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Comparision of Intrathecal Levobupivacaine and Bupivacaine Combined With Fentanyl, for Infraumblical Surgeries

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ABSTRACT

Intrathecal combination of local anaesthetics with opioids produces a synergistic effect without intensifying motor and sympathetic blockades and enables more stable haemodynamics. Sensory ,motor blockade and hemodynamic effects of low-dose levobupivacaine and bupivacaine combined with fentanyl in spinal anesthesia for infraumblical surgeries were compared.

Sixty patients undergoing infraumblical surgeries received low-dose 0.5% levobupivacaine +fentanyl 25 µg (group L) or low-dose 0.5% bupivacaine +fentanyl 25 µg (group B).Time to achieve sensory blockade ,maximum spread and regression of sensory blockade , sensory and motor blockade at the beginning and end of surgery ,haemodynamic parameters and its side-effects were assessed.

The qualities of sensory blockade and haemodynamic effects were similar in both groups. Significantly more patients had complete motor blockade in Group B than in Group L at the beginning and end of surgery.

KEYWORDS levobupivacaine, bupivacaine, fentanyl, infraumblical surgery.

Introduction:

Subarachnoid anaesthesia (SAB) is the most popular and effective technique for Infra-umbilical surgeries.Currently, 0.5% hyperbaric bupivacaine hydrochloride is extensively used because of its longer duration of motor and sensory blockade. But it carries an increased risk of cardiac and central nervous system toxicity,if an inadvertent intravenous injection occurs.[1,2]

Most of the infra umbilical surgeries are day care procedures which requires early mobilization with less motor blockade. Levobupivacaine is an amide type local anaesthetic that is S-enantiomer of racemic bupivacaine with clinical profile resembling to that of bupivacaine with lower potency of motor blockade.It has been stated that its faster protein binding rate reflects a decreased degree of toxicity and studies done have supported that it has lesser cardiovascular and central nervous system toxicity than bupivacaine.[3-6]

Neuraxial anaesthesia can be undertaken using local anaesthetics at different doses and baricity. Intrathecal opioids added to local anaesthetics produce a well-documented synergistic effect without intensifying motor and sympathetic blockades,and enable successful anaesthesia with the use of a low-dose local anaesthetic which results in more stable haemodynamics.[7-9]

The aim of the present study was to evaluate the clinical effectiveness and blockade quality of low-dose levobupivacaine and to compare it with low-dose bupivacaine when combined with fentanyl in infraumblical surgeries. The primary endpoint was the difference in motor blockade between the two groups. Other endpoints were the differences between the two groups with respect to the characteristics of sensory blockade, haemodynamic stability and side effects.

Materials and Methods:

The Ethical Committee of Basveshwara general and teaching Hospital attached to Mahadevappa Rampure medical college, kalburgi approved this prospective randomised, double-blind study. All patients provided written informed consent to participate in this study.

We studied 60 patients (age 18–45 years) of American Society of Anesthesiologists (ASA) physical status I–II who were undergoing elective infraumblical surgeries with duration of maximum upto 2 hours.The exclusion criteria were,patients who would not accept spinal anaesthesia and those with abnormal coagulation profiles,known hypersensitivity to amide local anaesthetics and/or opioids, skin infections ,ASA grade 3, 4 and 5, age < 18 and > 45.

All patients were premedicated with intravenous (i.v.)50 mg of Ranitidine and 10 mg of Metoclopramide 2 h before surgery.Thirty minutes before spinal anaesthesia, we started the intravenous infusion of 10ml/kg of crystalloid solution (Ringer lactate) to provide volume preload. Patients were randomised into two groups Group L and Group B. In both groups, spinal anesthesia was performed by anaesthesiologist using the same technique with the patient in the lateral position using a midline approach at L3–L4 or L4–L5 with a 25-G Quincke needle. After free flow of CSF was observed, patients in the levobupivacaine group (group L) received 12 mg (2.2 ml) 0.5% levobupivacaine+25 µg fentanyl (0.5 ml), and the bupivacaine group (group B) received 12 mg 0.5% bupivacaine(2.2 ml) +25 µg fentanyl (0.5 ml) .Patients were moved to the supine position immediately after administration of the spinal blockade. The anaesthesiologist who performed spinal anaesthesia was blinded to the study groups.The study solutions used in the present study were prepared by another anaesthesiologist and used at room temperature (23°C).

