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A comparative study of 0.25% levobupivacaine and 0.25% levobupivacaine with dexmedetomidine in ultrasound-guided transverse abdominis plane block for post-operative analgesia in infraumbilical surgeries

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ABSTRACT

Background: Transversus abdominis plane (TAP) block delivers excellent analgesia with few side effects. Previous research suggests that the efficacy and duration of the block can be increased by adding adjuvants such as dexmedetomidine to the local anesthetics. **Aims and Objectives:** To compare the post-operative analgesic effectiveness of 0.25% levobupivacaine and 0.25% levobupivacaine with dexmedetomidine 1 µg/kg in US-guided TAP block in infraumbilical surgery patients. **Materials and Methods:** Ultrasound-guided TAP block was given to sixty patients. Patients consented for infraumbilical surgery, and patients were randomly assigned to two groups: Group L received 20 mL of 0.25% levobupivacaine alone and Group LD received 20 mL of 0.25% levobupivacaine with dexmedetomidine 1 µg/kg. The efficacy of analgesia was measured in terms of degree and duration of analgesia; the post-operative pain was evaluated using a visual analog scale (VAS). The Chi-square test and Student's t-test were used for statistical analysis. **Results:** Result shows that there is no statistically significant difference in gender, age group, weight, height, BMI, and type of surgery between groups, with a P = 0.40, 0.83, 0.37, 0.59, and 0.93, respectively. In addition, there is no statistically significant difference in the duration of surgery between the groups (P = 0.63). However, it was observed statistically significant differences in the onset of analgesia requirement, duration of effect of analgesia, and the total anesthesia consumption between the experimental groups with a P = 0.001, 0.001, and 0.001, respectively. No significant difference in VAS was observed initially but was significant in later hours. **Conclusion:** Adding dexmedetomidine to 0.25% levobupivacaine enhanced the efficacy of the block and duration of post-operative analgesia compared to 0.25% levobupivacaine alone.

Key words: Transverse abdominis plane; Analgesia; Dexmedetomidine; Infraumbilical surgeries

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INTRODUCTION

In the post-operative phase, pain is one of the five vital signs that must be monitored. Pain is an unpleasant feeling or sensation associated with actual or imagined tissue injury in the muscles. Post-operative analgesia is a vital to reduce the risk of problems following surgery. Consequently, providing suitable pain relief for patients after surgery is

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crucial. This helps to shorten the hospital stay, achieves earlier mobilization, and improves overall patient satisfaction.[1] Opioid can be used to treat post-operative pain successfully; nevertheless, they are accompanied by dose-related adverse effects such as respiratory depression, drowsiness, pruritus, nausea, and vomiting. Therefore, a regional nerve block has been introduced as a better means to enhance analgesia following infraumbilical procedures.

As a standard method of post-operative pain relief following abdominal procedures, a transversus abdominis plane (TAP) block is often used. There may be an anatomical gap between the transverse abdominis muscle and the internal oblique muscle, which would be located in the TAP. A field block by TAP infiltration is referred to as a TAP block.[2] They provide sensory blockade of the anterolateral abdominal wall. It does not provide analgesia to the visceral peritoneum of the anterior abdominal wall.[3] Any procedure involving the lower abdomen, such as a hernia repair, appendectomy, cesarean section, laparoscopic surgery, hysterectomy, kidney transplant, or prostatectomy, calls for a TAP block.[4]

Levobupivacaine, the s-isomer of bupivacaine, is widely used in regional nerve blocks with better hemodynamic profiles having less cardiotoxic and neurotoxic properties. Studies suggest that adjuvants such as dexmedetomidine when added to local anesthetics enhance the efficacy of the block.[5] So far, very limited research data are available regarding the use of levobupivacaine with adjuvant dexmedetomidine. The purpose of this study was to investigate whether the addition of dexmedetomidine to levobupivacaine in TAP blocks provides better post-operative analgesia in infraumbilical surgery patients.

Aims and objectives

To compare the post-op analgesic effectiveness of 0.25% Levobupivacaine and 0.25% Levobupivacaine with dexmedetomidine in US-guided TAP block in infraumbilical surgery patients.

MATERIALS AND METHODS

A randomized prospective observational study was conducted at King George Hospital, Visakhapatnam, between April 2021 and October 2021. Approval of the Institutional Ethics Committee was taken. Sixty patients of either gender between 18 and 60 years of age with the American Society of Anesthesiologists (ASA) Grade I or II were included in the study. The patients who consented to lower abdominal surgeries were included in the present study. Patients were randomly assigned into two groups: Group levobupivacaine (L) - 20 mL of levobupivacaine (0.25%) and Group levobupivacaine+Dexmedetomidine (LD) - 20 mL of levobupivacaine (0.25%) with dexmedetomidine 1 μg/kg. All patients involved in this study provided written informed consent. Inclusion criteria: patients of either gender between the age of 18 and 60 years, willing to give consent for lower abdominal surgeries. Exclusion criteria: Patient refusal, history of relevant local anesthetics allergy, ASA grading III and IV, patients receiving analgesic and opioids, patients with renal and liver disorder, local skin infection or disease and others, coagulation disorders, history of chronic drug or alcohol abuse, history of underlying psychological condition, history of pulmonary, cardiac, hematological, endocrinal and neuromuscular disease, and BMI >40.

