesthesia as a function of the dose of intrathecal levobupivacaine. Horizontal bars denote 95% CI for ED$_{50}$ and ED$_{95}$. 
Spinal Ropivacaine for Cesarean Section
A Dose-finding Study

ED50: 16.7 mg
ED95: 26.8 mg

Fig. 1. Anesthetic outcome for all patients.
<table>
<thead>
<tr>
<th></th>
<th>ED 50 (95%CI)</th>
<th>ED 95 (95%CI)</th>
</tr>
</thead>
</table>

Roofthooft et al. IJOA 2007; 16, S6.
Fig. 1. Predicted (lines) and observed (symbols) dose–response relation of bupivacaine, levobupivacaine, and ropivacaine in 450 laboring parturients. Dose–response curves have been constructed using a probit regression model. Likelihood ratio tests have been used to compare the dose–response curves among the three groups. No significant difference (P = 0.91) in the dose–response curves of levobupivacaine and ropivacaine were observed. Significant differences in the dose–response curves of bupivacaine and ropivacaine (P = 0.0027) and the dose–response curves of bupivacaine and levobupivacaine (P = 0.0006) were noted. Definition of effective analgesia: The block was deemed successful if the visual analog scale score was less than 25 mm 15 min after initiation of analgesia and remained less than 25 mm for 45 min. Analgesia was deemed unsuccessful if the visual analog scale score was greater than 25 mm 15 min after initiation of analgesia or if the visual analog scale score returned to greater than 25 mm within 45 min.
Incidence of hypotension in high vs low dose bupivacaine treated patients

<table>
<thead>
<tr>
<th>Study</th>
<th>High dose</th>
<th>Low dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan et al. 1994</td>
<td>50%</td>
<td>5%</td>
</tr>
<tr>
<td>Ben-David et al. 2000</td>
<td>90%</td>
<td>30%</td>
</tr>
<tr>
<td>Choi et al. 2006</td>
<td>45%</td>
<td>22%</td>
</tr>
<tr>
<td>Van de Velde et al. 2006</td>
<td>64%</td>
<td>16%</td>
</tr>
<tr>
<td>Teoh et al. 2006</td>
<td>73%</td>
<td>14%</td>
</tr>
<tr>
<td>Kaya et al. 2007</td>
<td>100%</td>
<td>70%</td>
</tr>
</tbody>
</table>
Forest plot for hypotension comparing LD vs CD: individual trials and meta-analysis.


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Forest plot for analgesic supplementation comparing LD vs CD: individual trials and meta-analysis.

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Low dose</th>
<th>Conventional dose</th>
<th>Risk ratio M-H, Random, 95% CI</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Events</td>
<td>Total</td>
<td>Events</td>
<td>Total</td>
</tr>
<tr>
<td>Choi and colleagues</td>
<td>7</td>
<td>20</td>
<td>4</td>
<td>40</td>
</tr>
<tr>
<td>Choi and colleagues-b</td>
<td>0</td>
<td>20</td>
<td>4</td>
<td>40</td>
</tr>
<tr>
<td>Kiran and Singal</td>
<td>5</td>
<td>20</td>
<td>5</td>
<td>40</td>
</tr>
<tr>
<td>Ginosar and colleagues</td>
<td>11</td>
<td>18</td>
<td>3</td>
<td>24</td>
</tr>
<tr>
<td>Rivero and colleagues</td>
<td>3</td>
<td>51</td>
<td>0</td>
<td>58</td>
</tr>
<tr>
<td>Nagata and colleagues</td>
<td>0</td>
<td>19</td>
<td>0</td>
<td>14</td>
</tr>
<tr>
<td>Guasch and colleagues</td>
<td>3</td>
<td>21</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Kimoto and colleagues</td>
<td>10</td>
<td>16</td>
<td>1</td>
<td>31</td>
</tr>
<tr>
<td>Carvalho and colleagues</td>
<td>16</td>
<td>25</td>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>Bryson and colleagues</td>
<td>5</td>
<td>27</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>Leo and colleagues</td>
<td>12</td>
<td>40</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>Mebazaa and colleagues</td>
<td>1</td>
<td>40</td>
<td>0</td>
<td>40</td>
</tr>
</tbody>
</table>

Total (95% CI): 317 376 100.0% 3.76 (2.38, 5.92)

Total events: 73 20
Heterogeneity: $I^2=0.00$, $P=0.72$; $P=0.0%$
Test for overall effect: $Z=5.70$ ($P<0.00001$)

Analgesic supplementation: not correct – epidural augmentation is an integral part of the technique.