All patients underwent non-invasive monitoring of systolic blood pressure (SBP) and diastolic blood pressure (DBP), measurement of blood oxygen saturation (SpO2) using pulse oximetry, and electrocardiography for heart rate (HR). A dedicated observer recorded these parameters before spinal anaesthesia,every 2 min for ten min after spinal anaesthesia,every 5 min thereafter for 30 min and every 15 min thereafter for one hour and every 30 min till end of surgery .Supplementary oxygen was given to all patients via a face mask.

Blockade characteristics were assessed by testing for sensory and motor blockade.Sensory blockade was monitored with

the pin-prick test at 1-min intervals for the first 5 min, then every 2 min for 20 min, and until end of surgery. Surgery was allowed if the upper dermatome to the level of the loss of discrimination to a pin-prick was at least T10.The time to achieve sensory blockade of T10,maximum spread of sensory blockade,time to S2 regression,as well as sensorial blockade levels at the beginning and end of surgery were recorded. Motor blockade was assessed based on modified Bromage scale (0=no paralysis, able to flex hips/knees/ankles; 1=able to move knees, unable to raise extended legs; 2=able to flex ankles, unable to flex knees; 3=unable to move any part of the lower limbs) at 1-min intervals for the first 5 min, then every 2 min for 20 min,until the end of surgery.Bromage scores at the beginning and end of surgery were noted.

Perioperative hypotension (SBP <20% of baseline or 90 mmHg) or episodes of bradycardia (heart rate <50 beats/min) were recorded and treated with boluses of fluid or 5 mg ephedrine or 0.6 mg atropine by the intravenous route. Any other side-effects (e.g. respiratory depression, nausea, vomiting and pruritus)were recorded.

Statistics :Statistical analysis were conducted using Independent-sample *t*-tests for parametric data, Fisher's exact test and chi-square tests for frequency data were undertaken. p<0.05 was considered significant. Data are the mean ± standard deviation (SD), median (range), and the number of patients (n).

Results: There were no significant differences with regard to mean values of age, weight and as well as the duration of surgery in the two groups (Table 1).The sensory and motor blockades characteristics are shown in(Table 2 & 3).Values of SBP, DBP and heart rates were comparable and almost stable during surgery in both groups (Table 4).

Table 1: Patients demographics & duration of surgery in Levobupivacaine and Bupivacaine groups.

Variables	Group L	Group B
Age (years)	29.7±7.75	29.9±8.23
Weight (kg)	62.3±9.6	60.1±10.25
Duration ofsurgery (minutes)	57.5±20.4	60.1±20.1

Data are expressed as Mean ± Standard Deviation (SD), *: median (range), Group L: Group Levobupivacaine, Group B: Group Bupivacaine.

Table 2: Sensorial block characteristics of Levobupivacaine and Bupivacaine groups.

Variables	Group L	Group B
Time to achieve sensory block of T_{10}	4.86±0.27	4.7±0.19
Max spread of sensory block	T9	T8
Time to S2 regression (minutes)	64.12±3.33	62.4±3.46

Data are expressed as Mean ± Standard Deviation (SD), Group L: Group Levobupivacaine, Group B: Group Bupivacaine

The qualities of sensory blockade were similar and clinically effective in both groups (Tables 2 and 3). At the onset of surgery, 10 patients in group B and 3 patients in group L had a Bromage score of 3. At the end of surgery, 6 patients in group B and none of the patients in gropu L had a Bromage score of 3 .These differences were significant (p=0.032 and p=0.014, respectively) (Table 3).

The number of patients having episodes of hypotension and bradycardia were comparable between the two groups.The prevalence of hypotension was 30 % (9 patients) in group L and 25%(7 patients) in group B.One patients in group L and 3 patients in group B had an episode of bradycardia. Patients responded to intravenous boluses of fluid and ephedrine treatment. Atropine was used in 1 patient in group B. A total of 3 patients in group L and 5 of patients in group B had pruritis.

Table 3: Sensorial block level & motor block degree of Levobupivacaine and Bupivacaine groups.

Variables	Group L	Group B
Sensorial block level at the beginning of the surgery (T8/ T8-T10/ T10)	12(40)/ 1(3.3)/ 17(56.7)	16(53.3)/ 3(10) / 11(36.7)
Sensorial block level at the end of the surgery (T8/ T8-T10/ T10)	4(13.3) /7(23.3) /19(63.3)	8(26.7)/5(16.6) /17(56.7)
Bromage scores at the beginning of the surgery (0 - 1/2/3)	0-0/ 27(90)/ 3 (10)	0-0/ 20(66.7)/ 10(33.3)
Bromage scores at the end of the surgery (0 - 1/2/3)	0-14(46.6)/ 16(53.3)/ 0	7(22.3)/ 17(56.7)/ 6(20)

Data are expressed as number of patients (n) - %, *: p<0.05 compared with Group L, Group L: Group Levobupivacaine, Group B: Group

Bupivacaine

Table 4P: Haemodynamic parameters of the Levobupivacaine and Bupivacaine groups.

