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Original Article

Comparative Study of the Use of Intrathecal Bupivacaine and Bupivacaine with Fentanyl for Caesarean Section

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ABSTRACT

In caesarean section, sub arachnoid block using hyperbaric bupivacaine is the commonest anaesthetic technique. But this technique with conventional dose of hyperbaric bupivacaine (2.5ml-3ml) may be responsible for development of maternal and foetal side effects. So without hampering the quality of anaesthesia, the aim of the study was to compare the side effects between using low dose hyperbaric bupivacaine and fentanyl with conventional dose hyperbaric bupivacaine. It was a prospective, interventional, randomised, double-blinded and comparative study done in Jalalabad Ragib-Rabeya Medical College Hospital from April 2016 to December 2016. Sixty patients undergoing caesarean section under sub arachnoid block were allocated into two groups. Group B received 12.5 mg (2.5 ml) 0.5% hyperbaric bupivacaine and group B+F received 10 mg (2 ml) 0.5% hyperbaric bupivacaine with 20 μg (0.4 ml) fentanyl. Mean timing for sensory block was significantly earlier in group B+F ($p<0.001$). But mean timing for motor block was significantly earlier in group B ($p<0.00001$). Maternal haemodynamics were significantly better at 5th, 10th, 15th and 20th minute of intra-operative periods in group B+F. Foetal outcome had no change and complications were comparatively less in group B+F. Post-operative analgesia was better in group B+F than group B. For that low dose hyperbaric bupivacaine with fentanyl may be safer and better option for parturient undergoing caesarean section.

Keywords: *Bupivacaine, Fentanyl, Caesarean section, Sub-arachnoid block.*

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INTRODUCTION

Caesarean section is the commonest surgical procedure in obstetric care. Aim of this choice is decreasing the maternal mortality as well as good, healthy baby. But anaesthesia related complications accounted for 5.2% of maternal deaths[1]. Fatality risk is 16 times more during general anaesthesia than regional anaesthesia[2]. In comparison with general anaesthesia, regional technique specifically sub-arachnoid block is the most preferable, effective, affordable and flexible technique for caesarean section. It has no depressant action like parenteral and inhalational anaesthesia. The procedure of anaesthesia is simple, keeps the mother to remain awake, avoid the complications of airway manipulation, rapid onset of anaesthesia and complete muscle

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relaxation. But commonest disadvantage of this technique is the finite duration of anaesthesia and higher incidence of hypotension. Use of new techniques, avoid higher blocks, better management of local anaesthetic toxicity, reduced dose of local anaesthetics, use of additive drugs etc are helping to reach the goal of reduced maternal mortality associated with spinal anaesthesia[3]. Spinal anaesthesia in obstetric patients needs stricter dose calculations as the drugs are directly injected in intrathecal space. The chances of complications and side effects can be modified with minimum dose changes[4].

Bupivacaine, an amino-amide is the drug of choice for sub-arachnoid block. Due to transient neurological symptoms like radicular irritation[5,6,7]. Use of lidocaine for sub-arachnoid block has controversy. But the conventional dose of bupivacaine (12.5 mg) can cause high level of sensory and motor block with haemodynamic derangements leading to many undesirable per-operative effects like hypotension, bradycardia, shivering, nausea, vomiting etc and may require prolonged post-operative monitoring as well as delayed recovery[8,9,10]. So these dose dependent undesirable effects of bupivacaine can be minimized by using lower dose of bupivacaine with adjuvant like morphine, fentanyl, sufentanyl, alfentanyl etc.

Opioids, act on opioid receptor present in the substantia gelatinosa of dorsal horn of spinal cord. These drugs inhibit the ascending transmission of nociceptive information from the dorsal horn of spinal cord and to activate descending inhibitory pathway[11]. With local anaesthetics they have a synergistic effect as intensify the sensory block without increasing the sympathetic block. So they are offering haemodynamic stability by reducing the dose and side effects of local anaesthetics. Fentanyl, a lipophilic opioid, is the only opioid which is available as preservative free in our country. Addition of fentanyl along with intrathecal bupivacaine proves most suitable combination of sub-arachnoid block[12].

