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Original Article

## Comparison of epidural analgesia with combined spinal-epidural analgesia for labor: a retrospective study of 6497 cases

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### Keywords:

Epidural analgesia  
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**Background:** Combined spinal-epidural analgesia provides rapid-onset analgesia with minimal motor block, but it is a more invasive technique than epidural analgesia and the risk of complications may be increased. This study compared the safety and effect on delivery of combined spinal-epidural and epidural analgesia in labor.

**Methods:** A retrospective observational study was performed. Data were collected from 6497 women who received regional analgesia in our tertiary hospital in 2005. The incidence of complications during labor and the day after delivery was compared. The effect on labor outcome with both techniques was also assessed.

**Results:** 1964 received combined spinal-epidural (30.2%) and 4533 epidural analgesia (69.8%). Quality of analgesia was better in the combined spinal-epidural group. Labor outcome was similar in the two groups. Pruritus, paresthesia and back pain were more frequent in the combined spinal-epidural group. No differences were observed in the incidence of accidental dural puncture or post dural puncture headache.

**Conclusions:** We found that epidural and combined spinal-epidural analgesia were comparable in terms of safety, and had a similar effect on delivery type.

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### Introduction

Ideally obstetric analgesia produces effective pain relief with minimal side effects for both mother and baby. Furthermore it should not affect the progress of labor. Combined spinal-epidural (CSE) analgesia offers the advantages of both epidural and spinal techniques while minimizing some of their side effects.<sup>1</sup> It provides rapid onset analgesia and improves analgesic quality.<sup>2</sup> Moreover, the CSE technique reduces local anesthetic dosage producing minimal motor block and increasing maternal satisfaction.<sup>1,3</sup> However, as CSE is a more invasive technique the risk of infectious complications and headache may be

increased. Its influence on delivery type compared with epidural analgesia is likewise unclear.

In the present study we compared CSE with epidural analgesia looking at the incidence of complications and the effect on delivery in a tertiary university hospital, a unit with over 10,000 deliveries a year, in which over 90% receive regional analgesia in labor.

### Methods

A retrospective observational study was performed. Following local Ethics Committee approval data were collected from documentation of epidural and CSE

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techniques performed during labor in 2005 in a tertiary university hospital.

#### *Epidural and CSE protocol*

All blocks were performed in the sitting position. Monitoring during the procedure included pulse oximetry, ECG, and fetal cardiotocography. The epidural space was located at the L3-4 interspace using loss of resistance to air. In both groups a 3-mL epidural dose test of 0.25% bupivacaine with 1:200 000 adrenaline was given through the epidural catheter. In the epidural group, after the dose test, an 8-mL dose of 0.2% ropivacaine with fentanyl 50 µg was administered through the epidural catheter. This was followed by patient-controlled epidural analgesia (PCEA) using 0.12% ropivacaine with fentanyl 1.2 µg/mL. Boluses of 6-8 mL were available every 20-30 min and a background infusion was set at 6-8 mL/h by the attending anesthesiologist. In the CSE group a needle-through-needle technique was performed with 1 mL of isobaric 0.25% bupivacaine with fentanyl 20 µg injected intrathecally. This was followed by the same PCEA protocol as in the epidural group.

#### *Data collection*

A data-collection sheet was completed for all patients receiving regional analgesia. Data included patient characteristics, progress of labor at the time of insertion and mode of delivery. Complications during insertion such as vascular puncture, accidental dural puncture (ADP) and paresthesia were noted. The quality of analgesia and complications during labor including pruritus, nausea and vomiting, incomplete or patchy analgesia, pain at delivery and ineffective analgesia requiring epidural catheter replacement were noted. Post-partum complications such as headache, back pain and urinary retention were recorded by an anesthesiologist 24 h after labor.

