



EPIDURAL OPIOID FOR LABOUR ANALGESIA: COMPARISON OF FENTANYL AND SUFENTANIL

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Article Received on 15/01/2017

Article Revised on 05/02/2017

Article Accepted on 26/02/2017

ABSTRACT

Lumbar epidural analgesia is popular for labour analgesia. In this observer blinded randomized prospective study 58 women in labour received a mixture of epidural bupivacaine 0.125% (12.5 mg) and either sufentanil 12.5 mcg (Group BS) or fentanyl 25 mcg (Group BF) to a total volume of 10 ml. The onset and duration of sensory and motor block, duration of analgesia and VAS scores were compared. Vital parameters were monitored routinely, as also incidence of any significant side effects. The mode of delivery, Apgar scores, maternal satisfaction and cost effectiveness were noted between the two groups. The onset of sensory and motor blockade in both groups was similar. Mean duration of analgesia were also similar between Group BF (106 ± 8.7 minutes) and Group BS (104 ± 10.1 minutes) respectively. There was no significance difference in the pulse rate, systolic blood pressure, mean arterial pressure, respiratory rate, SPO₂, and foetal heart rate between the groups. There was no hypotension, bradycardia, respiratory depression, hypoxia, shivering or vomiting in any patient. Mode of delivery and Apgar score was also comparable in both groups. However, cost of sufentanil was 6 times higher than fentanyl. We conclude fentanyl may be preferred for epidural labour analgesia for cost effectiveness and availability.

KEYWORDS: Fentanyl, sufentanil, labour analgesia, epidural.

INTRODUCTION

Epidural analgesia is the most effective and least depressant method of intrapartum pain relief in current practice. The goal of maternal labour analgesia is relief of pain without compromising maternal safety, progress of labour, incidence of operative or instrumental deliveries and foetal wellbeing. Nevertheless, epidural analgesia during labour is blamed for an increased incidence of instrumental deliveries^[1], the motor block being partially responsible. Minimizing the degree of motor blockade to decrease the instrumental deliveries without decreasing the quality of analgesia can be achieved by further reduction in total amount of bupivacaine by adding an opioid or other adjuvants to the local anesthetic^[2]. Fentanyl and sufentanil both are short acting lipophilic opioids and have been used for labour analgesia in numerous studies^[3-6]. Sufentanil is several times more potent than fentanyl because of its greater affinity of opioid receptor^[6]. It has been reported that mother receiving effective epidural analgesia with sufentanil and fentanyl along with low dose of bupivacaine combinations may ambulate unaided during labour^[7].

This prospective observer blinded randomised study was conducted to compare epidural labour analgesia using either fentanyl and sufentanil regarding - a) their onset and duration of action, b) their adverse effects, if any upon the foetus and mother, and c) the cost benefit in our scenario.

MATERIAL AND METHODS

After getting approval from Institutional Ethics Committee of Calcutta Medical College & Hospital and written informed consent from the mother and her spouse, the study was initiated on 60 nulliparous women, aged 18-35 years, of ASA physical status I or II, at more than 37 weeks of gestation who requested for labour analgesia, at any time during labour.

Patients with any known contraindications of regional anaesthesia, cervical dilation more than 6 cm, patient receiving any other analgesics concurrently or within last four hours, medical disorders of mother or the foetus, foetal distress, bad obstetric history or valuable baby, neurological or psychiatric problem of mother, and non-vertex foetal presentation were excluded from the study.^[3-6]

Before the procedure was begun, all routine monitors were attached. The patients' base line vital signs (blood pressure, heart rate, respiratory rate, and SpO₂) and foetal heart rate (FHR) were documented. They were also taught the Visual Analogue Scale (VAS) scoring system of pain assessment before starting the procedure and pre-procedural VAS was also noted. Patients were requested to evacuate the bladder before the procedure. Each patient was preloaded with 15ml.kg⁻¹ of lactated Ringers solution IV over a period of 15 minutes.

