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Neuraxial Block for Labour Analgesia – Is the Combined Spinal Epidural (CSE) Modality a Good Alternative to Conventional Epidural Analgesia?

A T Sia, W R Camann, C E Ocampo, R W Goy, H M Tan, S Rajammal

ABSTRACT

Aim: Apart from conventional epidural analgesia (EA), the combined spinal-epidural (CSE) modality is fast becoming a popular technique for treating labour pain. In this study, we investigated the differences in the patient profile and outcome between CSE and EA for labour pain in KK Women's and Children's Hospital.

Methodology: Data pertaining to 1,532 healthy parturients who had received either CSE or EA for labour pain during a six-month period was systematically collected by using a specially designed form. Multiple logistic regression analysis was used to determine the independent predictors of patient satisfaction and the relation of parturient factors on the choice of block. The side effects and the outcome of labour were also compared.

Results: CSE accounted for 80% of all neuraxial blocks performed for labour analgesia (vs 20% for EA). Anaesthesiologists were more inclined to using CSE than EA for multiparous parturients (OR 2.03, p<0.01) in a more painful (OR=1.61, p=0.03) and advanced stage of labour (OR=1.12, p=0.03). The need for supplemental analgesics was greater for EA (p<0.01). Patient satisfaction was higher for CSE (OR=1.77, p<0.026). CSE had a higher risk of pruritus (29% vs 14%, p<0.01) but lower risk of post block neural deficits (0% vs 2%, p<0.01) than EA. No difference in the mode of delivery was detected between the two groups.

Conclusion: CSE is a safe and good alternative to EA as a technique of neuraxial block for labour analgesia.

Keywords: combined spinal epidural, epidural, analgesia, labour

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Department of Anaesthesia (O&G) KK Women s and Children s Hospital 100 Bukit Timah Road Singapore 229899

A T Sia, MBBS, MMed
Consultant Anaesthesiologist and Consultant-in-charge for Delivery Suite Anaesthetic Service

C E Ocampo, MD
Fellow

R W Goy, MBBS, MMed
Registrar

H M Tan, MBBS, MMed
Head

S Rajammal, SRN
Pain Nurse

Harvard Medical School

W R Camann, MD
Associate Professor of Anaesthesiology and also Director of Obstetric Anaesthesia, Brigham and Women s Hospital, Boston MA

Correspondence to:
Dr A T Sia
Tel: (65) 6394 1081
Fax: (65) 6291 2661
Email: athsia@kkh.com.sg

INTRODUCTION

Epidural analgesia (EA) is commonly regarded as one of the most effective modes of pain relief for labour and delivery. Recently, the combined spinal epidural (CSE) modality has gained much popularity for labour pain relief due to its rapidity of analgesic onset and its reliability in inducing near uniform analgesia. These two techniques (CSE and EA) are commonly used for labour analgesia in our institution.

Recent studies have suggested, albeit controversially, that CSE is superior to EA with regard to patient satisfaction and labour outcome[1,2]. However, there are no studies to date that compare these two modalities of neuraxial block, namely EA and CSE, for the labouring parturient in Singapore. Moreover, the indications for choosing either modality, in the context of providing neuraxial analgesia for labour, are still poorly defined. The objective of this current study is twofold; to investigate the factors in the parturient's profile that could have influenced the choice of neuraxial block among anaesthesiologists in KK Hospital and to elucidate the differences, if any, with regard to the indices of outcome between CSE and EA for labour.

METHODS

KK Women's and Children's Hospital is a tertiary referral centre for the fields of obstetrics, gynaecology and paediatrics in Singapore. The annual rate of childbirth delivery is approximately 15,000 in this institution and some 33% of all labouring women request for neuraxial analgesia. The rest of the parturients had either entonox or intermittent intramuscular pethidine injections (or both) for pain relief. With the approval of the Hospital Ethics Committee, a database had been established in our institution since May 2001 to capture the data of all ASA I-II labouring women who requested for and gave written consent to the procedure of neuraxial block for labour pain relief. For this purpose, the entry of information was done at the parturient's bedside. Information on parturients' weight, parturients' height, parity (nulliparous or otherwise), the use of preblock oxytocin (in induced or augmented labour), the extent of cervical dilatation (cm) just before the block and the degree of pain before the block was instituted (1=nil, 2=mild, 3=moderate and 4=severe) was collected. Information on the following was also