#### *Statistical analysis*

Data were analyzed using the SPSS statistical package. Patient characteristics, anesthesiologist's experience, progress of labor at the time of insertion, mode of delivery and complications at insertion, during labor and in the immediate post-partum period were analyzed. Univariate analysis was first performed on each variable for comparison between the two techniques. Student's t test was used for continuous quantitative variables, Mann-Whitney U test for

ordinate quantitative variables, Fisher's test for dichotomic qualitative variables,  $\chi^2$  test with Bonferroni correction for multiple comparisons for nominal qualitative variables. A *P* value of <0.05 was taken to indicate statistical significance, except in the last test where a value of <0.008 was used. When the univariate study identified statistically significant differences between the two techniques, a multivariate analysis (stepwise logistic regression) was used to detect the existence of confounding factors capable of accounting for observed differences.

#### **Results**

A total of 6518 women were initially studied. Data from 21 women were incomplete or lost and were not included in the analysis. The study therefore comprised 6497 women, of whom 1964 (30.2%) received CSE and 4533 (69.8%) epidural analgesia.

Patient characteristics are shown in Table 1. Women who received CSE were more likely to be multiparous and in more advanced labor than those in the epidural group. The experience of the anesthesiologist performing the procedure is shown in Table 2.

Table 3 gives the complications during the procedure. Stepwise logistic regression analysis revealed that paresthesia was more common with CSE analgesia [OR = 1.21 (1.07-1.37)], advancing maternal age [OR = 1.01 (1.00-1.02)] and operator inexperience, the incidence being higher in first year residents [OR = 2.07 (1.83-2.34)] and in second-third year residents [OR = 1.68 (1.40-2.00)] than among the more experienced. A greater proportion of women in the epidural analgesia group than in the CSE group had emetic symptoms, but logistic regression demonstrated that this difference was less in more advanced labor [OR = 0.81 (0.73-0.88)] and analgesic technique was not a significant factor. The most significant factor for developing pruritus was the use of CSE analgesia [OR = 2.15 (1.79-2.57)].

Results for quality of analgesia and labor outcome are shown in Table 4. Fewer women in the CSE group had ineffective analgesia requiring catheter replacement. To analyze differences in labor outcome, multiple comparisons were made using the Bonferroni correction. This revealed more spontaneous deliveries amongst those in the CSE group, but with stepwise logistic regression analysis, parity [OR = 2.10 (1.82-2.42)] and cervical dilatation at initiation of analgesia [OR = 1.13 (1.06-1.21)] were found to be predictive for spontaneous delivery and analgesic technique was not significant.

**Table 1 Patient characteristics**

	Epidural group n = 4533	CSE group n = 1964	P value
Weight (kg)	73.5 ± 11.4	73.3 ± 10.7	0.573
Height (cm)	162.4 ± 6.6	162.4 ± 6.7	0.737
Age (years)	30.3 ± 5.3	30.8 ± 5.3	<0.001
Multiparous(%)	1533 (34.4)	1009 (52.1)	<0.001
Gestational age (weeks)	38.9 ± 1.8	38.9 ± 1.8	0.723
Cervical dilatation at insertion (cm)	3	5	<0.001

Data are mean +SD except parity number (percent) and cervical dilatation (mode).

**Table 2 Professional performing the procedures**

	Epidural group n = 4533	CSE group n = 1964	Total
Senior residents or staff physicians	2031 (66.5%)	1023 (33.5%)	3054 (47%)
2 <sup>nd</sup> -3 <sup>rd</sup> year residents	1890 (71.5%)	754 (28.5%)	2644 (40.7%)
1 <sup>st</sup> year residents	612 (76.6%)	187 (23.4%)	799 (12.3%)

Data are number (percent).

**Table 3 Complications during puncture and labour**

	Epidural group n = 4533	CSE group n = 1964	P value
Vascular puncture	278 (7.6%)	104 (6.7%)	0.224
Accidental dural puncture	42 (1.2%)	18 (1.2%)	1.00
Paresthesia	1346 (36.9%)	634 (40.6%)	0.014
Nausea and vomiting	375 (9.0%)	115 (6.2%)	<0.001
Pruritus	437 (10.5%)	384 (20.8%)	<0.001

Data are number (percent).

