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Comparison of Epidural and Combined Spinal–Epidural Analgesia in the Management of Labour without Pain

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The effects of combined spinal–epidural analgesia (CSEA) and epidural analgesia (EA) were studied in 50 healthy parturients randomly allocated to receive bupivacaine plus fentanyl either epidurally, or intrathecally and epidurally. Significant differences from baseline values were seen in systolic blood pressure at all time-points except for 4 h in the EA group and at 3 and 4 h in the CSEA group. Significant differences from baseline values were seen in diastolic blood pressure at 1, 2, 3 and 4 h in the EA group, whereas no significant differences from baseline were seen in the CSEA group. Pain scores in both groups were significantly decreased compared with baseline and all scores, except at 2h, were significantly lower in the CSEA group compared with the EA group. The duration of labour and total amount of drugs used were significantly decreased and cervical dilatation was faster with CSEA compared with EA. In conclusion, CSEA was associated with more rapid onset of analgesia and faster progress in cervical dilatation compared with EA, and can be used safely for labour analgesia.

KEY WORDS: Labour analgesia; Epidural analgesia; Combined spinal–epidural analgesia; Local anaesthetics; Opioids

Introduction

Analgesia for labour without pain should ideally be safe and non-invasive, and should not affect the progress of labour.[1] Regional analgesia techniques decrease the depressant effects of opioids and sedatives on the fetus and improve placental perfusion and fetal oxygenation.[2]

Epidural analgesia (EA) has been shown to be associated with a late-onset drug effect, increased oxytocin usage, delay in the progress of labour and an increased incidence of operative delivery.[3,4] In recent years, combined spinal–epidural anaesthesia (CSEA) has been used increasingly as an alternative to EA. The intrathecal component in the combined technique provides fast analgesia without producing a motor block; the epidural component provides further analgesia.[3 – 6]

In this study, the effects of CSEA and EA on analgesia, the progress of labour, and fetal and maternal status were assessed.

Patients and methods

PATIENTS

Healthy parturients with an American Society of Anesthesiologists (ASA) Physical Status I – II[7] in labour at term who requested neuraxial analgesia were recruited to this study. Parturients were in established labour with cervical dilatation ≤ 5 cm and baseline pain scores ≥ 3 on a 0 – 10 visual analogue scale (where 0 = no pain and 10 = worst pain imaginable), and with vertex presentation, regular uterine contractions and normal fetal heart rate pattern.

Parturients who had received parenteral opioids or had baseline pain scores < 3 were excluded. Those with allergy to the study drugs, contra-indications to central neuraxial block, or systemic or obstetric complications, such as pre-eclampsia, multiple pregnancies, macrosomia, diabetes or malpresentation, were also excluded from the study. Faculty ethics committee approval was obtained for this study and written informed consent was obtained from all the study participants.

REGIONAL ANAESTHESIA

Before the administration of regional anaesthesia, each patient received a 500 ml pre-load of Ringer's lactate solution intravenously for hydration.

Patients were randomized to receive either EA or CSEA. In the EA group, the epidural space was identified with an 18-gauge Tuohy needle, using the loss of resistance technique at the L3 – L4 intervertebral space. A multi-orifice epidural catheter was then inserted 3 – 4 cm into the epidural space and attached to a patient-controlled analgesia (PCA) pump (Abbott Laboratories, North Chicago, Illinois, USA). Analgesia was obtained using 0.125% bupivacaine with 2 µg/ml fentanyl, with a 6 ml/h basal infusion, 5 ml bolus doses and a 10 min lockout interval.

In the CSEA group, the epidural space was identified with a 17-gauge Tuohy needle using the loss of resistance technique, and dural puncture was performed by passing a 27-gauge pencil-point spinal needle (Espocan®, B. Braun Melsungen AG, Melsungen, Germany) through the epidural needle. After ensuring a free flow of cerebrospinal fluid, hyperbaric 2.5 mg bupivacaine plus 0.025 mg fentanyl was given intrathecally. A 20-gauge epidural catheter was then inserted 3 cm into the epidural space and attached to a PCA pump. The epidural drug protocol was the same as for the EA group.