Certain studies were not included.
A Randomized Comparison of Low Doses of Hyperbaric Bupivacaine in Combined Spinal-Epidural Anesthesia for Cesarean Delivery

Serene Leo, MMED
Ban Leong Sng, MMED, FANZCA
Yvonne Lim, MMED
Alex T. H. Sia, MMED

BACKGROUND: The aim of our study was to investigate the block characteristics of intrathecal hyperbaric bupivacaine 7, 8, or 9 mg administered during combined spinal-epidural anesthesia for cesarean delivery and to elucidate the dose that produces adequate sensory blockade for surgery while minimizing the incidence of hypotension, high neuroblockade, and the need for intraoperative epidural supplementation.

METHODS: Sixty women presenting for elective cesarean delivery were randomly assigned to one of the 3 groups. Group 7 received intrathecal hyperbaric bupivacaine 7 mg, Group 8 received 8 mg, and Group 9 received 9 mg. Women in all 3 groups received intrathecal morphine 100 μg and IV hydroxyethyl starch 15 mL/kg at the time of initiation of combined spinal-epidural anesthesia. Surgery began when a sensory level of T4 was achieved. Patients were monitored for block characteristics and side effects by a blinded observer. Our primary outcome was the maximum cephalad sensory block height.

RESULTS: There was a difference in the maximum extent of cephalad sensory block among groups (Group 7: median T2 [interquartile range T2–T3]; Group 8: median T2 [T1–T2]; Group 9: median T1 [C8–T2]; P = 0.02). However, the time taken to reach T4 was similar in all 3 groups. The incidence of hypotension requiring vasopressors was different among groups (30% in Group 7, 35% in Group 8, and 70% in Group 9; P = 0.04). No patient had inadequate anesthesia. Neonatal outcomes were similar in all 3 groups.

CONCLUSION: The lowest dose of hyperbaric bupivacaine (7 mg) provided equally rapid onset and effective anesthesia for cesarean delivery while reducing the incidence of hypotension compared with 8 and 9 mg. However, because of its shorter duration of anesthesia, it may be feasible only when the block can be reinforced using a functional epidural catheter.

A Randomized Comparison of Low Doses of Hyperbaric Bupivacaine in Combined Spinal-Epidural Anesthesia for Cesarean Delivery

Table 4. Hemodynamic Profiles and Side Effects

<table>
<thead>
<tr>
<th></th>
<th>7 mg (N = 20)</th>
<th>8 mg (N = 20)</th>
<th>9 mg (N = 20)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients with</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>hypotension</td>
<td>6 (30)</td>
<td>11 (55)</td>
<td>14 (70)</td>
<td>0.04*</td>
</tr>
<tr>
<td>Lowest SBP recorded (mm Hg)</td>
<td>94 (12)</td>
<td>91 (14)</td>
<td>87 (10)</td>
<td>0.17</td>
</tr>
<tr>
<td>Lowest HR recorded (bpm)</td>
<td>76 (10)</td>
<td>81 (12)</td>
<td>73 (10)</td>
<td>0.07</td>
</tr>
<tr>
<td>Phentolamine dose (µg)</td>
<td>0 (0-175)</td>
<td>100 (0-100)</td>
<td>100 (0-275)</td>
<td>0.12</td>
</tr>
<tr>
<td>Ephedrine dose (mg)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0.35</td>
</tr>
<tr>
<td>Nausea</td>
<td>3 (15)</td>
<td>4 (20)</td>
<td>2 (10)</td>
<td>0.70</td>
</tr>
<tr>
<td>Vomiting</td>
<td>2 (10)</td>
<td>1 (5)</td>
<td>0</td>
<td>0.54</td>
</tr>
<tr>
<td>Shivering</td>
<td>2 (10)</td>
<td>0</td>
<td>1 (5)</td>
<td>0.35</td>
</tr>
<tr>
<td>Block &gt; T1</td>
<td>1 (5)</td>
<td>1 (5)</td>
<td>5 (25)</td>
<td>0.08</td>
</tr>
<tr>
<td>No. of patients requiring epidural lidocaine bolus</td>
<td>8 (40)</td>
<td>4 (20)</td>
<td>3 (15)</td>
<td>0.16</td>
</tr>
</tbody>
</table>