	SYSTOLIC BP		DIASTOLIC BP		HEART RATE	
Time	Group L	Group B	Group L	Group B	Group L	Group B
BASAL	121.3±15.0	123.6±4.9	72.6±11.4	72.9±9.7	92.64±15.4	94.9±12.3
After **preloading**	126.8±3.2	128.4±16.8	78.2±11.7	80.3±13.8	94.8±15.6	95.06±11.8
After spinal **anaesthesia**	118.7±12.4	122.6±18.2	70.4±14.2	76.08±17.5	98.6±16.5	99.6±16.2
2.min ASpA	111.6±11.8	114.3±13.2	69.4±14.2	76.2±17.2	99.8±18.2	98.8±16.8
4.min ASpA	110.6±17.0	113.2±18	66.94±13.02	71.3±14.4	98.7±17.8	101.9±24.2
6.min ASpA	107.4±16.9	112.9±20.0	66.2±14.9	68.8±17.6	97.6±17.4	101.2±22.7
8.min ASpA	101.4±22.6	106.8±22.6	59.4±13.8	66.3±15.3	95.4±15.2	101.8±21.3
10.min ASpA	108.5±20.1	109.03±24.2	59.2±14.9	67.03±19.2	94.36±14.9	97.25±17.1
15.min ASpA	112.6±14.22	113.5±15.9	58.1±13.6	65.6±18.6	94±16.2	96.6±14.2
20.min ASpA	115.5±14.6	116.5±15.9	60.6±12.2	64.0±14.07	92.69±13.5	96.42±15.3
25.min ASpA	115.2±14.3	119.4±17.6	62.4±12.01	64.8±14.6	94.2±15.1	94.5±13.2
30.min AspA	116.2±14.8	120.4±16.8	62.89±11.3	65.06±16.57	93.28±14.2	94.43±14.5
35.min AspA	117.4±15.1	121.2±16.4	66.4±15.02	71.4±14.6	90.44±15.8	92.69±13.5
40.min AspA	119±8.8	120.6±12.9	68.51±14.4	74.2±15.1	89.66±14.8	89.94±14.4
45.min ASpA	122.3±13.2	124.1±14.5	68.76±14.01	75.6±15.4	88.64±15.1	86.2±14.8
60.min AspA	120.1±13.2	125.1±3.6	68.72±14.83	76.78±16.67	86.33±14.8	86.5±5.32
75.min AspA	124.4±13.6	123.6±14.9	69.41±14.2	72.9±9.7	86.52±13.4	84.8±6.1
90.min AspA	123.6±12.8	124.4±13.2	72.6±11.4	72.9±9.7	85.96±14.2	88.42±12.1
120.min AspA	122.8±11.6	123.2±12.2	78.2±11.7	80.3±13.8	86.78±13.6	88.91±14.1

Data are expressed as Mean ± Standard Deviation (SD), Group L: Group Levobupivacaine, Group B: Group Bupivacaine, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, HR: Heart rate, bpm: beat per minute, ASpA: after spinal anaesthesia.

DISCUSSION:

In this present study,low-dose levobupivacaine and low-dose bupivacaine combined with fentanyl produced a similar quality of sensorial blockade under spinal anaesthesia.Combination of fentanyl with low-dose levobupivacaine induced less motor blockade than low-dose bupivacaine when administered via the intrathecal route. Sahin AS et al[10] conducted a study in those patients undergoing single level lumbar disc surgery to compare the characteristics of intrathecal bupivacaine with levobupivacaine and concluded that block recovery time was shorter in levobupivacaine group,therefore postoperative neurological examination can be done earlier and early mobilization can be an advantage for postoperative recovery In the study by Orhan Gozaydin et al[11] conducted a for Comparison of Hyperbaric Levobupivacaine with Hyperbaric Bupivacaine in Unilateral Inguinal Hernia Operations Performed Under Spinal Anesthesia,concluded that Hyperbaric levobupivacaine was found to have similar effects to hyperbaric bupivacaine for anesthetic effects,hemodynamic parameters,postoperative analgesic necessity time,and the first 24-hour side effects and complications. Levobupivacaine,having a lesser cardiovascular and central nervous system, was suggested as an alternative to bupivacaine