PATIENT ASSESSMENT

Maternal systolic and diastolic blood pressures, peripheral oxygen saturation, and maternal and fetal heart rates were measured at baseline and monitored at regular intervals throughout the study.

The effectiveness of the analgesia was evaluated using the visual analogue scale. The progress of cervical dilatation and the duration of each phase of labour were recorded, together with the mode of delivery, the number of PCA demands and delivery doses, and the total amount of analgesia given.

STATISTICAL ANALYSIS

The two groups were compared using the independent *t*-test for normally distributed data and the Mann–Whitney *U*-test for data that was not normally distributed. For comparisons within groups, the non-parametric Wilcoxon test was used. Fisher's χ^2 test was used for the comparison of categorized data. *P*-values < 0.05 were considered to be statistically significant.

Results

A total of 50 parturients were included in the study. Of these, 25 received EA and 25 received CSEA. The demographic characteristics of the two groups were similar (Table 1).

When comparing the haemodynamic parameters, the systolic blood pressure after 2, 3 and 4 h and the diastolic blood pressure after 3 and 4 h were significantly lower in the EA group compared with the CSEA group ($P < 0.05$) (Fig. 1). All the systolic blood pressures except at 4 h in the EA group and at 3 and 4 h in the CSEA group were significantly different from baseline values ($P < 0.05$). In the EA group, the diastolic blood pressure was significantly different from baseline at 1, 2, 3 and 4 h ($P < 0.05$), whereas in the CSEA group there were no significant differences from the baseline value. Maternal heart rates in the EA and CSEA groups were significantly different at 3 and 4 h ($P < 0.05$) (Fig. 2A). In both groups no significant differences were observed in peripheral oxygen saturation values compared with baseline. There were no significant differences in peripheral oxygen saturation between the EA and CSEA groups.

Pain scores were significantly lower in the CSEA group compared with the EA group except after 2 h (Fig. 3). In both groups, all the scores were significantly lower than the baseline values ($P < 0.05$). The first and second phases of labour were significantly shorter in the CSEA group compared with the EA group ($P < 0.05$) (Table 2). There were no significant differences in the incidences of instrumental delivery or caesarean section between the two groups (Table 2). The total drug dose administered was significantly lower ($P < 0.05$) (Table 2) and cervical dilatation was significantly greater at 1, 2, 3 and 4 h in the CSEA group compared with the EA group ($P < 0.05$) (Fig. 4).

TABLE 1:
Demographic characteristics of healthy parturients in labour requesting neuraxial analgesia who received epidural anaesthesia (EA) or combined spinal–epidural anaesthesia (CSEA)

	EA group ($n = 25$)	CSEA group ($n = 25$)
Age (years)	24.44 ± 3.75	25.20 ± 4.92
Height (cm)	163.04 ± 4.06	164.36 ± 6.38
Weight (kg)	74.76 ± 10.30	76.16 ± 4.62
Gestational age (weeks)	39.48 ± 1.12	38.20 ± 0.93
Parity		
Multiparous	6	9
Nulliparous	19	16
Baseline cervical dilatation (cm)	3.6 ± 0.75	3.2 ± 0.47
Baseline pain score[a]	6.44 ± 1.63	6.4 ± 1.95
Fetal birth weight (g)	3480 ± 428.69	3298 ± 242.63

Values are the number of patients or the mean ± SD.
[a]0 – 10 visual analogue scale.
There were no significant differences between the two groups.

