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Comparative Evaluation of Levobupivacaine and Levobupivacaine with Dexmedetomidine in Infraumbilical Surgeries

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Abstract

Background and Aim: Spinal anesthesia is a widely used technique providing faster onset with effective and uniformly distributed sensory and motor block. Due to decreased cardiovascular and central nervous system toxicity, levobupivacaine is a good alternative for spinal anesthesia. Present study was done to compare the effects of adding of dexmedetomidine to levobupivacaine in prolonging the analgesia produced by epidural levobupivacaine alone in patients undergoing infraumbilical surgeries.

Material and Methods: A prospective study was carried out which included 100 adult patients between the age group of 20 and 65 years of physical status American Society of Anesthesiologists Classes I and II who underwent infraumbilical surgeries. Group L patients received 3 ml (15 mg) of 0.5% isobaric levobupivacaine + 0.3 ml normal saline while Group LD patients received 3 ml (15 mg) of 0.5% isobaric levobupivacaine + 0.3 ml (3 µg) dexmedetomidine. The two groups were compared with respect to the onset and duration of sensory and motor block and hemodynamic stability.

Results: In Group LD, increase in VAS was observed at 210 min and the first dose of rescue analgesia was given at 5th h postoperatively. The second dose of recue analgesia was given at 12th h and the third dose was given at 21st h. Postoperative VAS scores at different time intervals were significantly lower in Group LD than Group L, thus indicating superior analgesia. The time of request of the first dose of rescue analgesia was delayed in Group LD and the difference in the two groups was highly significant ($P < 0.001$).

Conclusion: Epidural administration of dexmedetomidine with levobupivacaine hydrochloride 0.5% results in faster onset of sensory and motor blockade compared to levobupivacaine hydrochloride 0.5% alone. Dexmedetomidine as an adjuvant to levobupivacaine hydrochloride 0.5% provides superior quality of analgesia without any significant hemodynamic instability.

Keywords: Dexmedetomidine; Infraumbilical Surgery; Levobupivacaine; Spinal anesthesia.

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INTRODUCTION

Effective postoperative pain control is an essential component of the care of the surgical patient. Inadequate pain control may result in increased morbidity or mortality.[1] Regional anesthesia has many benefits over general anesthesia as it eliminates the pain both intraoperatively and postoperatively, provides excellent muscle relaxation, and reduces intraoperative bleeding.[2] Regional anesthesia techniques are also superior to systemic opioid agents with regard to analgesia profile and adverse effects.[3] Spinal anesthesia is the most commonly used technique due to its unmatchable reliability, simplicity, and cost effectiveness. It provides a fast and effective onset of sensory and motor block, excellent muscle relaxation, and prolonged postoperative analgesia. Due to decreased cardiovascular and central nervous system toxicity, levobupivacaine is a good alternative.[5]

Spinal anesthesia is the most commonly used technique due to its unmatchable reliability, simplicity, and cost effectiveness. It provides a fast and effective onset of sensory and motor block, excellent muscle relaxation, and prolonged postoperative analgesia.[5] Due to decreased cardiovascular and central nervous system toxicity, levobupivacaine is a good alternative.[6] Various adjuvants, like epinephrine, fentanyl, dexamethasone, clonidine when added to levobupivacaine were found to prolong the duration of analgesia dexmedetomidine is a new addition to the class of alpha-2 agonist with varied beneficial effects when administered via epidural route.[7-10] It acts on both pre and post-synaptic sympathetic nerve terminal and central nervous system, thereby decreasing the sympathetic outflow and norepinephrine release causing sedative, antianxiety, analgesic, sympatholytic and hemodynamic effects.

Dexmedetomidine does cause a manageable hypotension and bradycardia which is treatable but the unraveling feature of this drug is the lack of opioid related side effects like respiratory depression, pruritus, nausea and vomiting. Present study was done to compare the effects of adding of dexmedetomidine to levobupivacaine in prolonging the analgesia produced by epidural levobupivacaine alone in patients undergoing infraumbilical surgeries.

MATERIAL AND METHODS

Present randomized study was conducted on sixty patients in the age group of 20–65 years of either sex of physical status American Society of Anesthesiologists (ASA) Classes I and II admitted for elective infraumbilical surgeries under spinal anesthesia. Ethical approval was taken from the institutional ethical committee and written informed consent was taken from all the participants. Total 100 patients were included in the study. Patients with peripheral or central neurological disease, raised intracranial tension, valvular heart diseases, significant ECG changes, renal disease, endocrinal disease, metabolic diseases, hepatic disease, coagulopathy and bleeding diathesis, body weight of > 100 and < 45 kg and height of <145 cm were excluded from this study.

