

COMBINED SPINAL EPIDURAL ANALGESIA IN LABOUR: COMPARISON OF BUPIVACAINE 1.25 MG WITH FENTANYL AND ROPIVACAINE 2.5 MG WITH FENTANYL INTRATHECAL*Prakash T. S. N¹, Ravi V²*¹Associate Professor, Department of Anaesthesia, Andhra Medical College, Visakhapatnam, Andhra Pradesh.²Associate Professor, Department of Anaesthesia, AC Subba Reddy Medical College, Nellore, Andhra Pradesh.

ABSTRACT

BACKGROUND

The concept of CSE has come into existence with the aims to provide the benefits of spinal block along with flexibility of an epidural catheter so as to modify and prolong the block for a longer period. CSE can be used to reduce or eliminate the disadvantages of spinal and epidural anaesthesia while preserving their advantages. The CSE technique has been used for orthopaedic and trauma surgery of lower limb, general surgery, urologic surgery, gynaecologic surgery, caesarean section, management of labour pain and postoperative pain. CSE blocks have also been used as research tools for controlled comparison between different epidural and subarachnoid techniques. Furthermore, the technique has been used successfully in all age groups including preterm neonates and infants, the very old and other high-risk patients. CSE is a multicompartment block. CSE involves intentional dural puncture followed by epidural drug administration. This introduces the possibility of drug flux from the epidural to the subarachnoid space, which may alter the characteristics of the block. Subarachnoid pressure is normally regarded as greater than epidural pressure by 5-15 cm H₂O. This pressure gradient is an obstacle to drug flux into the subarachnoid space. The epidural pressure rises transiently, but dramatically after drug administration, the similar rise in subarachnoid pressure occurs. There is a brief period during, which epidural pressure may exceed subarachnoid pressure. This produces conditions that would allow drug flux into the subarachnoid space.

MATERIALS AND METHODS

This clinical study was conducted in Department of Anaesthesiology in association with Department of Obstetrics and Gynaecology at Victoria General Hospital attached to Andhra Medical College, Visakhapatnam, from October 2013 to August 2014. Clearance was obtained from hospital ethics committee for the study. Written informed consent was obtained from all the patients. 40 parturients with ASA I and ASA II in established labour with cervical dilatation less than 5 cm was selected and randomly allocated into two groups using closed envelope method. Informed written consent was taken from all participants. They were divided into 2 groups of 20 each. Group I received intrathecal Inj. Bupivacaine 1.25 mg and Inj. Fentanyl 20 µg. Group II received intrathecal Inj. Ropivacaine 2.5 mg and Inj. Fentanyl 20 µg for combined spinal epidural. IV line was secured with 18G cannula. Patient was preloaded with 500 mL of Hartmann's solution. Basal vital parameter like pulse rate, blood pressure, respiration, O₂ saturation were recorded. The patient was positioned in a sitting position with the help of an assistant. Under aseptic conditions, the back was prepared with 5% povidone-iodine solution, spirit and area was draped. L3-L4 interspace was identified. Skin was infiltrated with 2 mL of 1% Xylocaine. After infiltration of local anaesthetic by using needle through needle technique 18-gauge Tuohy needle, epidural space was identified with loss of resistance to air technique. Then, a 15 mm (27 G) long 'Whitacre' spinal needle was introduced through the epidural needle and the correct position of the tip in the intrathecal space was confirmed by observation of free flow of CSF. Patients were allocated randomly to receive intrathecal injection of bupivacaine 1.25 mg (0.5% bupivacaine 0.25 mL) with fentanyl 20 µg (Group I n=30) or ropivacaine 2.5 mg/0.2% ropivacaine 1.25 mL) with fentanyl 20 µg (Group II, n=30) both made up to total volume of 2 mL with saline. Injection of intrathecal drug was completed in 10 secs., then 20G epidural catheter was threaded through the epidural needle into the epidural space in cephalad direction. The epidural needle was slowly pulled out without disturbing the catheter. About 3 to 5 cm of catheter was left in epidural space. The catheter was well secured with plaster. Patients vitals was recorded every 5, 10, 15, 30, 45, 60, 75, 90, 105 and 120 mins., i.e. (every 5 mins. for 15 mins. and then every 15 mins. for 2 hrs.) until the next request for analgesia. After positioning the patient in supine position, onset of analgesia and dermatome level were checked by loss of sensation to pinprick, time of onset and degree of motor blockade was checked by Bromage classification. VAS pain scores for all patients immediately before and after 15 mins. of the procedure at the next request for analgesia. Vitals were recorded and study was terminated. Continuation of epidural analgesia was done with 0.125% bupivacaine + 2 µg fentanyl in 10 mL. Monitoring - mother's vital parameters, progress of labour, efficacy of analgesia and foetal welfare were watched in coordination with attending obstetrician. Pulse, NIBP, SpO₂, respiratory rate were recorded before and after the start of procedure and every 5 mins. for first 15 mins. and then every 15 mins. for 2 hrs. If bradycardia occurred at any time (<60 bts./mins.), Inj. Glycopyrrolate 0.2 mg was given. If hypotension occurred, then it was treated appropriately with IV fluids and vasopressor. If pruritus occurred, it was treated with pheniramine. Sensory blockade assessed by pinprick and motor blockade was assessed by Bromage scale.