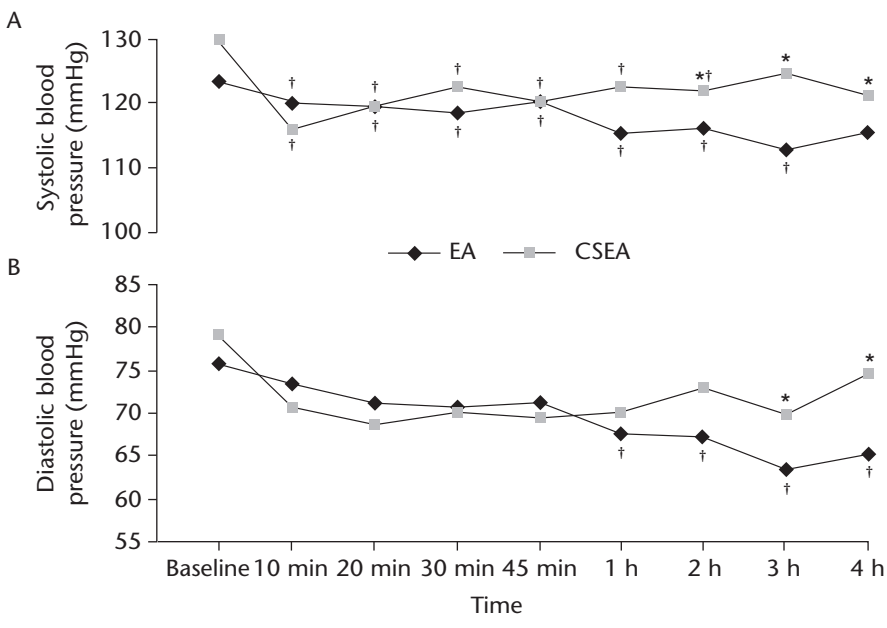


FIGURE 1: Systolic blood pressure (A) and diastolic blood pressure (B) during epidural anaesthesia (EA) ($n = 25$) or combined spinal–epidural anaesthesia (CSEA) ($n = 25$) in parturients in labour. *$P < 0.05$ between the groups. †$P < 0.05$ versus baseline values

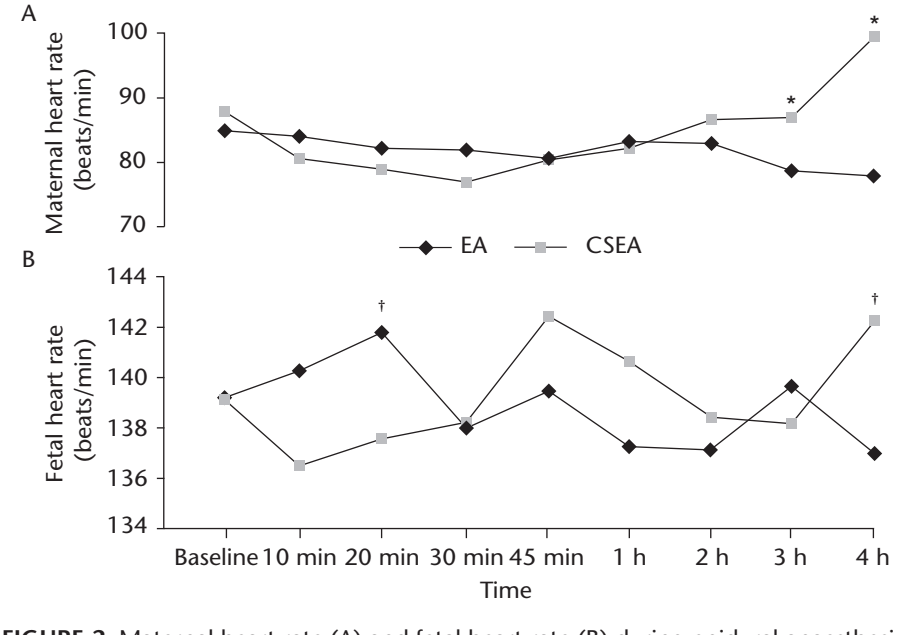


FIGURE 2: Maternal heart rate (A) and fetal heart rate (B) during epidural anaesthesia (EA) ($n = 25$) or combined spinal–epidural anaesthesia (CSEA) ($n = 25$) in parturients in labour. *$P < 0.05$ between groups. †$P < 0.05$ versus baseline values