Epidural technique was performed in sitting position under full asepsis at L₃₋₄ or L₄₋₅ interspace and catheter advanced 3 to 5 cm into the epidural space. The patients received a 'test dose' of 3 mL of 1.5% lidocaine with 1:200,000 epinephrine. Patients were allocated randomly into two groups of 30 women in each group (Group BS and Group BF respectively) using sealed envelope technique. Two patients were excluded in Group BS due to blockade of epidural catheter, so 58 patients were included in this study to receive a mixture of preservative free isobaric bupivacaine 0.125% along with either sufentanil or fentanyl to a total volume of 10 ml by epidural injection as follows :

Group BS (n = 28) received sufentanil 12.5 mcg (0.25 ml) + 2.5 ml bupivacaine (0.5%) + 7.25 ml normal saline
Group BF (n =30) received fentanyl 25mcg (0.5 ml) + 2.5 ml bupivacaine (0.5%) + 7 ml normal saline

After performing the block patients were placed supine with a wedge under the right hip. Onsets of sensory and motor block were assessed by using alcohols swab test and modified Bromage score^[8] respectively. VAS scores were recorded every minute for 10 minutes and motor block every 5 minutes for 30 minutes. Maternal mean blood pressure and heart rate were measured immediately after the administration of the study drugs and, every 10 minutes up to 3 hours and half hourly thereafter. Observations were performed by an anaesthesiologist blinded to the study drugs administered.

Episodes of hypotension (SBP less than 25% of base line), bradycardia (heart rate less than 50/min), respiratory depression (respiratory rate less than 10/min) and hypoxia (SpO₂ less than 90%) were recorded. Hypotension was to be treated with a bolus of intravenous fluid and boluses doses of phenylephrine (100 mcg IV) and bradycardia was to be treated with atropine sulphate 0.6 mg to 1.2 mg IV. The patients were carefully observed for any adverse effect like sedation, itching, nausea and vomiting, shivering at regular intervals during study period. Intravenous metoclopramide hydrochloride 10mg was used for vomiting and meperidine hydrochloride 25 mg IV was used to control shivering.

The FHR pattern was evaluated by using continuous cardiocography and any changes were documented. After the first 30 minutes, patients were allowed to

ambulate with assistance if they desired, provided there was no detectable motor block and the foetal heart rate pattern was normal. Patients were asked to report immediately when pain relief started.

The onset of analgesia was defined as the time between initial epidural injection and the first notion of pain relief by the patient. Duration of analgesia was defined as the time from onset of pain relief till the time when the patient first requested additional analgesics. If VAS was more than 4, the same bolus dosage the patient received initially, was administered for rescue analgesia. The study concludes whenever the patient asked for rescue analgesic or baby was delivered.

The epidural analgesia was subsequently managed by team of anaesthesiologists' for the remaining period of labour. Mode of delivery and neonatal Apgar scores (at 1 and 5 minutes) were recorded in both groups. After delivery of baby mothers were interviewed regarding the quality of analgesia by using a four point satisfaction scale (excellent, good, fair and dissatisfied).

Statistical Analysis

The sample size required for correctly rejecting the null hypothesis (of equal population means) with a probability of 90% (i.e. power = 0.90 or 90%) was minimum 23 patients in each group as determined by power of analysis using the 'PS-Power and Sample Size Calculations' software (version 2.1.30, September 2006) assuming a duration of sufentanil analgesia of 160 ± 30 min, a duration of fentanyl analgesia of 190 ± 45 min, 90% power, and α value of 0.05⁵. However, allowing for possibility of greater value of within-group deviations and chance of drop-outs 30 patients per group were taken.

All statistical analysis were performed with SPSSTM for Window (version 16.0), and Microsoft Excel XPTM software. Numerical parametric data were presented as mean (\pm SD). Ordinal and nominal data were expressed in cross tables as number (percent) of patients in each nominal or ordinal category. Numerical parametric data were compared by unpaired t-test (independent samples t-test). Nominal and ordinal data were compared by Pearson's Chi-square test. P<0.05 was considered statistically significant.

RESULTS

Maternal characteristics (age, height, weight, ASA grade and cervical dilatation at block initiation) did not differ significantly between two groups (Table 1).

Patients in both groups had similar mean onset of sensory block up to T₁₀ segment, 3.5 ± 0.8 minutes in BF group and 3.3 ± 0.5 minutes in BS group. Mean onset of motor blockade in Group BF and BS were 8.3 ± 1.6 minutes and 7.1 ± 0.6 minutes respectively. Mean duration of motor blockade was 14.5 ± 2.2 minutes and 12.8 ± 1.0 minutes in Group BF & BS patients

respectively. Mean duration of analgesia were also similar between Group BF 106 ± 8.7 minutes and Group BS 104 ± 10.1 minutes respectively (Table 2). VAS scores were similar for both the groups at start and after initiating epidural analgesia at different time intervals (Table 3).

There were no significant differences in the pulse rate, systolic blood pressure, mean arterial pressure, respiratory rates, SPO2 and FHR between the groups; also there was no incidence of hypotension (Fig 1). None of the patients in any groups had bradycardia, respiratory depression or hypoxia.