Data are mean (sd), median (range), or n (%).
SBP = systolic blood pressure; HR = heart rate.
* Data not normally distributed, thus expressed as median (interquartile range).
* Significant difference between Groups 7 mg and 9 mg (P = 0.03).

CONCLUSION: The lowest dose of hyperbaric bupivacaine (7 mg) provided equally rapid onset and effective anesthesia for cesarean delivery while reducing the incidence of hypotension compared with 8 and 9 mg. However, because of its shorter duration of anesthesia, it may be feasible only when the block can be reinforced using a functional epidural catheter.

(Anesth Analg 2009;109:1600-5)

Figure 1. Maximal cephalad sensory blockade. Box illustrates interquartile range. Whiskers illustrate minimum and maximum values. Significant difference between Group 7 mg versus Group 9 mg (P = 0.01). P value not significant for Group 7 mg versus Group 8 mg, and Group 8 mg versus Group 9 mg.
1.7m tall = 1.7 mL

1.5 mL 0.5% hyperbaric bupivacaine

0.5 mL Sufentanil

Walters et al. IJOA 2011; 20, Suppl, S6.
Opioid
Adding sufentanil to levobupivacaine or ropivacaine intrathecal anaesthesia affects the minimum local anaesthetic dose required

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Department of Anesthesia and Intensive Care, Azienda Ospedaliera, Center of Medical Statistics & IT. Fatebenefratelli General Hospital, 00156 Rome, Italy

![Graph showing the minimum local anaesthetic dose (MLAD) of levobupivacaine in women undergoing a caesarean section.](image.png)

**Fig. 1.** The minimum local anaesthetic dose (MLAD) of levobupivacaine in women undergoing a caesarean section is 10.65 mg [confidence interval (CI) 95%: 10.14–11.56]. The MLAD of levobupivacaine and sufentanil 3 mcg in women undergoing a caesarean section is 4.73 mg (CI 95%: 4.39–5.07).

![Graph showing the minimum local anaesthetic dose (MLAD) of ropivacaine in women undergoing a caesarean section.](image.png)

**Fig. 2.** The minimum local anaesthetic dose (MLAD) of ropivacaine in women undergoing a caesarean section is 14.12 mg [confidence interval (CI) 95%: 13.50–14.60]. The MLAD of ropivacaine and sufentanil 3 mcg in women undergoing a caesarean section is 6.44 mg (CI 95%: 5.86–7.02).
Dose response to intrathecal diamorphine for elective caesarean section and compliance with a national audit standard

I. Wrench, S. Sanghera, A. Pinder, L. Power, M. G. Adams
Department of Anaesthesia, Jessop Wing, Royal Hallamshire Hospital, Glossop Road, Sheffield, S10 2JF

**IJOA 2007; 16, 17 – 21.**

Table 2. Postoperative subcutaneous diamorphine requirement

<table>
<thead>
<tr>
<th></th>
<th>Dose of spinal diamorphine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 (n = 26)</td>
</tr>
<tr>
<td>Total dose (mg)</td>
<td>16.9 (10.1)</td>
</tr>
<tr>
<td>Minutes to first dose</td>
<td>183 (180)</td>
</tr>
<tr>
<td>Number not requiring subcutaneous diamorphine</td>
<td>2</td>
</tr>
</tbody>
</table>

Data are mean (SD).