The aim of our study is to compare the use of conventional dose (12.5 mg) intrathecal bupivacaine with low dose bupivacaine and fentanyl in relation to motor and sensory block, haemodynamic profile, foetal outcome, adverse effects and post-operative analgesia.

MATERIALS AND METHODS

It was a prospective, interventional, randomised, double-blind, comparative study done in Jalalabad Ragib-Rabeya Medical College Hospital from April 2016 to December 2016. After informed written consent 60 patients were allocated for the study that fulfilled the inclusion and exclusion criteria. American Society of Anaesthesiologists (ASA) grade I or II with normal coagulation profiles, age between 20-40 years, weight 40-70 kg, height 140-160 cm were enrolled in the study. ASA grade III and above, patient refusal, contraindication to neuro-axial block, pre-existing neurological disease, cardiac and respiratory failure, non co-operative patients, allergy to local anaesthetic drugs, mental disturbance, extreme weight and height were excluded from the study. The patients were randomly divided into 2 groups; group B and group B+F, 30 patients in each group. Group B received 0.5% hyperbaric bupivacaine 12.5 mg (2.5 ml) and group B+F received 0.5% hyperbaric bupivacaine 10 mg (2 ml) plus 20 µgm (0.4 ml) fentanyl. Before surgery, patients were confirmed with either adequate starvation or not. Their vital signs like blood pressure, pulse rate, respiratory rate were monitored. Secured peripheral venous accesses were ensured with 20 G intravenous (I/V) cannula. Before the spinal anaesthesia 500 ml intravenous Hartman's solutions were given to all patients as preload and intra operative fluid were also maintained by Hartman's solution. Spinal anaesthesia was administered through L^2-L^3 space in sitting position with 27 G Quincke's spinal needle after confirming free flow of cerebro-spinal fluid (CSF) and direction of the needle aperture upwards during injection. Immediate after injecting spinal drugs, all patients were placed in supine position. Heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), oxygen saturation were recorded every 5 minutes interval. Fall of SBP >20% of baseline or <90 mm of Hg was considered hypotensive and managed with Hartman's solution bolus (200 ml) and/ or injectable ephedrin 5 mg intravenous as needed. Pulse rate <50 beats/minute was identified as bradycardia and treated with injectable atropine. Sensory blocks were assessed bilaterally by pin prick method along mid clavicular line until complete loss of cutaneous sensation up to T_6 level. Two segments regression times were also noted by pin prick method. Motor blocks were assessed by Bromage scale as follows: grade 0: full flexion of hips, knees and feet possible, grade 1: just able to flex knees but full flexion of feet possible, grade 2: unable to flex knees but some flexion of feet possible and grade 3: unable to move legs and feet. The incidences of side effects like hypotension, bradycardia, nausea, vomiting, shivering, pruritus, sedation, respiratory depression were recorded. Foetal outcome were assessed by Apgar score at 1 minute and 5 minutes. Post operative pain

assessments were conducted by using Visual Analogue Scale (VAS). It ranges from "0" indicating no pain and "10" indicating severe intolerable pain. VAS (0-3) is taken as mild pain, VAS (4-6) moderate pain, VAS (7-9) severe pain and VAS (10) intolerable pain which alters normal physiological process of the body. Additional analgesia was used at VAS-4 level mandatorily. Post-operative nursing stuffs were trained to follow the Visual Analogue Scale. Data were analyzed by the software SPSS for windows version 17. Table and figures were drawn by using Microsoft word and excel. Continuous variables were presented as Mean±SD (standard deviation). Categorical variables were presented as number of cases and percentages. Comparisons between different parameters in the two studied groups were performed by t test. The data were considered significant if P value was ≤ 0.05.