Statistical Analysis- In the present study, results are given as mean±standard deviation and range values for continuous data. Students test was used to compare the two groups, categorical data are expressed as number and percentages and difference between the groups was compared by chi-square test. A p value of 0.05 or less was set for statistical significance.

RESULTS

Maternal hypotension of 15% was noted in both groups, which was statistically significant. Onset of sensory analgesia in seconds showed a standard deviation of 38.12 with a mean difference of 47 seconds between the two groups was found to be statistically highly significant with a p value of <0.001. Maximal dermatomal level of sensory block achieved also showed statistically significant p value of <0.001. Two segment regression of spinal component of CSE showed a mean difference of 13.1 mins. with a mean time of 89.7 mins. for regression.

CONCLUSIONS

In conclusion, we found that intrathecal ropivacaine 2.5 mg was as effective as intrathecal bupivacaine 1.25 mg when added to fentanyl 20 µg in providing labour analgesia using combined spinal epidural technique in the first stage of labour with more efficient sensory block in terms of longer duration of action and better VAS scores, minimal motor block and hypotension. Thus, ropivacaine 2.5 mg would provide a suitable alternative to bupivacaine with better analgesia and minimal adverse effects.

KEYWORDS

Anaesthesia, Spinal E03.155.086.331, Anaesthesia, Epidural E03.155.086.131, Parturition G08.686.785.760.769.490.

HOW TO CITE THIS ARTICLE: Prakash TSN, Ravi V. Combined spinal epidural analgesia in labour: comparison of bupivacaine 1.25 mg with fentanyl and ropivacaine 2.5 mg with fentanyl intrathecal. *J. Evid. Based Med. Healthc.* 2016; 3(83), 4526-4532. DOI: 10.18410/jebmh/2016/959

BACKGROUND

Neuraxial techniques were introduced for pain relief in labour in 1950. Central neuraxial analgesia is the most versatile method of labour analgesia and the gold standard technique for pain control in obstetrics that is currently available. According to Anim-Somuah, the satisfaction of birth experience is greater with neuraxial techniques. Epidural blockade is an effective means of providing analgesia during labour.^[1] There has been growing interest in use of Combined Spinal Epidural technique (CSE) for labour analgesia. New regional techniques for labour analgesia use a low concentration of local anaesthetic often in combination with an opioid what is known as "Walking Epidural" by Kuczkowski KM and Cohen SE, which allows the mother to have more mobility and control over her pain and her ability to push.^[2,3] Wilson MJ achieved high quality pain relief with CSE allowing mobilisation in labour and the ability to titrate and extend analgesia to anaesthesia for CS.^[4]