No patients in any groups had sedation or developed shivering and vomiting in any point of time. Only 2

patients had nausea in group BF patient but did not require any treatment. However 3 patients in group BF and 2 patients in group BS had pruritus that also did not require any treatment (Table 4).

The incidences of vaginal and instrumental delivery in both the groups were also comparable and there were no significant difference. Only 3 patients in group BF and 5 patients in group BS required caesarean section due to cervical dystocia. Three patients in each group required outlet forceps due to pelvic outlet contraction (Table 5). Maternal satisfaction was also excellent in both groups (Table 6) and none complained of backache. Neonatal Apgar score was also comparable in both the groups. However, cost of sufentanil was 6 times higher than fentanyl.

Table 1. Demographic characteristics of patients in the two groups under study

Demographic parameter	Group BF		Group BS		Two - tailed p value
	Mean	Std. Deviation	Mean	Std. Deviation	
Age in years	23.3	1.2	23.2	1.5	0.89*
Weight in kg	64.4	2.5	66.4	1.8	0.07*
Height in cm	165.2	2.4	166.3	2.0	0.05*
ASA 1&11	1.1	0.3	1.1	0.3	0.91*
Cervical dilatation (cm) at catheter placement	4.5	0.3	4.6	0.3	0.24*

*P > 0.05= not significant

Table 2. Block characteristics

	Group BF	Group BS
Onset of sensory block (min)	3.5 ± 0.8	$3.3 \pm 0.5^*$
Onset of motor block (min)	8.3 ± 1.6	$7.1 \pm 0.6^*$
Mean duration of motor block (min)	14.5 ± 2.2	$12.8 \pm 1.0^*$
Mean duration of analgesia (min)	106 ± 8.7	$104 \pm 10.1^*$

*P > 0.05 = not significant

Table 3. VAS scores at block onset

VAS	BF	BS	Mean Difference	Two-tailed p - value*
VAS After 0 Min	9.5	9.6071	-0.10714	0.537
VAS After 1 Min	6.4333	5.5357	0.89762	0.239
VAS After 2 Min	3.7333	3.7857	-0.05238	0.811
VAS After 3 Min	3.1333	2.6429	0.49048	0.133
VAS After 4 Min	0.6667	0.6429	0.02381	0.936
VAS After 5 Min	0.2	0	0.2	0.087
VAS After 6 Min	0.0333	0	0.03333	0.338

* P > 0.05 = not significant

Table 4. Side effects

Side Effects	BF	BS
Sedation	0	0
Nausea	2 (6%)*	0
Vomiting	0	0
Pruritus	3 (10%)*	2 (6%)
Shivering	0	0

*P > 0.05 = not significant

Table 5. Mode of Delivery of Babies between the groups

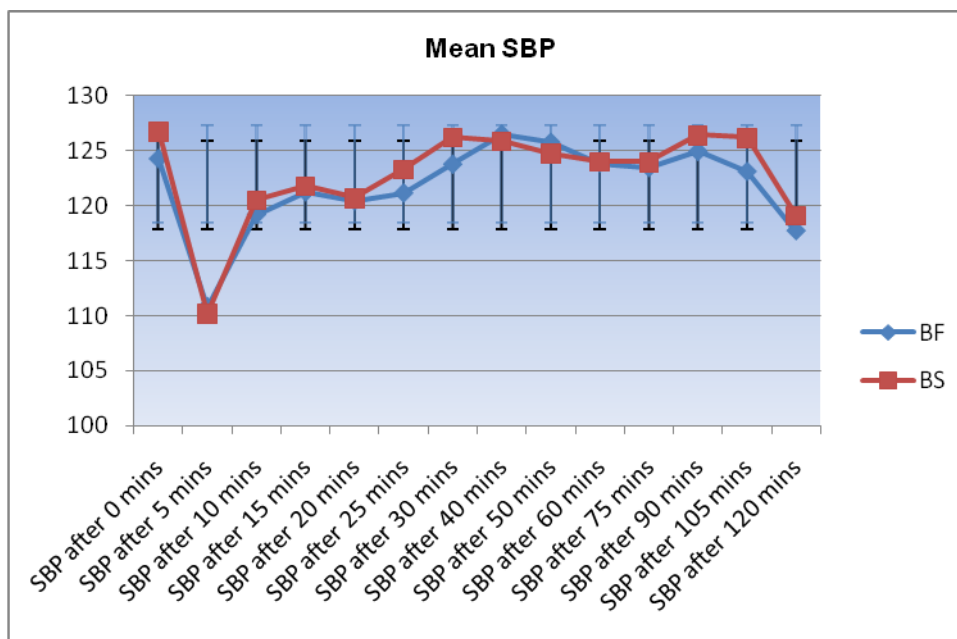
Mode of Delivery	BF	BS	Total
Normal	24 (80%)	20 (71%)*	44
CS	3 (10%)	5 (17%)*	8
Forceps	3 (10%)	3 (10%)*	6
Total	30	28	58