RESULTS

Table-I showed demographic profiles of two groups. The results showed that, there were significant motor and sensory block difference between two groups (Table-II and Table-III). In haemodynamic comparison of both groups, systolic blood pressure (SBP) and mean arterial pressure (MAP) were statistically well controlled at 5^{th}, 10^{th}, 15^{th} and 20^{th} minutes in group B+F. Diastolic blood pressure (DBP) was also statistically better at 10^{th} and 20^{th} minutes in group B+F (Table-IV). Heart rate was significantly higher in group B at 10^{th}, 15^{th}, 20^{th}, 25^{th} and 30^{th} minutes (Table-V). Foetal outcome was equal in both groups (Table-VI). Adverse effects were relatively less in group B+F than group B (Table-VII). Comparative study of MAP of both groups was also shown in figure-1 by line diagram. Line diagram of figure-2 shows the comparative difference between the heart rate of both groups. Bar diagram of figure-3 showed the Visual Analogue Scale (VAS) scoring of post-operative pain reveals group B+F was better than group B.

Table-I: *Demographic profile of patients (n=60).*

Variable	Group-B Mean±SD	Group B+F Mean±SD	P value
Age (years)	29.06±5.12	29.76±6.07	0.465
Weight (kg)	61.7±11.76	66.3±11.57	0.034
Height (cm)	146.13±8.35	148.36±6.94	0.353
ASA (I:II)	20:10	24:6	

Table-II: *Comparison of motor blocks between the two groups (n=60).*

Variable	Group-B Mean±SD	Group B+F Mean±SD	P value
Time for onset (sec)	36.66±13.85	60.16±14.65	0.0004
Time for peak level (sec)	156.33±24.91	215±34.41	0.00001
Time for recovery (min)	151.33 ±14.01	101.66 ±9.03	0.00001

Table-III: *Comparison of sensory blocks between the two groups (n=60).*

Variable	Group-B Mean±SD	Group B+F Mean±SD	P value
Sensory block onset (sec)	75.5±12.27	57.16±10.31	0.00001
To reach peak sensory level (min)	5.8±1.36	4.45±1.09	0.001
Two segment regression of sensory block (min)	86.5±12.71	100.5±10.03	0.002
Sensory block recovery (min)	113.5±10.01	126.33±11.51	0.002

Table-IV: *Haemodynamic profiles (n=60).*

BP	N	Group-B Mean±SD	Group B+F Mean±SD	P value
SBP				
Basal	30	118.33±14.28	120.33±16.29	0.14
5min	30	104.5±12.88	115.5±14.58	0.001
10min	30	91.66±11.47	108±14.77	0.00003
15min	30	95.83±12.73	110±14.62	0.00001
20min	30	100.16±9.78	104.33±15.52	0.001
25min	30	112±10.05	112.66±16.22	0.85
30min	30	117±11.56	114.33±14.18	0.66
35min	06	110.01±4.18	110.09±11.54	0.012
40min	02	110.09±7.07	111.34±21.21	0.295
DBP				
Basal	30	75±15.25	72.66±11.57	0.29
5min	30	62±12.42	67±11.49	0.02
10min	30	55.83±10.17	63.5±10.26	0.018
15min	30	59.33±9.53	64.83±9.60	0.071
20min	30	58.83±8.97	64.5±10.69	0.04
25min	30	66.33±10.58	66.33±10.98	0.65
30min	30	66.66±11.24	67.33±10.23	0.81
35min	06	68.1±7.52	63.33±15.28	0.146
40min	02	65.1±00	65.1±14.1	0.5

BP	N	Group-B Mean±SD	Group B+F Mean±SD	P value
MAP				
Basal	30	89.44±14.45	88.55±12.52	0.57
5min	30	76.16±11.38	83.16±12.07	0.005
10min	30	67.77±9.48	78.33±11.00	0.0002
15min	30	71.5±7.90	80.16±10.65	0.002
20min	30	72.41±7.48	80.5±11.72	0.005
25min	30	81.55±9.54	81.77±11.73	0.19
30min	30	83.44±9.97	83±10.80	0.85
35min	06	88.6±5.81	77.7±13.8	0.079
40min	02	88.3±2.35	85±16.49	0.401

Table-V: *Comparison of heart rate between the two groups (n=60).*

HR	N	Group-B Mean±SD	Group B+F Mean±SD	P value
Basal	30	85.36±9.49	83.73±11.51	0.71
5min	30	95.83±12.6	90.83±8.71	0.41
10min	30	99.66±13.12	89.66±7.42	0.0005
15min	30	99.66±5.4	90.23±7.2	0.0001
20min	30	98.7±6.87	88.73±7.98	0.0001
25min	30	94.26± 8.6	87.43±7.90	0.0004
30min	30	90.43± 8.87	86.2±6.45	0.041
35min	06	94.3±3.82	90.3±4.5	0.101
40min	02	94±5.6	90±00	0.211