Simmons SW advocated sacral analgesia, which produces rapid onset of pain relief and reliable sacral analgesia with CSE compared to epidural analgesia and made it a particularly attractive option for the provision of analgesia in late labour or for a parturient with rapid progress in labour.^[5] The ideal intrathecal drug recipe has yet to be determined. The most commonly used drugs are the lipophilic opioids fentanyl or sufentanil usually in combination with a local anaesthetic most frequently bupivacaine, levobupivacaine or ropivacaine. Co-administration of local anaesthetic with opioid produces synergistic effect.^[6]

Ropivacaine local anaesthetic is found to be less cardiotoxic in animal models. It may also be more selective for sensory fibers when compared to other local anaesthetics, thus producing less motor block.^[7,8] This allows for increased maternal ambulation and also allows for normal progression of labour. These factors suggest that ropivacaine may be superior to bupivacaine in obstetric analgesia. Our current trial was designed to clarify the relative analgesic potency of clinically relevant doses of intrathecal ropivacaine 2.5 mg combined with fentanyl 20 µg compared to low dose intrathecal bupivacaine 1.25 mg with fentanyl 20 µg.

AIM AND OBJECTIVES

AIM

To compare the efficacy of spinal component intrathecal bupivacaine 1.25 mg along with 20 µg fentanyl versus intrathecal ropivacaine 2.5 mg along with 20 µg fentanyl for labour analgesia using combined spinal epidural technique.

OBJECTIVES OF THE STUDY

- To study the onset of analgesia.
- Duration of sensory blockade.
- Incidence motor block in early part of labour.
- To study the side effects of the drugs.
- Pruritus.
- Hypotension.
- Foetal bradycardia.

MATERIAL AND METHODS

Both the group I and group II were similar with respect to age of the parturients. Mean age in group I was 21.95 and SD of 1.96. In group II, mean age was 21.55 with SD of 1.75. P-value of 0.51 and was statistically insignificant (Table 1).

Financial or Other, Competing Interest: None.
Submission 21-09-2016, Peer Review 28-09-2016,
Acceptance 08-10-2016, Published 17-10-2016.

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DOI: 10.18410/jebmh/2016/959



Age Distribution

Parameter	Mean±SD		Mean Difference	P* Value	Sig.
	Group I (n=20)	Group II (n=20)			
Age (Years)	21.95	21.55	0.4	0.51	NS
	±	±			
	1.96	1.75			

Table 1

The mean height and standard deviation were 154.6 cm and 2.6 in group I and 154.3 cm and 3.8 in group II, respectively. The p-value of 0.4 was statistically not significant (Table 2).

Distribution of Parturients According to Their Height

Parameter	Mean±SD		Mean Difference	P* Value	Sig.
	Group I (n=20)	Group II (n=20)			
Height (cm)	154.65	154.3	0.35	>0.05	NS
	±	±			
	2.67	3.8			

Table 2

Most of the parturients weighed between 55-64 kg in both the groups. In group I, the mean weight was 61.7 kg and SD 4.74. In group II, mean weight was 62.15 kg and SD 5.23, p-value of 0.74 was not significant (Table 3).

Distribution of Parturients Based on Their Weight

	<55 Kg	55-64 Kg	>65 Kg	Mean	SD	Chi-Square=0.587
Group I	2	13	5	61.7	4.74	P value= 0.745
Group II	1	15	4	62.15	5.23	

Table 3

The onset of sensory analgesia in seconds in number of patients of this study. In group I, mean was 186 secs. and SD of 45.23 and in group II mean was 123 secs. SD of 38.12 and mean difference between 2 groups 47 secs. P-value of <0.001 highly significant (Table 4).

Parameter	Mean±SD		Mean Difference	P* Value	Sig.
	Group I (n=20)	Group II (n=20)			
Sensory Onset of Action in Secs.	186	123	0.05	<0.001	HS
	±	±			
	45.23	38.12			

Table 4

Maximum dermatomal level of sensory blockade achieved after spinal component of CSE. The range was T7 to T10 in group I with average level of T9. Majority of patients in group I achieved an average sensory blockade up to T9 segment. In group II, range being T6 to T10 with average level of T7-T8, majority of patients achieved sensory blockade of T7 segment. P-value was <0.001, which was highly significant (Table 5).