collected: the type of block (CSE or EA), the problems encountered during the block (accidental dural puncture, accidental venous puncture and paresthesia) and whether the procedure had to be repeated due to suboptimal analgesia. For the first half an hour post-block, side effects i.e. shivering, pruritus, motor block (inability to flex knees fully) and the lowest systolic blood pressure measured non-invasively on the right brachial artery every five minutes were documented. The total number of epidural top-up doses for supplementation of analgesia throughout labour was also recorded. This information was provided by the anaesthesiologists who had performed and supplemented the block.

Only parturients who had received either CSE or EA were included in the study. Parturients who had had an accidental dural puncture were excluded from the analysis. The selection of either EA or CSE was in accordance with the anaesthesiologists' discretion and this decision was then discussed with the parturient. For CSE, analgesia was induced with up to 2.5 mg of intrathecal (IT) bupivacaine or ropivacaine in addition to IT fentanyl of not more than 25μg. EA was induced with 8-15 ml of 0.125-0.2% ropivacaine or bupivacaine. For both EA and CSE, analgesia was maintained with a 6-12 ml/h continuous infusion of either 0.1-0.15% of ropivacaine plus 2 μg/ml fentanyl or 0.1-0.15% bupivacaine plus 2 μg/ml fentanyl within 15 minutes of induction of analgesia. Breakthrough pain, defined as labour pain felt in spite of epidural analgesia, during labour was treated with top-up boluses of 5-15 ml of 1.5% lidocaine, 0.25% bupivacaine or 0.25% ropivacaine. In addition, epidural doses of up to 25 μg of fentanyl could also have been employed to supplement rescue analgesia. The decision to replace any ineffective epidural catheter was left to the individual anaesthesiologist. All the analgesic solutions were prepared by the respective anaesthesiologist at the bedside under sterile conditions.

The management of epidural analgesia during the second stage was empirical and not dictated by any existing patient based protocol; epidural infusions were either stopped or continued throughout the second stage of labour on the advice of the obstetricians. In a majority of the cases, the epidural infusions were routinely stopped at the time of diagnosis of the second stage of labour on the advice of the obstetrician. The collection of this information and data about the mode of delivery, the duration of labour after neuraxial block and the duration of second stage of labour became the responsibility of the delivery suite nurses who were unaware of the study. This was accomplished after the delivery of the neonate.

All the parturients were followed up in the next 24 hours after neuraxial block by a dedicated pain service team. The pain nurse, who was not involved in the intrapartum management of the parturients, was responsible to record the following post-block complications, i) significant new onset moderate to severe headache; ii) neural deficit consisting of either weakness or numbness of the lower limbs 12-24 hours after delivery; iii) moderate to severe backache and iv) urinary retention as characterised by the inability to void (requiring intermittent or continuous urinary drainage, excluding parturients who had had Caesarean delivery) 12-24 hours after delivery. The information on the overall satisfaction of parturients with neuraxial analgesia was also collected; this was categorised under the following: 1=poor, 2=unsure, 3=good, 4=excellent.

The original forms were then retrieved promptly by the research clerk and data were entered systematically into the SPSS (Statistical Package for Social Sciences) version 9.0 formatted databank. In order to reduce operator bias, blocks performed by trainees were not included for analysis. Many trainees chose not to perform CSE due to unfamiliarity with the technique. Moreover, the level of proficiency of the operator could have an impact on the parturients' satisfaction. Hence, only subjects who were treated by anaesthesiologists with at least five years of experience were analysed. This constituted 60% of all the neuraxial blocks performed for labour analgesia. All the anaesthesiologists were encouraged to provide the information as prompted by the form. A total of 1,532 subjects were collected over a study period of six months.