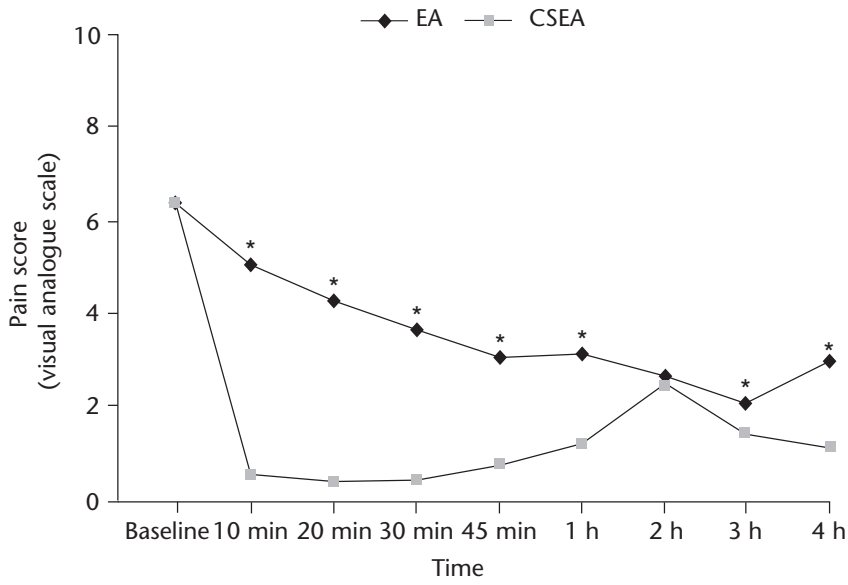


FIGURE 3: Pain scores (0 – 10 visual analogue scale) during epidural anaesthesia (EA) (n = 25) or combined spinal–epidural anaesthesia (CSEA) (n = 25) in parturients in labour. *P < 0.05 between groups

TABLE 2:
Progress in labour and analgesia requirement in parturients receiving epidural anaesthesia (EA) or combined spinal–epidural anaesthesia (CSEA)

	EA (n = 25)	CSEA (n = 25)
Length of first phase of labour (min)	376.30 ± 242.93	246.04 ± 147.58[a]
Length of second phase of labour (min)	80.13 ± 52.57	42.04 ± 25.67[a]
Length of third phase of labour (min)	7.26 ± 2.59	8.25 ± 2.29
Instrumental delivery	3 (vacuum)	–
Caesarean section	2	1
Drugs administered		
Number of PCA doses on demand	14.39 ± 18.80	6.37 ± 12.04[a]
Number of PCA doses delivered automatically	5.30 ± 3.12	1.25 ± 1.42[a]
Total (ml)	58.76 ± 33.06	15.05 ± 13.87[a]

Values are the number of patients or mean ± SD.
PCA, patient-controlled analgesia.
[a]P < 0.05 CSEA group versus EA group.

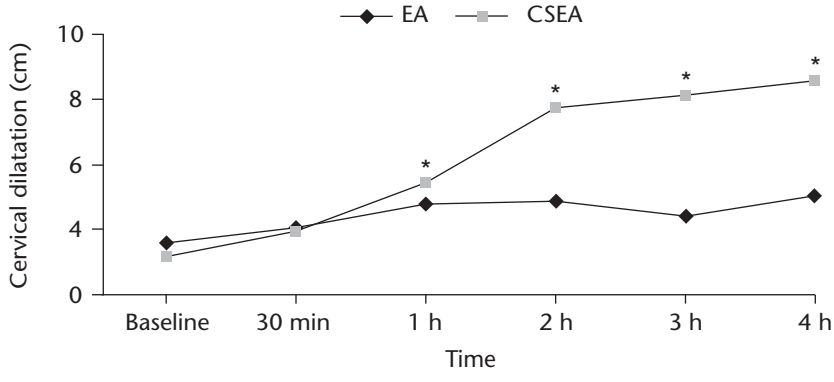


FIGURE 4: Cervical dilatation during epidural anaesthesia (EA) (n = 25) or combined spinal–epidural anaesthesia (CSEA) (n = 25) in parturients in labour. *P < 0.05 between groups

Fetal heart rate values were significantly greater compared with baseline in the EA group at 20 min and in the CSEA group at 4 h (P < 0.05) (Fig. 2B).