Table-VI: *Comparison of foetal outcome between the two groups (n=60).*

Variable	Group-B Mean±SD	Group B+F Mean±SD	P value
APGAR score in 1min	9.32±0.79	9.97±0.51	0.03
APGAR score in 5min	9.81±0.91	9.67±0.34	0.04

Table-VII: *Comparison of adverse effects between the two groups (n=60).*

Effects	Group-B	Group B+F
Hypotension	10 (33%)	2 (6%)
Bradycardia	6 (20%)	0
Res. depression	0	0
Nausea	13 (43%)	0
Vomiting	7 (23%)	0
Shivering	14 (46%)	2 (6%)
Pruritus	0	0
Sedation	0	0

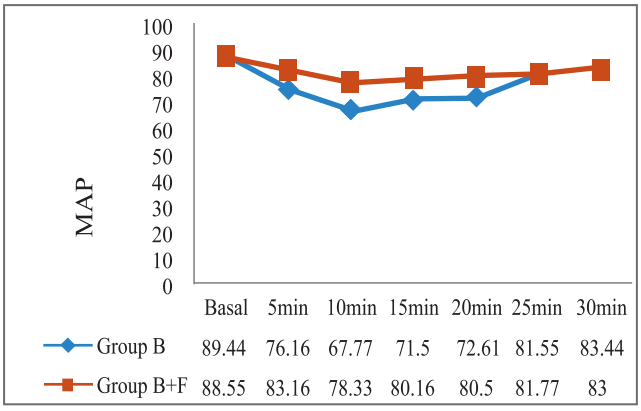

Figure-1: *Comparison of MAP of both groups (n=60).*

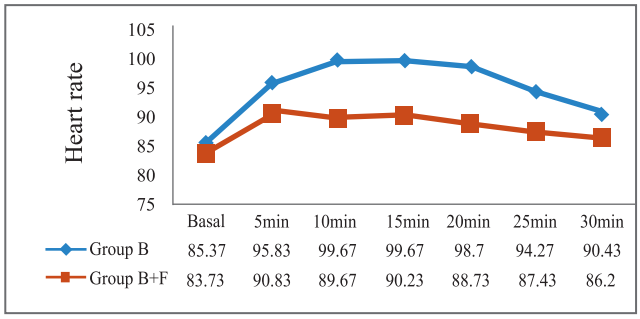

Figure-2: *Comparison of heart rate of both groups (n=60).*

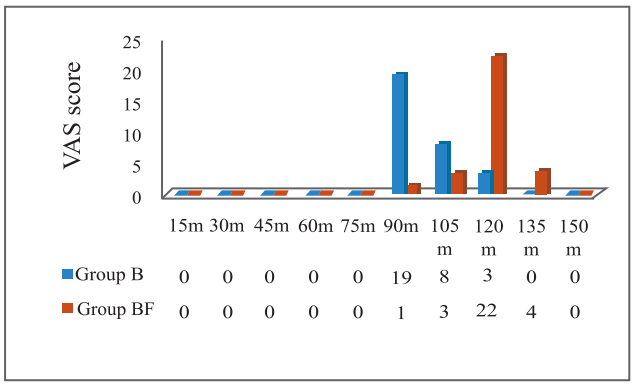

Figure-3: *VAS comparison of both groups (n=60).*

DISCUSSION

Demographic profiles of both groups were comparable with respect to age, weight, height and ASA grading. Onset of sensory analgesia was defined as loss of pin prick sensation at great toe. Onset time of sensory analgesia was significantly faster in group B+F (57.17±10.31) than group B (75.7±12.27). Meetei KS et al.[13] and Bogra J et al.[3] found similar results in their study. Peak sensory level was varied between T_4-T_6 in both groups. Time required to reach sensory block up to T_6 was earlier in group B+F (4.45±1.09) than group B (5.8±1.36). Gajbhare et al.[11] found identical results. Two segment regression time and complete sensory

recovery time were significantly longer in group B+F (100.5±10.03) compared to group B (86.5±12.71). Agarwal et al[14]. and Gajbhare et al[11]. found indistinguishable results with us. There was no complain of any intra operative discomfort in group B+F, while 7 patients in group B complained about that and 3 patients required supplementary injectable pethidine 25 mg to minimize the intra operative discomfort. Agarwal et al[14]. explained that analgesia by opioids is specific for visceral pain rather than somatic pain.