Multiple logistic regression was used to investigate if the parturient's height, parturient's weight, the status of nulliparity, the use of preblock oxytocin, the extent of cervical dilatation and the degree of preblock labour pain were predictors of the choice of neuraxial analgesia. The choice of neuraxial block, i.e. EA or CSE was used as the independent variable in the analysis of analgesic outcome (time-weighted number of analgesic supplements, post procedure complications and side effects of analgesia). The possible influence of the choice of block on obstetric outcome (mode of delivery, duration of labour and the duration of second stage of labour) was also analysed. The Mann U Whitney, independent t-test and χ^2 test were used to analyse non-parametric data, parametric data and proportions, respectively. Additionally, we investigated the possible relationship of analgesic and obstetric management on the overall parturient satisfaction with neuraxial analgesia by using multiple logistic regression analysis.

Table I. The relation of parturient factors on the choice of block.

Multiple Logistic Regression
EA= Control dependent variable (0), CSE= New dependent variable (1)
Variables in the Equation

Variable	B	S.E.	Wald	Sig	R	Exp(B)	95% CI
PREBLOCK	-.2653	.2291	1.3406	.2469	.0000	.7670	0.52-1.24
WEIGHT	-.0009	.0016	.3428	.5582	.0000	.9991	0.99-1.01
HEIGHT	-.0013	.0059	.0523	.8191	.0000	.9987	0.98-1.01
PARITY	.7058	.2349	9.0280	**.0027**	.1045	**2.025**	**1.30-3.90**
PREPAIN	.3126	.1431	4.7749	**.0289**	.0657	**1.367**	**1.10-2.50**
CERVICAL	.2058	.0959	4.6078	**.0318**	.0637	**1.228**	**1.02-1.35**
CONSTANT	1.6507	.6023	7.5106	.0061			

Preblock pain was coded as 1=nil, 2=mild, 3=moderate and 4=severe

Significant interaction was found between parity, cervical dilatation and preblock pain by using the product term of the variables (parity•cervical dilatation, parity•pain, cervical dilatation•pain and pain•cervical dilatation•parity) and applying the Likelihood Ratio Test (for the model with the interaction term versus the main effects only model).

Table II. Side effects and complications after neuraxial block.

	CSE (n=1233)	EA (n=299)	P value
Reduction of systolic blood pressure (SBP) in the first 1/2 hour post block (%, mean ± sd) (Baseline SBP-lowest SBP)/Baseline SBP X 100	5.81 ± 14	6.34 ± 12	0.06
Pruritus (within 1/2 hour after block) (%)	29.4	14.4	**0.01***
Shivering (within 1/2 hour after block) (%)	32.3	37.1	0.13
Motor block (within 1/2 hour of block) (%)	1	2	0.22
Foetal heart tracing abnormality (within 1/2 hour after block) (%)	8.3	11.6	0.27
Postpartum backache (%)	10.0	8.7	0.47
Postpartum headache (%)	2.5	4.0	0.17
Postpartum urinary retention (%)	4.7	4.0	0.56
Postpartum neural deficit (%)	0	2	**0.01***

All values are expressed as percentage of the total number of subjects in each group (n) except reduction in SBP.

*significant difference was found between CSE and EA.

RESULTS

During the six-month period of the study, a total of 1,532 cases of neuraxial block were collected. Of these cases, 80% (n=1233) were CSEs and 20% (n=299) EAs. Multiple logistic regression revealed that parity, cervical dilatation and the degree of pain before block were the significant predictors (with a significant interaction between the variables) of the type of block performed (Table I). The adjusted odds ratio (OR) of 1.36 and a 95% confidence interval (CI) of 1.10-2.50 for the influence of preblock pain indicated that anaesthesiologists preferred CSE to EA for parturients who were experiencing relatively more pain at the time of the block. Similarly, by using cervical dilatation as a surrogate for the stage of labour at the time of neuraxial block, CSE was also preferred in women who were in a more advanced stage of labour (OR 1.22, 95% CI=1.02-1.35). Anaesthesiologists also tended to choose CSE in multiparous parturients (odds ratio 2.03, 95% CI=1.30-3.90). One could infer that the initiation of analgesia in a multiparous parturient in a more advanced stage of labour with the spinal block component of CSE was deemed preferable to EA.