Maximal Dermatomal Level of Sensory Blockade after Spinal Component of CSE

$\chi^2 = 17.783$ P<0.001 HS.

Dermatomal of Level	Group I	Group II
T6	0	6
T7	1	6
T8	4	5
T9	8	2
T10	7	1
T11	0	0

Table 5

Grade of motor blockade by Bromage scale, 90% of patients had grade 0 motor blockade and 95% of patients in group II had grade 0 motor blockade. Grade I motor blockade in 10% of patients of group I and 5% in group II. The p=0.04 statistically not significant (Table 6).

Grade of Motor Blockade after Spinal Component of CSE

Motor Onset of Action	Group I	Group II
0	18 (90%)	19 (95%)
I	2 (10%)	1 (5%)

Table 6

The mean pulse rate varied significantly. It was statistically significant at end of 90 mins. and 180 mins. mean difference being 6.6 and p of <0.001, which was significant and mean difference of 6.85 and p<0.001, which was statistically significant (Table 7).

Changes in Heart Rate

Time (Mins.)	Mean		SD		Mean Difference	P* Value	Sig.
	Group I	Group II	Group I	Group II			
0	97.95	91.75	8.43	11.99	6.2	0.067	NS
1	84.15	84	6.77	6.26	0.15	0.9424	NS
5	82.15	80.6	8.89	6.09	1.55	0.5244	NS
15	79.25	77	7.00	8.07	2.25	0.3523	NS
30	79.35	78.7	6.96	7.56	0.65	0.7788	NS
45	79.6	76.95	6.92	6.22	2.65	0.2106	NS
60	78.6	75.35	6.99	8.70	3.25	0.201	NS
90	80.8	74.2	5.03	7.89	6.6	0.0035	Sig
180	81.2	74.35	5.77	7.35	6.85	0.0023	Sig

Table 7

The time taken for two segment regression of spinal component of CSE showed significant change between two groups. Mean time of 76.6 mins. and standard deviation of 10.9 in group I and mean time of 89.7 mins. and SD of 23.04 with mean difference of 13.1 and p-value <0.05, which was highly significant (Table 8).

Parameter	Mean±SD		Mean Difference	P* Value	Sig.
	Group I (n=20)	Group II (n=20)			
	76.6	89.7	13.1	0.027	S
	±	±			
	10.96	23.04			

Table 8

Using visual analogue scale for measurement of pain, we observed that in group I 60% percent of patient showed excellent analgesia compared to 90% in group II. 40% showed good analgesia in group I compared to 10% in group II. P-value <0.05, which was statistically significant Table 9.

VAS Score:

VAS After Spinal	Group I	Group II
1-2	12 (60%)	18 (90%)
3-4	8 (40%)	2 (10%)

Table 9

$\chi^2 = 4.8$ P=0.028

In the present study, foetal bradycardia 15% in group I and 10% in group II not statistically significant; hypotension was present in 15% in group I and 15% in group II, which was statistically significant; pruritus present in 60% in group I and 75% group II, which was not statistically significant.

Inclusion Criteria

- Healthy primigravida and gravida 2 patients at term.
- ASA I and ASA II.
- Maternal request for labour analgesia.
- Age group 18-35 years.
- Women in active labour with cervical dilatation in primi about 4-5 cm and gravid 2 with cervical dilatation of 3-4 cm.

Exclusion Criteria

- Patients unwilling for procedure.
- Parturient with gravid 3 or more.
- Parturients with multiple pregnancies.
- Pregnancy-induced hypertension.
- Severe anaemia.
- Cephalopelvic disproportion.
- Previous LSCS.
- History of antepartum haemorrhage.
- History of allergy to local anaesthetic.
- History of CVS/RS disease.
- History of bleeding disorders.
- Diabetes mellitus.
- History of psychiatric/neurologic disease.