*P > 0.05 = not significant

Table 6. Maternal satisfaction score

Maternal Satisfaction Score	BF	BS	Total
Excellent	27 (90%)	25 (90%)*	52
Good	3 (10%)	3 (10%)*	6
Fair	0	0	
Dissatisfied	0	0	
Total	30	28	58

*P > 0.05 = not significant

**Fig 1. Mean Systolic Blood Pressure (SBP) between the groups**

DISCUSSION

Epidural analgesia for labour and delivery has been accepted in most obstetric centres because of its effectiveness and safety. Addition of opioids with local anaesthetic has been advocated to prolong the duration of effective analgesia and also to decrease the dose of local anaesthetic^[9]. Vertommen JD et al^[4], Herman NL et al^[6] and Bernard JM et al^[10] have used sufentanil 7.5 mcg, 8 mcg, 15.6mcg per 10 ml study solution respectively. We have chosen our dose of sufentanil (i.e. 12.5 mcg/10 ml) as an intermediate dose between these range of doses. The 2:1 ratio of fentanyl to sufentanil used in this study was selected because it was approximately equianalgesic as in a previous study^[3].

The onset of sensory block up to T₁₀ segment were 3.5 ± 0.8 min and 3.3 ± 0.5 min in epidural fentanyl groups and epidural sufentanil respectively in our study, which

was similar to previous studies done by Steinberg RB et al^[11]. In our study the mean analgesic duration with epidural fentanyl 2.5 mcg/ml and epidural sufentanil 1.25 mcg/ml was 106 minutes and 104 minutes respectively. These were comparable and similar to study of Connolly NR et al^[5]. The onset and duration of motor blockade were also comparable in both the groups in this study.

In our study 95% parturient had excellent pain relief (median VAS 1-3) within 3-5 minutes of bolus dosage which was similar with that of previous studied by Vertommen JD et al^[4], Steinberg RB et al^[11], and Sharma RK et al^[12].

There was no significant difference in the heart rate, blood pressure, systolic and mean arterial pressure, respiratory rate, SpO₂ between the groups. None of the

parturients in any of the groups had bradycardia, respiratory depression, or hypoxia. These observations were similar to that observed in previous studies by Vertommen JD *et al*^[4], Steinberg RB *et al*^[11], Cohen S *et al*^[3], Herman NL *et al*^[6], and Bernard JM *et al*^[10]. In the present study, there was no hypotension in any patient. Regarding side effects like sedation, nausea or vomiting, pruritus and shivering were also comparable in both the groups. These observations were similar to the above mentioned studies.

The observed incidence of caesarean delivery in our study varied from 10% to 17% between the groups. There was also 10% incidence of instrumental delivery in both groups. Instrumental and operative delivery amongst the groups were similar to observations of Vertommen JD *et al*^[4], Olofsson CH *et al*^[13], Connelly NR *et al*^[5], Bernard JM *et al*^[10], Le Guen *et al*^[14], and Sharma RM *et al*^[12].

The Apgar score of 9-10 at one & five minutes were also comparable between the groups. A comparison of the costs of fentanyl and sufentanil suggests that fentanyl may be advantageous. The average cost of a 2-ml fentanyl (100mcg) ampoule was Rs.35.00 and that of a 1-ml sufentanil (50mcg) vial was Rs.217.00, six times higher than of fentanyl at the time of our study.

CONCLUSION

It is inferred that equianalgesic doses of epidural fentanyl (25mcg) and sufentanil (12.5 mcg) given with low dosage of bupivacaine (0.125%) improved the quality of analgesia regarding their onset and duration when used in early labour in both the groups. Haemodynamic stability of parturients was maintained throughout the study period and there were no significant adverse effects. Instrumental delivery did not increase and maternal satisfaction was also excellent with no neonatal depression. So, we conclude, considering the cost and availability fentanyl may be a better choice to sufentanil for epidural labour analgesia.

ACKNOWLEDGEMENT: The authors are grateful to the faculty, students and staff of the Department of Obstetrics and Gynaecology, Medical College & Hospital, for their help in conduct of this study in every way.

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