Original Article

A comparative evaluation of different doses of dexmedetomidine as an adjuvant to bupivacaine in transversus abdominis plane block for postoperative analgesia in unilateral inguinal hernioplasty

Rathi Mitesh Madangopal, Aashish Dang, Megha Aggarwal, Jay Kumar

Department of Anaesthesiology and Critical Care, NDMC Medical College and Associated Hindu-Rao Hospital, Delhi, India

Abstract

Background and Aims: The present study is designed to evaluate addition of two different doses of dexmedetomidine (0.25 mcg/kg and 0.5 mcg/kg) as an adjuvant to bupivacaine in transversus abdominis plane block for post-operative analgesia in patients undergoing unilateral inguinal hernioplasty.

Material and Methods: A total of 90 patients scheduled to undergo elective unilateral open inguinal hernioplasty were divided into three groups in a randomized triple blind way. In group B (n = 30), patients received TAP block using 22 ml of solution, consisting of 20 ml of 0.25% bupivacaine and 2 ml of normal saline; in group BD1 (n = 30), patients received TAP block using 22 ml of solution, consisting of 20 ml of 0.25% bupivacaine and dexmedetomidine 0.25 mcg/kg dissolved in 2 ml of normal saline; while in group BD2 (n = 30), patients received TAP block using 22 ml of solution, consisting of 20 ml of 0.25% bupivacaine and dexmedetomidine 0.5 mcg/kg dissolved in 2 ml of normal saline.

Results: Time to first analgesia was significantly prolonged in group BD2 (874.48 ± 118.28 minutes) as compared to BD1 (536.5 ± 60.35 minutes) and B (341.5 ± 46.22 minutes) ($P < 0.0001$). Total consumption of diclofenac was also reduced in BD2 (80.17 ± 19.34 mg) as compared with B (150 ± 0 mg) and BD1 (147.5 ± 13.69 mg) ($P < 0.001$). Patients in dexmedetomidine group were more sedated at 1-hour ($P < 0.05$). None of our patients required any intervention for hemodynamic changes which were significantly more in dexmedetomidine group.

Conclusion: Dexmedetomidine in a dose of 0.5 mcg/kg is better than dose of 0.25 mcg/kg as an adjuvant to 0.25% bupivacaine in transversus abdominis plane block for post-operative pain relief in unilateral inguinal hernioplasty. However, it causes mores sedation and hemodynamic changes.

Keywords: Dexmedetomidine, hernioplasty, post-operative analgesia, transversus abdominis plane block

Introduction

Inguinal hernioplasty is one of the most commonly performed surgical procedures associated with moderate to severe postoperative pain. Pain is because of incisional site pain (somatic) and visceral pain (deep intraabdominal).

Acute postoperative pain is a complex physiological reaction, and it is detrimental because it increases the patient's discomfort and may transform into chronic pain. Optimal postoperative analgesia is important to prevent negative outcomes. Nonsteroidal anti-inflammatory drugs (NSAIDs),

Address for correspondence: Dr. Aashish Dang,
Flat No. 4, New Doctors Flats, Hindu Rao Hospital,
Malka Ganj, Delhi - 110 001, India.
E-mail: dradang007@gmail.com

Access this article online

Quick Response Code:

Website: www.joacp.org

DOI: 10.4103/joacp.JOACP_26_19

How to cite this article: Madangopal RM, Dang A, Aggarwal M, Kumar J. A comparative evaluation of different doses of dexmedetomidine as an adjuvant to bupivacaine in transversus abdominis plane block for postoperative analgesia in unilateral inguinal hernioplasty. J Anaesthesiol Clin Pharmacol 2020;36:398-406.

Submitted: 31-Jan-2020 **Revised:** 04-Sep-2020
Accepted: 24-Oct-2020 **Published:** 16-Oct-2020

intravenous (IV) opioids, epidural analgesia, and regional blocks using local anesthetic (LA) agent, with or without adjuvants or with a continuous catheter, are the analgesic modalities recommended to relieve postoperative pain.[1]

The transversus abdominis plane (TAP) block is a peripheral nerve block that involves innervations of the anterolateral abdominal wall derived from T6-L1.[2] The block can be given either by anatomical landmark technique or by using an ultrasound probe. In anatomical technique, the landmark is "lumbar triangle of Petit." The needle-entry site is cephalic to iliac crest in this triangle. The local anesthetic is deposited in a plane between internal oblique and transversus abdominis muscle. It provides adequate postoperative analgesia following various abdominal surgeries.[3-6] The block duration is limited to the effect of administered LAs. The use of an infusion catheter to administer local anesthetic is an option to prolong the block's duration.[7] Recently, adjuvant medications like dexamethasone,[8] magnesium sulfate,[9] and dexmedetomidine[10] have been added to LA to prolong its effect.