DISCUSSION

In our study, combined spinal epidural technique was done in sitting position using a single space needle through needle technique with 18G Tuohy needle. Lee et al performed CSE at L2-3 or L3-4 intervertebral space using a single space needle through needle technique with 18G Tuohy needle and 25G Whitacre spinal needle.^[9]

In our study, we used 27G Whitacre needle for the intrathecal component; since, this has the advantage of less post-dural puncture headache. Similar studies for labour analgesia were done by D. Hughes using CSE comparing intrathecal ropivacaine 2.5 mg versus bupivacaine 2.5 mg. Their study group had a higher mean age, weight, height compared to our study group. This may be due to change in demographic pattern. Their study population was mostly Caucasian and higher socioeconomic strata compared to the present study.^[10] In our study, the onset of analgesia was similar in both groups and analgesia was achieved within 5 mins. in both groups. Though, there was statistically significant difference in time of onset, both groups were effective in producing analgesia within 5 minutes and the difference was clinically negligible. Meenoti Pramod, Laxmi L Tanya et al reported that intrathecal ropivacaine 2.5 mg with 25 µg of fentanyl had onset of analgesia of 1.08±0.27 minutes compared to intrathecal bupivacaine 2.5 mg with 25 µg fentanyl of 1.1±0.3 seconds.^[11] In this study, ropivacaine was found to have a statistically significant faster onset of analgesia, but it was clinically negligible. This was similar to the finding in our study groups with the onset of analgesia occurring within 5 minutes. D Hughes et al reported that ropivacaine 2.5 mg had onset of analgesia at a mean time of 6.5 minutes, however, in this study, the definition of onset of analgesia was time period between administration of drug to the onset of the next painless contraction.^[10]

This might have resulted in the observations of longer onset of analgesia in the study and hence not comparable to our present study. Lee et al reported the onset of analgesia for bupivacaine 1.25 mg with fentanyl 25 µg versus bupivacaine 2.5 mg with fentanyl 25 µg was rapid and within 5 mins. for both the groups similar to the findings in our study.^[9] Yvonne Lim et al reported the duration of analgesia to be 52.6±4.0 minutes for ropivacaine 2.5 mg, 76.3±5.9 minutes for bupivacaine 2.5 mg. This study showed that at similar doses bupivacaine was more potent than ropivacaine. The study also reported greater incidence of motor block with bupivacaine and was found to be statistically significant.^[12] Addition of fentanyl in our study has caused longer duration of action in ropivacaine-fentanyl group compared to Yvonne Lim study. D. Hughes et al reported the mean duration of analgesia to be 64±21 minutes for ropivacaine 2.5 mg, 74±19 minutes for bupivacaine 2.5 mg. Intrathecal fentanyl 25 µg was used in both study groups. This was similar to the finding in our study in terms of duration of analgesia.^[10] Lee et al reported the median duration of analgesia of 75 mins. for bupivacaine 1.25 mg with fentanyl 25 µg, 120 mins. for bupivacaine 2.5 mg with fentanyl 25 µg. Thus, bupivacaine at higher doses produced a clinically significant increase in duration of action. This

study also showed a significant increase in motor blockade with 2.5 mg bupivacaine. The higher duration of action in this study compared to our study maybe due to use of higher dose of opioid^[9] Evangeline H.L.

Lim et al reported that the duration of analgesia for group fentanyl 25 µg with hyperbaric bupivacaine 1.25 mg was 129.5±48.5 mins. and 100.4±50.0 mins. for group fentanyl 25 µg with isobaric bupivacaine 1.25 mg.^[13] The prolonged duration of analgesia maybe due to the use of a higher dose of fentanyl and when compared to our study. In a study by Potdar MP et al, the duration of spinal analgesia was significantly greater with ropivacaine 2.5 mg + fentanyl 25 µg 106.63±17.99 mins. and in bupivacaine 2.5 mg + fentanyl 25 µg 111.75±23.58 mins. than the control Group F, which was 60±10.39 mins. with a P = 0.001.^[11] The duration of analgesia was higher in this group because of use of a higher dose of fentanyl use of a higher dose of fentanyl when compared to our study. Hughes et al reported the mean height of sensory blockade to be T6 for ropivacaine 2.5 mg with 25 µg fentanyl, T5 for bupivacaine 2.5 mg with 25 µg fentanyl. This was not clinically significant.^[10]