In terms of side effects, pruritus was found more frequently in the CSE group (29.4% vs 14.4%, RR 2.68, 95% CI=1.89-3.81). On the other hand, with respect to complications post-block, neural deficit occurred more frequently in the EA group (2% vs 0%, RR 0.08, 95% CI=0.02-0.40) (Table II). None of the parturients who had had a headache needed an epidural blood patch.

We also found the frequency that epidural infusions needed to be supplemented by physician "top-up" doses after block (i.e. "time-weighted" epidural top-ups as defined by the number of epidural top-up per hour of the duration of labour from block to

Table III. Characteristics of labour progress and obstetric outcome.

	CSE (n=1233)	EA (n=299)	P value
Time-weighted frequency of epidural supplements (per hour of labour after block)	0.042 ± 0.003	0.067 ± 0.009	**0.01***
Duration of labour after block (hour)			
# Nulliparous	6.17 ± 0.17	6.90 ± 0.28	**0.03***
# Multiparous	3.94 ± 0.20	4.27 ± 0.45	0.50
Duration of second stage of labour (min)			
Nulliparous	94.0 ± 5.2	111 ± 16	0.17
Multiparous	45.4 ± 4.2	42.6 ± 4.1	0.79
Neonatal birthweight (kg)	3.12 ± 0.47	3.15 ± 0.43	0.39
Caesarean delivery (%)			
Nulliparous	15	16	0.63
Multiparous	6	10	0.16
Instrumental (forceps/vacuum) delivery (%)			
Nulliparous	33	0.63	1.00
Multiparous	14	0.16	0.10
Epidural infusion stopped at 2nd stage of labour (% of n)	70	75	0.16

All values are expressed as mean ± s.e.m except the categories of "Caesarean delivery", "Instrumental delivery" and "Epidural infusion stopped at 2nd stage" which are expressed as the percentage of the total number (n) in each group.

\# In relation to the total number of parturients who had received neuraxial blocks, 68% were nulliparous, 32% multiparous.

* Significant difference was found between CSE and EA.

delivery) was higher in the EA group (mean 0.067 per hour ± sem 0.009 vs 0.042 ± 0.003, p<0.01). When the data were stratified in accordance with parity, there was no difference in the mode of delivery detected between the two groups. In nulliparous women, EA was associated with a longer duration of labour after block (Table III).

Multiple logistic regression analysis looking at all the possible variables that could have had an influence on parturient satisfaction with regard to labour neuraxial analgesia found that only the type of block (CSE or EA) was a significant predictor. In comparison with EA, CSE was more likely (OR 1.77, 95% CI= 1.1- 5.0) to be related to a favourable (good + excellent) outcome in parturient satisfaction (Table IV).

DISCUSSION

Our review shows that CSE was the block of choice for the subset of multiparous parturients in a more painful and advanced stage of labour. This reflects the intuitive acceptance that induction with a spinal block (as in CSE) produces a faster onset and a more efficacious block than EA. The initiation of analgesia with CSE could be deemed superior to and more uniform than EA in counteracting the increased noniception that occurs as the second stage of labour approaches, especially with respect to the contribution of the perineal afferents. Taken in another light, our finding suggests that in the context of parturients in early, relatively less painful labour, anaesthesiologists were less inclined to utilising CSE. This could have been due to the belief that in comparison with EA, CSE is more "invasive"[3]. CSE may theoretically compound the risks of conventional epidural blocks due to deliberate dural puncture even though this is not clearly borne out by the currently available evidence[4]. In that study, Norris et al found that CSE is not more likely to cause serious complications than EA. Although adverse neurological sequelae following CSE have been documented, some degree of reporting bias associated with this relatively new procedure compared with the more time tested EA cannot be excluded[5].