All patients had a comprehensive history and physical examination in addition to the standard diagnostic tests. An IV line was placed using 18G cannula. Before giving the TAP block, several baseline variables such as blood pressure, pulse rate, and respiratory rate were noted. Every patient was preloaded with 1000 mL of Ringer lactate. Using a visual analog scale (VAS), we could determine the pain level at the start of the study. No pain on one end and as severe pain as it goes further on other end of the spectrum. The VAS ranges from 0 (no discomfort) to 10 (extreme misery). The mean onset time and duration of sensory and motor blocks were noted. The hemodynamic parameters along with the time of the first rescue analgesic and the total dose of rescue analgesic required in the first 24 h and any other complications were also noted. Continuous data were analyzed using Student's t-tests, whereas categorical data such as the time of onset and duration of the block were analyzed appropriately using the Chi-square test. $P<0.05$ was considered statistically significant and a $P<0.001$ as statistically highly significant.

RESULTS

The two study groups were comparable in gender, age, physical conditions such as weight, height, and BMI, and type of surgery of patients. Among 60 patients, there were 16 males (53.33%) and 14 females (46.67%) in the L group. In the LD group, the males were 19 (63.33%), and the females were 11 (36.67%). We observed no statistically significant difference in gender between groups ($P=0.40$).

Similarly, there was no statistically significant difference in age group, weight, height, BMI, and type of surgery between groups, shown by the $P=0.40$, 0.83, 0.37, 0.59, and 0.93, respectively (Table 1). The block was accomplished in all the patients with no significant difference between the two groups.

Among sixty patients, the mean duration of surgery in L group was 81.00 h, and in LD group, the duration was 78.77 h; suggesting no statistically significant difference in the duration of surgery between the two groups (P=0.63), whereas the mean onset of analgesia was delayed in the L group which was observed to be 17.03 h than in the LD group of 9.60 h, suggesting that there is a significant difference in the onset of analgesia between the groups (P=0.001). We also observed that the mean duration of analgesia in the L group was 412.90 h and in the LD group was 718 h, showing a significant difference in the duration of analgesia between the groups (P=0.001) proving the prolonged efficacy of analgesia in the presence of adjuvant (Table 2).

The mean of the total tramadol consumption in the L group was 293.33 mg and in the LD group was 116 mg, showing a significantly lesser dose of total tramadol consumption in the LD group (P=0.001). All other post-operative hemodynamic parameters were comparable between the two groups with no side effects.

Among sixty patients, there is no statistically significant difference in VAS at the 1st h and 2nd h, with a P=1.00 and 1.00 between the groups. However, there is a statistically significant difference in VAS at the 4th h, 6th h, 8th h, and 12th h, with a P=0.001, 0.001, 0.001, and 0.001, respectively (Table 3).

DISCUSSION

Our current study compared local anesthetic levobupivacaine (0.25%) alone and levobupivacaine (0.25%) with adjuvant dexmedetomidine (1 μg/kg) for enhanced anesthetic effect. The results of the study showed the enhanced analgesic effect of local anesthesia levobupivacaine when used with the adjuvant dexmedetomidine as post-operative analgesia in TAP block in infraumbilical surgeries.

Our findings are consistent with a previous study, where Varshney et al. found that reduced VAS scores and reduced post-operative rescue analgesia in Group levobupivacaine +

Table 1: Distribution of patient characteristics

Variable	Levobupivacaine (%)	Levobupivacaine+Dexmedetomidine (%)	P-value
Gender			
Male	16 (53.33)	19 (63.33)	0.40
Female	14 (46.67)	11 (36.67)	
Age group (years)			
18–30	10 (33.33)	16 (53.33)	0.40
31–40	9 (30.00)	8 (26.67)	
41–50	8 (26.67)	4 (13.33)	
51–60	3 (10.00)	2 (6.67)	
Weight			
41–50 kg	4 (13.33)	3 (10.00)	0.83
51–60 kg	7 (23.33)	10 (33.33)	
61–70 kg	11 (36.67)	9 (30.00)	
71–90 kg	8 (26.67)	8 (26.67)	
Height			
151–160 cm	13 (43.33)	11 (36.67)	0.37
161–170 cm	16 (53.34)	15 (50.00)	
171–180 cm	1 (3.33)	4 (13.33)	
BMI			
Underweight	0	0	0.59
Normal	20 (66.67)	18 (60.00)	
Overweight	10 (33.33)	12 (40.00)	
Type of surgery			
Acute appendicitis	16 (53.33)	16 (53.34)	0.93
Left Inguinal hernia	8 (26.67)	7 (23.33)	
Right inguinal hernia	6 (20.00)	7 (23.33)	

Table 2: The mean duration of surgery, the onset of analgesia, duration of analgesia and total tramadol consumption (mg) comparison between the two groups