The efficacy of neuraxial local anaesthetics is enhanced by the addition of intrathecal opioids. Such combinations are usually associated with improved anaesthesia and analgesia. It also allows the use of very low doses of local anaesthetic, which contributes to more stable haemodynamics [12,13] . R Hakan Erbay et al[14] conducted a study to compare low dose hyperbaric levobupivacaine and hyperbaric bupivacaine for transurethral surgery and concluded that low dose levobupivacaine plus fentanyl may be preferred over to low dose bupivacaine plus fentanyl because of the reduced motor block, shorter duration of motor block, longer sensory block and longer time for the requirement of first analgesia. In the study by Parpaglioni et al[15], the addition of sufentanil via the intrathecal route reduced the minimum local anaesthetic dose of spinal levobupivacaine and ropivacaine. It did not affect their potency ratio significantly, and resulted in enhanced spinal anaesthesia.Intrathecal fentanyl added to low-dose local anaesthetics produces a synergistic effect without increasing sympathetic blockade or delaying discharge from hospital.

In a study by Cuvas et al[16], addition of fentanyl 15 µg (0.3 ml) to 0.5% levobupivacaine (2.2 ml) produced a shorter duration of motor blockade than pure 0.5% levobupivacaine (2.5 ml solution) in spinal anaesthesia,both regimens were effective for transurethral resections. Akcaboy et al[17] compared the effectiveness of low doses of 0.5% levobupivacaine and 0.5% bupivacaine (5 mg and 7.5 mg,respectively) when combined with fentanyl (25 µg).These regimens were shown to be effective in spinal anaesthesia for transurethral resection of the prostate (TURP) if used in higher doses. In both studies, levobupivacaine plus fentanyl resulted in effective sensorial blockade with less motor blockade than bupivacaine plus fentanyl.In a study by Bremerich et al[18] they compared fixed doses of intrathecal hypertonic 0.5% levobupivacaine(10 mg) and 0.5% bupivacaine(10 mg) combined with intrathecal fentanyl (10 and 20 µg), or sufentanil (5 µg) in terms of the characteristics of sensory and motor blockade in parturients undergoing elective CS with spinal anaesthesia,levobupivacaine produced a significantly shorter and less pronounced motor blockade than racemic bupivacaine regardless of the type and dose of opioid added. In the present study, we preferred to use 12 mg of 0.5% levobupivacaine and 0.5% bupivacaine as a low dose in combination with 25 µg fentanyl for spinal anaesthesia for patients undergoing elective infraumblical surgeries. Levobupivacaine produced adequate and comparable sensorial blockade with bupivacaine but induced less motor blockade than bupivacaine,a result consistent with previous studies.

In the present study,decrease in SBP and DBP as well as changes in heart rate were in comparable ranges between group L and Group B. Coppejans et al[19] compared equipotent doses of bupivacaine, levobupivacaine and ropivacaine combined with sufentanil in patients undergoing elective CS with combined spinal-epidural anaesthesia.They found that haemodynamic values were comparable between the three groups (although a trend towards better SBPs and a lower prevalence of severe hypotension were noticed with levobupivacaine). Erdil et al[20] noted, in spinal anaesthesia, better haemodynamic stability associated with low-dose levobupivacaine plus fentanyl compared with that seen with low-dose bupivacaine plus fentanyl.

In the present study, the relatively lower prevalence of hypotension in both groups was thought to be a result of volume preloading before spinal anaesthesia and lowering of the local anaesthetic dose in combination with an opioid. Pruritis was also recorded in both groups in the present study. Pruritis is a common adverse effect of intrathecal use of fentanyl which has been reported by other investigators.[17,21]

One limitation of our study is that not evaluating the time to full recovery of sensory block, which can also be related with analgesia time or time to first analgesic request. In the literature there is conflicting results of this data showing shorter time to full recovery of sensory block[14] or longer time to first analgesic[22] request with intrathecal bupivacaine compared to levobupivacaine in combination with opioids.This can be assessed in a future study.

CONCLUSION:

To conclude spinal anaesthesia with 12 mg levobupivacaine plus 25 µg fentanyl provided less motor blockade with effective sensorial blockade compared with that seen with 12 mg bupivacaine plus 25 µg fentanyl in infraumblical surgeries. Such induced motor blockade offers the advantage of early mobilization with good hemodynamic stability for early discharge.

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