Discussion

Regional anaesthesia has been reported to be associated with an increased incidence of caesarean section due to dystocia and of instrumental vaginal delivery.[8] However, in a case–control study, it was shown that regional anaesthesia was not responsible for the slower progress of labour but was more widely used in cases with slower progress.[6]

In the present study, the effects of EA and CSEA techniques on labour analgesia and maternal and fetal status were assessed. Although statistically significant changes were observed, these changes were not considered to be clinically significant. Systolic blood pressure in all patients was > 100 mmHg at all times and decreases from baseline values were < 20%.

Cervical dilatation is more rapid with CSEA than with EA.[5] The reason for this is not clear. One possible reason is that smaller doses of local anaesthetics are required for CSEA, since it has been reported that epidural bupivacaine directly delays uterine activity.[9] Another possible reason is that the rapid analgesia provided by CSEA causes rapid changes in maternal catecholamine levels. When there is effective analgesia in labour, noradrenaline levels do not change but adrenaline levels decrease.[10] In a study comparing EA and CSEA, it was suggested that maternal adrenaline may be acting as a tocolytic, and that CSEA may be associated with a more rapid decrease in adrenaline levels, resulting in stimulation of uterine contractions.[11]

In the present study, CSEA was associated with significantly less drug usage and significantly lower pain scores in the first and second phases of labour; thus, the effectiveness of the analgesia in the CSEA group was greater than in the EA group.

In conclusion, CSEA was associated with a more rapid onset of analgesia, more rapid progress in cervical dilatation and lower doses of local anaesthetics compared with EA, and can be used safely for labour analgesia.

Acknowledgement

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Conflicts of interest

No conflicts of interest were declared in relation to this article.

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References

1 Tan TK: Epidural analgesia in obstetrics. *Ann Acad Med Singapore* 1998; **27:** 235 – 242.
2 Mattingly J, D'Alessio J, Ramanathan J: Effects of obstetric analgesics and anesthetics on the neonate: a review. *Paediatr Drugs* 2003; **5:** 615 – 627.
3. Collis RE, Davies DWL, Aveling W: Randomised comparison of combined spinal–epidural and standard epidural analgesia in labour. *Lancet* 1995; **345:** 1413 – 1416.
4 Hughes D, Simmons SW, Brown J, Cyna AM: Combined spinal–epidural versus epidural analgesia in labour. *Cochrane Database Syst Rev* 2003; **4:** CD003401.
5 Tsen LC, Thue B, Datta S, Segal S: Is combined spinal–epidural analgesia associated with more rapid cervical dilation in nulliparous patients when compared with conventional epidural analgesia? *Anesthesiology* 1999; **91:** 920 – 925.
6 Gorton H, Lyons G: Regional analgesia for labour. *Curr Anaesth Crit Care* 2000; **11:** 92 – 96.
7 Morgan GE, Mikhail MS, Murray MJ (eds): The Practice of Anesthesiology. *In: Clinical Anesthesiology,* 3th edn. New York: Lange McGraw-Hill, 2002; pp1 – 14.
8 Thorp JA, Hu DH, Albin RM, McNitt J, Meyer BA, Cohen GR, *et al*: The effect of intrapartum epidural analgesia on nulliparous labor: a randomized, controlled, prospective trial. *Am J Obstet Gynecol* 1993; **169:** 851 – 858.
9 Willdeck-Lund G, Lindmark G, Nilsson BA: Effect of segmental epidural analgesia upon the uterine activity with special reference to the use of different local anaesthetic agents. *Acta Anaesthesiol Scand* 1979; **23:** 519 – 528.
10 Cascio M, Pygon B, Bernett C, Ramanathan S: Labour analgesia with intrathecal fentanyl decreases maternal stress. *Can J Anaesth* 1997; **44:** 605 – 609.
11 Lederman RP, Lederman E, Work BA Jr, McCann DS: The relationship of maternal anxiety, plasma catecholamines, and plasma cortisol to progress in labor. *Am J Obstet Gynecol* 1978; **132:** 495 – 500.

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