*aP < 0.05 (ANOVA for all). bP < 0.05 χ² for trend. *P < 0.05. **P < 0.01 compared to placebo.

Table 3. Postoperative visual analogue pain

<table>
<thead>
<tr>
<th></th>
<th>Dose of spinal diamorphine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 (n = 26)</td>
</tr>
<tr>
<td>Pain scores at rest</td>
<td>3.3 (0-8.1)</td>
</tr>
<tr>
<td>2 h</td>
<td>3.1 (0-7)</td>
</tr>
<tr>
<td>6 h</td>
<td>1.53 (0-7)</td>
</tr>
<tr>
<td>Pain scores on movement</td>
<td>3.9 (0-10)</td>
</tr>
<tr>
<td>2 h</td>
<td>5.2 (0-9.2)</td>
</tr>
<tr>
<td>6 h</td>
<td>3.4 (0-7.8)</td>
</tr>
</tbody>
</table>

Data are mean (SD).

*P < 0.05. **P < 0.01. ***P < 0.001, compared to placebo.
Dose–Response Relationship of Intrathecal Morphine for Postcesarean Analgesia

Craig M. Palmer, M.D.,* Scott Emerson, M.D., Ph.D.,† Dimitri Volgoropolous, M.D.,‡ Diane Alves, R.N.§

Figure 2

Table 1: Mean (standard deviation) PCA morphine dose

<table>
<thead>
<tr>
<th>Group</th>
<th>0.0</th>
<th>0.025</th>
<th>0.050</th>
<th>0.075</th>
<th>0.10</th>
<th>0.20</th>
<th>0.30</th>
<th>0.40</th>
<th>0.50</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCA Morphine*</td>
<td>67 (16)</td>
<td>45 (17)</td>
<td>30 (25)</td>
<td>211 (29)</td>
<td>262 (23)</td>
<td>48 (51)</td>
<td>231 (18)</td>
<td>131 (12)</td>
<td>171 (17)</td>
</tr>
</tbody>
</table>

* Includes IV morphine “loading dose” in PACU and morphine equivalents administered intravenously.

Values are mean (standard deviation).

Table 2: Summary of nausea, vomiting, and pruritus

<table>
<thead>
<tr>
<th>Group</th>
<th>0.0</th>
<th>0.025</th>
<th>0.050</th>
<th>0.075</th>
<th>0.1</th>
<th>0.2</th>
<th>0.3</th>
<th>0.4</th>
<th>0.5</th>
<th>ANOVA</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nausea</td>
<td>2 (4)</td>
<td>1 (4)</td>
<td>1 (1)</td>
<td>1 (2)</td>
<td>1 (1)</td>
<td>3 (2)</td>
<td>2 (1)</td>
<td>1 (1)</td>
<td>1 (1)</td>
<td>.7723</td>
<td>.7611</td>
</tr>
<tr>
<td>Vomiting</td>
<td>0 (2)</td>
<td>0 (2)</td>
<td>0 (2)</td>
<td>0 (2)</td>
<td>0 (2)</td>
<td>0 (2)</td>
<td>0 (2)</td>
<td>0 (2)</td>
<td>0 (2)</td>
<td>.6884</td>
<td>.1989</td>
</tr>
<tr>
<td>Pruritus</td>
<td>1 (3)</td>
<td>1 (3)</td>
<td>1 (3)</td>
<td>1 (3)</td>
<td>1 (3)</td>
<td>1 (3)</td>
<td>1 (3)</td>
<td>1 (3)</td>
<td>1 (3)</td>
<td>.0029</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Interventions</td>
<td>1 (2)</td>
<td>1 (2)</td>
<td>1 (2)</td>
<td>1 (2)</td>
<td>1 (2)</td>
<td>1 (2)</td>
<td>1 (2)</td>
<td>1 (2)</td>
<td>1 (2)</td>
<td>.0004</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

Values are median (range). Each patient’s score (for nausea, vomiting, and pruritus) is the sum of the scores received in each of the six 4-h intervals after injection plus the intrascore metric; therefore, the minimum possible score is 0 and the maximum possible score is 21 (7 × 3 = 21).
Lecture outline

Planned C-section

De Novo Epidural
SSS or CSE
General Anesthesia

Emergency – unplanned C-section

De Novo Epidural
SSS or CSE
General Anesthesia

Topped-up Epidural
When and where?