All patients received diazepam 0.2 mg/kg orally, the night before surgery. The patients were preloaded with Lactated Ringer's solution 15 mL/kg. They were monitored with automated noninvasive blood pressure, pulse oximetry, and electrocardiogram. Oxygen was given at the rate of 5–6 L/min through a face mask. The anesthesiologist performing the technique recorded the intraoperative data and followed the patient postoperatively until discharged from post anesthesia care unit. Assessment of sensory block by the loss of sensation to pinprick of 22 gauge blunt hypodermic needle and motor block by modified Bromage score 11 was done every 2 min for first 10 min, then every 5 min up to 30 min, every 15 min up to 120 min, half-hourly up to 240 min, and hourly until 12 h of surgery. Continuous multiparameter monitoring of respiratory rate, heart rate, noninvasive systolic and diastolic blood pressure, SpO2, and electrocardiogram was done for hemodynamic response. Readings were recorded preoperatively, then intraoperatively at 0, 3, and 5 min, then at an interval of every 5 min up to 30 min, every 15 min up to 120 min, halfhourly up to 180 min, hourly until 12 h, and thereafter 3 hourly till 24 h of surgery in both the groups. Bradycardia was treated with injection atropine sulfate intravenously according to heart rate. Hypotension was treated with intravenous ephedrine intravenously as per required and additional Ringer's lactate solution. The operation was started when surgical anesthesia (up to the T10 sensory dermatome) has developed. In case of failed or partial neuraxial block, the patient was given general anesthesia and that patient was excluded from the study.

Statistical Analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2007) and then exported to data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA). For all tests, confidence level and level of significance were set at 95% and 5% respectively.

RESULTS

The mean age, sex, weight, ASA grading, duration of surgery, baseline parameters, and quality of surgical analgesia were comparable in the two groups as shown in Table 1.

Table 1: Demographic file and parameters of study participants

Variables	Group L	Group LD	P value
Age (Years)	41.95±14.2	41.70±14.22	0.47
Gender			
Male	30	32	0.18
Female	20	18	
ASA Grading			
Grade I	80	72	0.09
Grade II	40	48	
Duration of surgery	58.35±6.14	58.01±7.22	0.36
Heart rate (/min)	83.20±6.14	83.72±8.15	0.44
Systolic blood pressure (mmHg)	128.10±5.4	125.76±13.0	0.78
Diastolic blood pressure (mmHg)	80.02±9.40	79.43±8.22	0.22
Respiratory rate (/min) (mean±SD	17.10±2.64	18.10±0.35	0.1

In Group LD, increase in VAS was observed at 210 min and the first dose of rescue analgesia was given at 5th h postoperatively. The second dose of recue analgesia was given at 12th h and the third dose was given at 21st h. Postoperative VAS scores at different time intervals were significantly lower in Group LD than Group L, thus indicating superior analgesia. The time of request of the first dose of rescue analgesia was delayed in Group LD as it was demanded at 309.93 ± 23.19 min and in Group L was at 168.30 ± 12.32 min. The difference in the two groups was highly significant ($P < 0.001$). A dose dependent reduction in rescue analgesia requirements was noted in our study. Anumber of rescue analgesia doses were 3.60 ± 0.49 in Group L, whereas 2.90 ± 0.31 in Group LD and the difference was highly significant ($P < 0.001$) (Table 2).

Table 2: Visual analog scale score and rescue analgesia in postoperative period

	VAS score post-operative period (mean±SD)		Rescue analgesia (mean±SD)		
	Group L	Group LD	Group L	Group LD	P value
90 min	0.0 ±0.0	0. ±0.0	0.0 ±0.0	0.0 ±0.0	0.4
105 min	0.11±0.32	0.02±0.19	0.0 ±0.0	0.0 ±0.0	0.25
120 min	0.79±0.84	0.42±0.68	0.0 ±0.0	0.0 ±0.0	0.08
150 min	2.82±2.52	0.21±0.14069	0.26±0.44	0.0 ±0.0	0.001*
180 min	3.95±2.62	0.74±0.24	0.68±0.41	0.0 ±0.0	0.002*
210 min	3.44±1.26	2.45±1.01	0.14±0.35	0.0 ±0.0	0.002*
4 h	2.27±0.91	3.11±0.89	0.0 ±0.0	0.0 ±0.0	0.03*
5 h	0.0 ±0.0	3.34±1.07	0.0 ±0.0	0.35±0.42	0.004*
6 h	0.0 ±0.0	1.81±1.33	0.0 ±0.0	0.62±0.48	0.01*
7 h	0.04±0.19	0.87±0.76	0.0 ±0.0	0.0 ±0.0	0.002*
8 h	0.44±0.78	0.07±0.26	0.0 ±0.0	0.0 ±0.0	0.002*
9 h	3.41±2.20	0.29±0.59660	024±0.44	0.0 ±0.0	0.05*
10 h	2.64±1.63	1.30±0.96	0.47±0.51	0.0 ±0.0	0.004*

Table cont....