Our study showed that compared with EA, CSE did not increase the risk of postpartum headache, backache or urinary retention. Indeed, EA was associated with a higher incidence of transient neurological deficit, even though this could have been attributed to the fact that parturients in the EA group were exposed to a greater effect of analgesics subsequent to the longer duration of labour. The popular practice of adopting intrathecal fentanyl as a component for analgesic induction has positively contributed to a higher incidence of pruritus in the CSE group[6]. Even though CSE could potentially cause foetal heart abnormality post block, we found this to be not more frequent than EA[7]. The use of higher doses of opioids in the intrathecal component of CSE for the induction of analgesia has been found to be associated with foetal heart rate abnormalities[8]. We believe that limiting the dose of IT opioids to 25 microgram of fentanyl or

Table IV. Factors influencing parturient satisfaction with analgesia.

Multiple Logistic Regression
Dependent variable = Parturient satisfaction with neuraxial block
(0 = poor+unsure, 1 = good+excellent)
Note: 123 subjects (8% of 1,532) scored 0; 1,409 subjects (92%) scored 1

Variable	B	S.E.	Wald	Sig	R	Exp(B)	95%CI
CSE	.5728	.2579	4.9331	**.0263**	.0688	**1.7732**	**1.11-5.00**
NVD	-.1589	.2923	.2956	.5867	.0000	.8530	0.49-1.45
TIMEWEIG	-.0047	.0596	.0063	.9370	.0000	.9953	0.63-1.59
LTIME	-.0166	.0347	.2286	.6326	.0000	.9836	0.98-1.04
SECSTAGE	.0039	.0025	2.5640	.1093	.0302	1.0040	0.94-1.01
EPIDOFF	.0023	.2482	.0001	.9924	.0000	1.0024	0.63-1.59
HEADACHE	-.2880	.6293	.2095	.6472	.0000	.7497	0.24-2.83
NEURAL	-.3237	1.0840	.0892	.7652	.0000	.7234	0.13-9.28
URINARY	.3479	.6111	.3242	.5691	.0000	1.4161	0.42-4.60
BACKACHE	-.5195	.3136	2.7444	.0976	-.0347	.5948	0.33-1.14
NAUSEA	.1938	.3408	.3234	.5696	.0000	1.2138	0.67-2.43
REPEA	-.0974	.7872	.0153	.9015	.0000	.9072	0.19-2.36
ITCH	-.1650	.2521	.4282	.5129	.0000	.8479	0.59-1.50
SHIVERIN	.0175	.2433	.0052	.9428	.0000	1.0176	0.57-1.41
MOTORBLK	.1842	1.0533	.0306	.8612	.0000	1.2023	0.58-1.48
CONSTANT	2.429	.6783	2.552	.0230			

Total number of cases: 1,532 (Unweighted)
Number of selected cases: 1,532
Number of unselected cases: 0

Variable(s) Entered on Step Number

CSE	0 = epidural 1 = cse
NVD	0 = non nvd 1 = normal vaginal delivery
TIMEWEIG	time-weighted frequency of epidural top-ups (per hour)
LTIME	duration of labour (time of block to delivery, min)
SECSTAGE	duration of 2nd stage (min)
EPIDOFF	Epidural off at os full? 0=yes 1=no
HEADACHE	headache postpartum 0=no 1=yes
NEURAL	neural deficit 0=no 1=yes
URINARY	urinary retention 0=no 1=yes
BACKACHE	backache 0=no 1=yes
NAUSEA	nausea and vomiting 0=no 1=yes
REPEA	repeat procedure due to suboptimal block 0=no 1=yes
ITCH	itch 0=no 1=yes
SHIVERIN	shivering 0=no 1=yes
MOTORBLK	motor block 0=no 1=yes

less was contributory to minimising the incidence of post block foetal heart abnormality.

Our study also shows that CSE was associated with a reduced need for subsequent analgesic supplementation for breakthrough pain. The increased efficacy of the epidural catheter after CSE was also recognised in a previous study that showed a greater need for analgesic supplementation after a conventional epidural during labour[9]. In arriving at this conclusion, we had taken the duration of labour into account and hence, a time weighted frequency was computed in the analysis. While the actual cause for the reduced need of supplementation of analgesia in the case of CSE remains to be determined, the role of the dural rent in enhancing the effect of local anesthetics deposited epidurally has been demonstrated previously[10]. The greater need for supplementation of the block and a longer duration of labour in the EA group could have contributed to a relatively higher incidence of residual block in this group compared with the CSE group, albeit that in all the cases, the neural deficit resolved spontaneously.