**Table 4 Quality of analgesia and labor outcome**

	Epidural group n = 4533	CSE group n = 1964	P value
Ineffective analgesia requiring catheter replacement	258 (6.2%)	63 (3.4%)	<0.001
Incomplete/patchy analgesia	32 (0.8%)	6 (0.3%)	0.052
Pain at delivery	310 (5.0%)	83 (4.5%)	0.4
Spontaneous delivery	3107 (71.7%)	1545 (82.4%)	<0.001
Cesarean section for fetal distress	239 (5.5%)	73 (3.9%)	<0.001
Cesarean section for dystocia+non-progression	479 (11.1%)	102 (5.4%)	<0.001
Vaginal instrumental delivery	507 (11.7%)	156 (8.3%)	<0.001

Data are number (percent).

**Table 5 Puerperal complications**

	Epidural group n = 4533	CSE group n = 1964	P value
Post-puncture headache	28 (0.8%)	22 (1.4%)	0.064
Urinary retention	45 (1.2%)	22 (1.4%)	0.791
Back pain	420 (11.6%)	232 (14.3%)	0.008

Data are number (percent).

The incidence of headache and urinary retention were similar in the two groups (Table 5). Logistic regression analysis showed that risk factors for back pain were CSE [OR = 1.24 (1.03-1.49)] and increased parity [OR = 1.32 (1.21-1.44)], while greater maternal age [OR = 0.99 (0.97-1.00)] and height [OR = 0.96 (0.95-0.98)] appeared to exert a protective effect. Sensory loss was recorded in six women in the epidural analgesia group and four in the CSE group. Loss of motor power was observed in two women in each group. In all cases there was full recovery within 48-72 h.

## Discussion

Comparing the two techniques with multivariate analysis to eliminate the confounding variables, pruritus, paresthesia and back pain were more common with CSE than with epidural analgesia. No statistical differences were found in the incidence of other complications or in labor outcome between the groups.

In the present study the quality of analgesia was better in the CSE group. Evidence suggests that analgesic quality,

defined as the time to onset of action, is better with CSE, and this in turn is reflected by increased maternal satisfaction.<sup>4,5</sup> This is one of the main advantages of CSE, which makes the technique attractive when rapid and effective analgesia is required, as in advanced labor.

When performing regional analgesia in labor, the incidence of vessel puncture is estimated to be 9-20%, while that of intravascular catheter placement is about 5%.<sup>6</sup> Our incidence of vascular puncture was low, with no differences between the two analgesic techniques.

The risk of ADP is inversely related to the experience of the operator. In a study of UK obstetric practice, ADP rates of those using saline was 0.69% and for those using air was 1.11%.<sup>7</sup> It has been suggested that ADP is less frequent with CSE as if there is doubt as to whether the epidural space has been located, rather than advancing the epidural needle, confirmation can be obtained by advancing the spinal needle to see if the dura is breached and CSF identified.<sup>8</sup> In our study, however, the incidence of ADP was found to be 1.2% in each group, similar to the UK figure when air is used to identify the epidural space. The lack of difference may be the result of performing CSE in more

advanced labor, when women experience more pain and are less likely to remain still, increasing the risk of ADP. Another factor may be that residents in training perform a larger number of ADPs.

Theoretically, the incidence of headache should be greater with CSE, as the dura is punctured. However, a number of studies have found that the risk of headache does not increase with CSE, compared with epidural analgesia.<sup>4,5,9–12</sup> This may be for number of reasons. The use of an epidural needle allows use of a very fine-gauge spinal needle, minimizing the hole in the dura.<sup>2,3</sup> The presence of an epidural catheter and of the anesthetic solution increases the pressure within the epidural space, which in turn reduces the risk of CSF loss through the rent in the dura. Intrathecal or epidural opioids may also exert a certain prophylactic effect upon post-puncture headache.<sup>1</sup> Furthermore, inadvertent dural puncture with the epidural needle produces headache much more often than dural puncture in the context of CSE.<sup>1,2</sup>

The incidence of paresthesia with CSE analgesia has been reported to be 56.9% when a needle-through-needle technique is performed and of these 20.7% were reported on performing dural puncture.<sup>13</sup> In our study the incidence was 40.6% in the CSE group with predictive factors including patient age and anesthetic inexperience, with the risk significantly higher amongst first year residents.