11 h	1.09±2.71	2.71±1.06	0.21±0.39	0.29±0.47	0.01*
12 h	0.47±2.26	2.70±1.85	0.10±0.29	0.64±0.48	0.001*
15 h	2.33±1.73	0.52±1.14	0.27±0.45	0.06±0.03	0.03*
18 h	2.61±1.89	2.84±1.37	0.64±0.49	0.51±0.49	0.47
21 h	2.19±1.46	1.92±2.05	0.17±0.33	0.47±0.32	0.22
24 h	4.02±1.42	2.54±1.66	0.49±0.41	0.24±0.42	0.001*

**** Indicates statistically significance at p≤0.05***

None of the patients of Group L had urinary retention while it was observed in only 3% of patients of Group LD and the difference was statistically no significant. Other side effects such as pruritus, nausea, vomiting, headache, backache, local anesthetic toxicity, and respiratory depression were not recorded in any of the patients of both the groups.

DISCUSSION

Regional anesthesia techniques are superior to systemic opioid agents with regard to analgesia profile and adverse effects. Levobupivacaine is a preferred local anesthetic due to its early onset and prolonged duration of sensory block, shorter duration of motor block, and lower cardiac toxicity. In previous studies, it was concluded that the addition of dexmedetomidine to levobupivacaine produces effective analgesia and prolonged the duration of motor and sensory block along with better postoperative analgesia and fewer side effects.[12-14]

The synergism between epidural local anesthetics and opioids is well established but evidence regarding combination of local anesthetics with dexmedetomidine through epidural route is scarce in literature.[15,16] The demographic profile in the present study was comparable with respect to age, body weight, sex, height, duration of surgery; throughout the perioperative period patient were calm and comfortable. Thus, showing dexmedetomidine produces better sedation when used epidurally.

Studies using a combination of intrathecal dexmedetomidine and local anesthetics are lacking. In our study, the intrathecal dose of dexmedetomidine selected was based on previous animal studies. A number of animal studies conducted using intrathecal dexmedetomidine at a dose range of 2.5–100 μg did not report any neurologic deficits with its use.[17-22]

The mean heart rate at various intervals intraoperatively was found to be comparable in both the groups. It was in accordance with a study conducted by Esmaoğlu et al.[23] Basuni and Ezz[24] observed bradycardia in 3.3% of patients in levobupivacaine and dexmedetomidine group, whereas it was in 13% of patients in our study. This can be explained by the fact that dose of levobupivacaine used in the study by Basuni and Ezz was 4 mg, whereas the dose was 15 mg in the present study. However, there was no statistically significant difference in the mean heart rate of both the groups during the perioperative and postoperative period ($P > 0.05$) in both the studies. There was no statistical difference in change in the respiratory rate at different time intervals between the two groups ($P > 0.05$). This lack of respiratory depression with dexmedetomidine has also been demonstrated in studies done by Esmaoğlu et al and Basuni and Ezz.[23,24]

The addition of dexmedetomidine to levobupivacaine improved the postoperative analgesia resulting in a reduction of the number of analgesic doses required in the 24 h post-operatively. Better degree of analgesia in Group LD seen in our study was due to the synergism of dexmedetomidine and levobupivacaine and effectiveness of dexmedetomidine in abolishing visceral pain. This was in accordance with studies conducted by Kim et al[25] Basuni and Ezz,[24] Eid et al.[26] and Amer et al.[27]

CONCLUSION

Epidural administration of dexmedetomidine with levobupivacaine hydrochloride 0.5% results in faster onset of sensory and motor blockade compared to levobupivacaine hydrochloride 0.5% alone. Duration of sensory and motor blockade and duration of analgesia were significantly prolonged when dexmedetomidine was added as an adjuvant to levobupivacaine hydrochloride

0.5%. Dexmedetomidine as an adjuvant to levobupivacaine hydrochloride 0.5% provides superior quality of analgesia without any significant hemodynamic instability.

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