As our review is a retrospective one that looks at the practice of neuraxial blocks for labour analgesia,

it is difficult to determine the cause-effect relationship between the mode of neuraxial analgesia and the total duration of labour. Interestingly, we found CSE to be associated with a shorter duration of labour among nulliparous women. Even though CSE has also been shown to reduce the duration of labour in a previous prospective study, the veracity of extrapolating these results to our current study is probably invalid as the treatment of our subjects was not randomised[11].

Besides, while CSE has been shown to reduce the incidence of instrumental delivery in a previously reported study, we could not find any difference in the instrumental and Caesarian delivery rates between the CSE and EA group after the collected data was stratified for parity[1]. Similarly, when nulliparous subjects were analysed separately from the multiparous ones, there was no difference in the duration of the second stage of labour between CSE and EA. It is possible that the outcome of labour in our review could have been confounded by factors such as parity and the stage of labour at the time of block induction apart from the treatment modality received (i.e. CSE or EA) due to non-randomisation of the subjects. Moreover, the lack of standardisation of treatment protocols for both EA and CSE precludes any further meaningful comparison between the two groups in this respect.

Our study shows that CSE was the independent predictor of patient satisfaction. None of the features related to either the outcome of delivery (e.g. mode of delivery, duration of labor and the duration of second stage) or the other factors pertaining to the quality of analgesia (side effects, complications, continuation of epidural analgesia in the second stage or a repeat of block) had an independent influence on parturient satisfaction with labour analgesia. One could also hypothesise that the other factors not evident in our data such as the rapidity of onset of analgesia and the uniformity of the block rendered by CSE compared with EA could have influenced the patient satisfaction favourably. Again, as there was no standardisation of regimens used for labour analgesia in our institution, further comparison of CSE versus EA in this respect is precluded. Nevertheless, Collis et al had also reported a higher satisfaction score for CSE than EA in a previously reported prospective study[2].

Our data also revealed that the majority of our obstetricians do routinely advise a termination of the epidural infusion when the second stage of labour is reached. It is hoped that allowing the block to wear off, hence, the return of sensation, would enable the parturients to "push" more effectively during delivery. However, as we currently often use dilute local anaesthetic plus opioid solutions, good analgesia could be achieved with a relatively preserved sensation of pressure and urge to push. Allowing the block to wear off completely in the second stage may result in the refusal of some women to "push" as extreme pain returns. Our data showed that while the degree of satisfaction was not influenced by the termination of epidural analgesia during the second stage, an earlier report had shown that the incidence of instrumental delivery may actually increase with this practice[12]. Therefore, while it may be prudent to decrease the rate of infusion or temporarily discontinue it if too dense a block is present, the practice of routinely switching off the epidural infusion at the beginning of 2nd stage needs further investigation.

Although CSE apparently incurs a slightly greater cost than EA due to the usage of the additional spinal needle, consideration must be accorded to the potential advantage rendered by the reduced need for subsequent epidural supplementation in the CSE group[13]. Evidently, the greater need for epidural top-ups in the EA group would result in greater manpower commitment and drug expenditure, in addition to probably being partially causative to a lower degree of maternal satisfaction compared with CSE.

In conclusion, our study shows that compared with EA, CSE was the more popular choice (80% CSE vs 20% EA) of neuraxial block for labour analgesia in our institution. Also, more parturients who were multiparous and in a more advanced plus painful stage of labour had had CSE compared with EA. Women who had received CSE had a higher incidence of transient pruritus because of the use of intrathecal fentanyl for induction of analgesia. EA was associated with a higher incidence of prolonged block, probably due to a longer duration of labour and a greater need for analgesic supplementation compared with CSE. Although no difference in the mode of delivery was found between EA and CSE, parturient satisfaction with labour analgesia was higher in the CSE group. CSE is a safe and good alternative to EA as a technique of neuraxial block for labour analgesia.

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