The use of local anesthetics with fentanyl via both spinal and epidural routes may induce nausea and vomiting. The literature reports a broad range of incidences associated with epidural analgesia ranging from 10–50%.<sup>14</sup> In our series nausea was more common in the epidural group. This could be explained by the fact that women in the epidural group were earlier in labor and received more fentanyl.

Pruritus is the most common side effect of spinal opioids, and a frequent problem in the obstetric population.<sup>15</sup> In a meta-analysis of studies comparing CSE and epidural analgesia in labor, pruritus was the only complication significantly more common with CSE than with epidural analgesia.<sup>4</sup> All studies agree that the increase in pruritus is related to the use of spinal opioids.<sup>5,6,8,9,16</sup> Our study supports these findings. The low incidence of pruritus in our study could be because women were asked about this complication 24h after delivery, when mild pruritus may easily be forgotten.

In our study risk factors for back pain after delivery were CSE and increased parity. Multiparous women usually have faster labors so a CSE technique is performed more often. They may be in more advanced labor, making it difficult to remain still during the technique. This may increase needle manipulation that could increase the risk of back pain. In contrast, factors found to reduce the risk of developing back pain were increased patient height and age. We are unable to explain this finding. Back pain is a common post-partum complaint. Although the underlying cause is most commonly musculoskeletal, the possibility of a neurological disorder must always be considered. It is very common to consult the anesthetist about this problem, due to the perceived relationship with neuraxial blocks. The literature shows the incidence to be about 21–50%, and more frequent in women who have also suffered

back pain in pregnancy. Although some retrospective studies associated the epidural technique with an increased incidence of back pain, randomized studies refuted this possibility.<sup>17</sup>

Other complications recorded during the puerperium, such as urinary retention and prolonged sensory and motor deficit, showed no differences between CSE and epidural analgesia. The incidence of these problems was too low to draw firm conclusions, despite the large size of the series.

Some authors have suggested that CSE analgesia reduces the incidence of instrumental deliveries.<sup>9</sup> The COMET study, conducted in the UK between 1999 and 2000, compared three groups: epidural with 0.25% bupivacaine, low-dose CSE followed by epidural low-dose boluses and a low-dose epidural infusion. An increased rate of spontaneous vaginal deliveries, with a reduction in instrumental deliveries, was observed in those receiving CSE and epidural infusions compared to 0.25% bupivacaine. However, the incidence of cesarean sections was the same in the three groups.<sup>10,11</sup> Other studies have reported no differences in mode of delivery between CSE and epidural technique.<sup>3,5,6,10,12,18</sup> It would appear likely that dose of local anesthetic rather than the technique itself has an effect on delivery outcome. This is supported by the Cochrane meta-analysis, which concluded that there are no differences in the mode of delivery between the two analgesic techniques.<sup>4</sup> In our study, the stage of labor at the time of initiation of analgesia and parity were both greater in the CSE compared to the epidural group. However, these two factors both favor spontaneous delivery, and could be confounding factors when evaluating the influence of analgesic technique on mode of delivery. This possibility was confirmed by multivariate analysis that demonstrated that the technique employed was not a significant factor influencing mode of delivery.

The present study has a number of limitations that require comment. This is a retrospective study in which information was obtained from a database not specifically designed to analyze the study variables. Data collection was therefore not as reliable as that of a prospective study. Another limitation is the heterogeneity of the professionals performing the techniques. As ours is a teaching hospital with many trainees, the two techniques were performed by individuals with considerable variation in experience. CSE has only recently been introduced in our hospital, and we are therefore in a transition phase with this technique yet to find its role in labor analgesia. These limitations are partly compensated by the large sample size, involving one center, with an obstetric population recruited from the same area, with a limited team of people using standard procedures and materials, and involving a statistical analysis of data designed to identify and eliminate possible confounding factors.

It can be concluded that in our population CSE analgesia is more commonly associated with pruritus and back pain but it affords analgesia of superior quality. No differences were noted in the incidence of ADP or post dural puncture headache between CSE and epidural analgesia. The techniques used did not influence mode of delivery. In sum-

mary, both procedures offer the same level of safety, and exert a similar effect upon delivery but quality of pain relief appears to be improved with CSE analgesia.

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