Outcome	Levobupivacaine		Levobupivacaine+Dexmedetomidine		P-value
	Mean	SD	Mean	SD	
Duration of surgery	81.00	17.47	78.77	18.48	0.63
Onset of analgesia	17.03	2.85	9.60	1.85	0.001
Duration of analgesia	412.90	63.62	718.77	139.71	0.001
Total tramadol consumption (mg)	293.33	75.12	116.00	48.32	0.001

Table 3: VAS pain score

VAS score	Levobupivacaine		Levobupivacaine+Dexmedetomidine		P-value
	Mean	SD	Mean	SD	
1st h	0.00	0.00	0.00	0.00	1.00
2nd h	0.00	0.00	0.00	0.00	1.00
4th h	1.20	0.76	0.07	0.25	0.001
6th h	2.97	0.85	1.30	0.53	0.001
8th h	4.47	0.57	2.60	0.50	0.001
12th h	4.37	1.02	3.00	0.61	0.001
24th h	2.80	1.16	2.63	0.96	0.55

dexmedetomidine compared to group levobupivacaine and control. The data showed that 0.25% levobupivacaine with dexmedetomidine 1μg/kg in bilateral TAP block offered effective pain relief in the immediate post-op period. The use of dexmedetomidine enhanced pain management and increased patient satisfaction with no adverse effects.[6]

Similarly, Acharya et al. found that Group B (levobupivacaine 0.25% 20 mL+1 mcg/ kg clonidine) had more prolonged analgesia than Group A (levobupivacaine 0.25% alone) considerably. In contrast to Group A, all of Group B's patients expressed high satisfaction levels. In addition, the patients did not suffer from hypotension or bradycardia. The results showed that adding the clonidine group significantly increased the duration of post-operative analgesia, decreased the need for post-operative recovery analgesia, and enhanced maternal comfort.[7]

Sarvesh et al. have also reported similar results demonstrating that the RD group (18 mL of 0.375% ropivacaine+0.5 μg/kg dexmedetomidine) had prolonged post-operative analgesia than the R group (18 mL 0.375% ropivacaine). In addition, morphine consumption by the RD group over 24 h period decreased significantly compared to the R group. The results showed that dexmedetomidine when added to ropivacaine, increased the post-operative analgesia duration while significantly decreasing the need for opioids without increasing the risk of severe adverse effects.[8]

A similar study was performed by Kaygusuz et al., on sensory and motor block duration, time before initial analgesic usage, and the overall demand for analgesics, which were shown to be substantially longer in Group D (5% levobupivacaine 39 mL+1 mL dexmedetomidine). In addition, individuals in Group D had lower VAS values at 5, 10, and 12 h postoperatively compared to patients in Group L (39 mL levobupivacaine). Dexmedetomidine reduces total analgesic usage during axillary brachial plexus block without affecting sensory or motor block onset, duration, or period to first analgesic use.[9]

In a study by Singh et al., patients in Group II (levobupivacaine 0.5%+1 mL (100 μg) of dexmedetomidine) experienced long-lasting sensory and motor blockade than those in Group I (levobupivacaine 0.5%). In addition, Group II had much longer analgesic effects than Group I. Dexmedetomidine+levobupivacaine reduced sensory and motor block onset time and enhanced DOA without increasing adverse effects.[10]

Another study on supraclavicular plexus block showed better motor, sensory block, and much longer duration analgesia. Adding dexmedetomidine showed better onset of sensory and motor block compared to the use of levobupivacaine alone.[11] This is consistent with our observation in the current study. Furthermore, in another study, dexmedetomidine (1 μg/kg) has been used to study the VAS score at all post-operative time points. It was observed that the use of dexmedetomidine substantially lowered VAS scores, offered a more prolonged period until the first need for pain medication, and lowered total pain medication use (mg) compared to the use of levobupivacaine alone.[12] Still in another study, quicker onset of motor block durations, longer sensory, and more prolonged analgesia were observed when bupivacaine was used along with 1 μg/kg dexmedetomidine compared to bupivacaine alone for the supraclavicular block.[13]

Our results corroborate with the existing research, where we used 20 mL of levobupivacaine (0.25%) (n=30) in group L patients and 20 mL of levobupivacaine (0.25%) along with 1 μg/kg dexmedetomidine adjuvant in Group LD patients. We, therefore, found that dexmedetomidine enhances the anesthetic efficacy of levobupivacaine. The patient's group with (levobupivacaine+dexmedetomidine) required lesser doses of rescue analgesia than levobupivacaine alone. Both groups also observed a positive correlation with the VAS pain score, analgesia duration, and total consumption of tramadol. In addition, adding dexmedetomidine to 0.25%, levobupivacaine increased the efficacy of the block and duration of post-operative analgesia in surgeries.

Limitations of the study

The study was done on patients undergoing lower abdominal surgeries under subarachnoid block. The

analgesic effect was assessed after the level of anesthesia had receded to the T10 level, which is entirely subjective, rather than waiting for the complete recession of spinal anesthesia. Therefore, there may be some overlapping effects of SAB over the TAP block.

CONCLUSION

The present study concludes that, adding dexmedetomidine to 0.25% levobupivacaine enhanced the efficacy of the block and duration of post-operative analgesia compared to 0.25% levobupivacaine alone.

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