Depends on local situation.

If in labour room:
- Titrated/slow injection
- Safest drugs available
- Anesthetist does not leave patient unattended
- Vasoactive drugs available

Labour Room

Operating Room
A prospective audit of regional anaesthesia failure in 5080 Caesarean sections*

S. M. Kinsella

**Figure 2** Flow diagram of top-up epidural management. A successful epidural is one that was used for Caesarean section with no intra-operative discomfort. [LA, local anaesthetic; GA, general anaesthesia; RA, regional anaesthesia, for definition of severe and mild pain see text].
Risk factors of failure to convert a labour epidural for C-section.

- Number of clinician top-ups.
- Maternal height and BMI.
- Epidural technique.
- Degree of urgency.
- Duration of epidural catheter use.

Prevention of failure.

- Regular evaluation.
- Active management of doubtful catheters.
- Early resite.
- Combined spinal epidural technique.
- Adequate testing prior to incision!
Local Anesthetic:
- Lidocaine.
- Bupivacaine.
- Levobupivacaine.
- Ropivacaine.
- Chloro-procaine.

Opioid adjuvants:
- Fentanyl.
- Sufentanil.
- Morphine.
- Diamorphine.

Other adjuvants:
- Adrenaline.
- Neostigmine.
- Clonidine.
- Magnesium.

Alkalisation
Extending epidural analgesia for emergency Caesarean section: a meta-analysis

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Extending epidural analgesia for emergency Caesarean section

S. Malhotra*
S. M. Yentis
N. Lucas
London, UK
*E-mail: surbhi27@mac.com
Lidocaine 2% Epinephrine ± Fentanyl

Ropivacaine 0.75% ± Fentanyl

Lidocaine 2% Epinephrine Bicarbonate

Levobupivacaine Bupivacaine

Chloroprocaine 3%
Speed of onset.
Quality of Anaesthesia:
- intraoperative pain.
- conversion to GA.

Maternal side-effects:
- Toxicity.
- Drug mixing errors.

Fetal side-effects.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>LEB</th>
<th>LEF</th>
<th>R 0.75</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Speed of Onset</strong></td>
<td>&gt;</td>
<td>&gt;</td>
<td>&gt;</td>
</tr>
<tr>
<td><strong>Quality of Anesthesia</strong></td>
<td>&gt;</td>
<td>=</td>
<td>=</td>
</tr>
<tr>
<td><strong>Toxicity risk</strong></td>
<td>=</td>
<td>&gt;</td>
<td>&gt;</td>
</tr>
<tr>
<td><strong>Potential for drug errors</strong></td>
<td>&gt;</td>
<td>&gt;</td>
<td>=</td>
</tr>
<tr>
<td><strong>Fetal effects</strong></td>
<td>&gt;</td>
<td>=</td>
<td>=</td>
</tr>
</tbody>
</table>

> : Means preferred over
Conclusions (1).

- **Magical spinal mixture:**
  - Hyperbaric local anaesthetic.
  - Low dose (caveat: short duration of effective anaesthesia) as part of CSE.
  - Opioid.
  - Morphine or diamorphine.

- **Magical epidural mixtures:**
  - Organisational – logistical aspects and protocols are extremely important and may yield more benefit than the actual magical mixture used!
  - STOP using Levo and Bupi.
  - LEF or LEB or Ropivacaine 0.75% are good mixtures. Choice must be based on local practice.
  - Additional opioids not required.
  - Individualized patient management.
The Department of Anesthesia, University Hospitals, Catholic University of Leuven, Belgium presents

The 30th International Winter Symposium

OBSTETRIC ANESTHESIA TOWARDS BETTER CARE FOR MOTHER AND CHILD

February 6 – 7, 2015
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