This was similar to the findings in our study for dermatomal height for ropivacaine group. Potdar MP et al reported the mean height of sensory blockade to be T9 for ropivacaine 2.5 mg with fentanyl 25 µg versus T10 for bupivacaine 2.5 mg with 25 µg fentanyl.^[11] Similarly, Lee et al observed the mean dermatome level to be T11 with bupivacaine 1.25 mg with fentanyl.^[9] This difference in height of sensory block maybe because the above studies had put the patient in slightly head up position after spinal component to avoid higher level of block and hence not comparable to findings our study. The incidence of motor block was 2 cases in ropivacaine group. This result was similar to study done by Lim Y who used 2.5 mg ropivacaine intrathecally for CSE. The study by him showed a statistically significant increase in motor block with higher dose of bupivacaine 2.5 mg.^[14] This is comparable to the findings in the present study. VAS scores after 15 mins. of procedure were found to be lower in Group II. Eight patients in group I had VAS >2 in Group I compared to two patients in group II. This was statistically significant and implied that ropivacaine group had better analgesia at end of 15 mins.

There was significant variation in heart rates at 90 and 180 minutes. This might be due to regression of analgesia of intrathecal component in both groups around the same time. This was supported by other studies by Lee et al where lower incidence of hypotension was seen with bupivacaine 1.25 mg group.^[9] There were two instrumental deliveries in each group. They were due to big size babies. In a similar study by Potdar MP et al, the incidence of assisted vaginal deliveries was similar in both bupivacaine-fentanyl, ropivacaine-fentanyl group with one forceps delivery in each group similar to our study.^[11] Similar results were seen in other studies by Lee et al and Hughes et al^[9,10] Incidence of foetal bradycardia was similar in both groups. This finding is in concurrence with the finding of several studies reporting incidence of FHR changes CSE.^[15] This has been attributed

to the administration of intrathecal opioids mainly fentanyl, sufentanil.^[16,17] The theory proposes rapid analgesia causing foetal bradycardia secondary to transient uterine hypertonus due to a transient decrease in epinephrine levels.^[18]

However, these FHR changes are easily manageable with simple measures such as left uterine displacement, treating maternal hypotension if any, oxygen administration via facemask in intractable cases, subcutaneous NTG may be given. Fortunately, these changes are not associated with adverse foetal outcome similar to other similar studies.^[19] Pruritus occurred in 12 cases in Group I and 15 cases in Group II. Pruritus was mild and self-limiting in all cases. Pruritus is a well-documented finding in association with administration of intrathecal opioid.^[20,21] This has been attributed to result from action of opioids both at segmental spinal and supraspinal levels.^[22,23] Rapid spread of intrathecal opioid cephalic from the site of administration is thought to cause pruritus in CSE.

CONCLUSION

In conclusion, we found that intrathecal ropivacaine 2.5 mg was as effective as intrathecal bupivacaine 1.25 mg when added to fentanyl 20 µg in providing labour analgesia using combined spinal epidural technique in the first stage of labour with more efficient sensory block in terms of longer duration of action and better VAS scores, minimal motor block and hypotension. Thus, ropivacaine 2.5 mg would provide a suitable alternative to bupivacaine with better analgesia and minimal adverse effects. The limitation of the present study are the small sample size, a larger study group would minimise other confounding factors, such as age, parity. Motor block was assessed using Bromage scale using a single scale would fail to detect small variations in motor weakness, use of a multiple tools to assess motor block would help detect minor degrees of motor block and help tailor the dose of drug. Further studies using various intrathecal doses of opioids or other adjuvants in combination with low-dose ropivacaine would provide a better understanding of the suitable combination of low dose local anaesthetic and adjuvant for providing safe and efficient labour analgesia.

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