All patients had grade III motor blockade in our study which is accordance with the result of Choi et al[15]. Onset time and the peak level of motor block were significantly earlier in group B. Fentanyl had no effect on motor blockade[16]. But duration and complete recovery from motor block were earlier in group B+F. Patients of group B received higher dose of bupivacaine than group B+F. The results of Gajbhare et al[11]. commensurated with us. Maintenance of normal maternal blood pressure during caesarean section under spinal anaesthesia was the prime challenge for good foetal outcome. Adequate blood pressure maintaining during caesarean delivery resulted in better neonatal blood gas and acid-base measurements. Because the mature placenta had no auto regulatory ability and utero-placental circulation depends on systemic blood pressure[11].

Basal blood pressure of both groups was comparable without any significance. But addition of fentanyl and low dose bupivacaine significantly reduced the fall of systolic blood pressure (SBP) at 5th, 10th, 15th and 20th minutes and diastolic blood pressure (DBP) at 10th and 20th minutes in group B+F. This result coincides with the study of Bogra et al[3]. and Jain et al[17]. Similar pattern was also found in MAP too. Basal heart rates were almost equal in both groups. But due to addition of fentanyl 20µg intrathecaly in group B+F, heart rates were significantly maintained in a linear line around the basal rate, may be due to lack of visceral pain and less incidence of hypotension[11]. Foetal safety was equally important as maternal good outcome in caesarean delivery. According to Apgar score at 1 minute and 5 minutes, foetal outcome were almost same in both groups. There was no respiratory disturbance in group B+F. Dahlgren et al.[18], Agarwal et al.[15] and Bogra et al[3]. concluded that intrathecal fentanyl had no adverse effects on foetus which coincided our study.

In our study, 10 (33%) patients in group B had hypotension among them 3 patients required additional injectable ephedrine 5 mg I/V along with I/V fluid. On the other hand in group B+F, 2 (6%) patients had hypotension and required additional I/V fluid. Bogra et al.[3] found similar result and concluded that, incidence of hypotension was more with increasing concentration of bupivacaine. Fentanyl had no effect on sympathetic nervous system. So low dose intrathecal bupivacaine with fentanyl reduced the chances of hypotension. During caesarean section under regional anaesthesia nausea and vomiting were common due to peritoneal traction, exteriorization and reposition of uterus[19]. Despite of adequate blockade (T_4-T_6) in group B, 13 patients developed nausea and 7 patients developed vomiting. In group B+F, no patient developed nausea and vomiting. Dhumal et al[20]. explained that hypotensive episodes were responsible for the events of nausea or vomiting.

Sadegh et al[21]. studied the effect of intrathecal fentanyl for prevention of shivering in caesarean section. They reported the incidence of shivering to be less in fentanyl group. Fourteen patients in group B and 2 patients in group B+F developed shivering in our study. There were no cases of pruritus, sedation and respiratory depression in both groups.

In this study we found that, 19 patients in group-B felt moderate pain (VAS-4) at 90 minutes where as 22 patients in group-B+F, felt moderate pain (VAS-4) at 120 minutes. The result of this study showed that 20µg fentanyl prolonged the 0.5% hyperbaric bupivacaine induced sensory blocked. Similar finding was reported by Wang et al[22]. in their study.

CONCLUSION

Low dose 0.5% hyperbaric bupivacaine and 20 µg fentanyl can be a better option than 0.5% hyperbaric bupivacaine alone for caesarean section in respect to sensory and motor block, haemodynamic stability, adverse effects, foetal outcome and post-operative analgesia.

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