Dexmedetomidine is a selective alpha-2 ($\alpha 2$) adrenergic receptor agonist with analgesic and sedative properties.[11] Its use with bupivacaine given intrathecally[12] epidurally[13] or in peripheral nerve blocks[14] is associated with prolongation of the effect of the LA.

Material and Methods

After obtaining the institutional ethical committee (IEC) approval, letter no. HRH/9806, dated 02/11/2016, this prospective randomized triple-blind controlled trial study was conducted. The study included 90 patients belonging to either sex and age group 18–60 years. Other parameters for inclusion were the American Society of Anesthesiologist physical status (ASA-PS) I or II, weight 50–80 kg, height 150–180 cm, and patients undergoing elective unilateral inguinal hernioplasty under the subarachnoid block (SAB).

The sample size was calculated using a study conducted by Rai *et al.*[15] Taking the time to first analgesic requirement as reference and minimum required sample size with 90% power of study and 5% level of significance is 27 patients in each study group. To reduce margin of error, the total sample size taken was 90 (30 patients per group).

All patients were subjected to preanesthetic check-up. The exclusion criteria were patients who refused to participate in the study; contraindications of the SAB; history of cardiac, respiratory, renal, or hepatic diseases; allergy to study medication or LAs; and/or consuming adrenoreceptors agonist or antagonist.

The study participants fasted overnight for 8 h. Written informed consent was obtained for surgery and participation in study, and the participants were preoperatively explained in brief about the anesthetic technique, including the TAP block, and visual analog score (VAS). The night before the surgery, tablet alprazolam 0.5 mg and ranitidine 150 mg were given perorally. Upon arrival in the operating room, standard monitors, including heart rate (HR), non-invasive blood pressure (NIBP), electrocardiogram (ECG), and blood oxygen saturation (SpO2), were applied; preoperative vitals were recorded; IV line was secured; and ringer lactate was started. Under strict asepsis, the SAB was given using 25G Quincke spinal needle with 3 ml 0.5% heavy bupivacaine in the L3–L4 interspace. The surgery was started after achieving level of block at T6. Vitals were monitored continuously during the procedure.

After the completion of the surgery, when the level of SAB receded to the T10 level, TAP block was given on the side of surgery by using anatomical landmark double-pop technique with blunt regional anesthesia needle (22G, B. Braun, Stipulex). Using block randomization with the sealed envelope system, 30 patients each were allotted into three groups. Fifteen randomly generated treatment allocations were prepared in sealed opaque envelopes, assigning A, B, and C in five envelopes each. One label represented the group receiving dexmedetomidine 0.25 mcg/kg as an adjuvant to 0.25% bupivacaine; the second label represented the group receiving dexmedetomidine 0.5 mcg/kg as an adjuvant to 0.25% bupivacaine; and the last label represented the group receiving 0.25% bupivacaine. Once the patient gave consent to enter the trial, an envelope was opened and he/she was allocated in a group. In this technique, patients were randomized in a series of blocks of 15, i.e., for every 15 randomized patients, 5 received dexmedetomidine 0.25 mcg/kg as an adjuvant to 0.25% bupivacaine, the next 5 received dexmedetomidine 0.5 mcg/kg as an adjuvant to 0.25% bupivacaine, and the remaining 5 patients received 0.25% bupivacaine. Neither the patient nor the investigator recording the readings and the doctor giving the drug was aware of which label represented which group, making the study triple blinded. The anesthesiologist who prepared the drugs was not involved in the study.

Group B (Control)- Patients (n = 30) received TAP block using 22 ml solution—consisting of 20 ml 0.25% bupivacaine and 2 ml normal saline.

Group BD1- Patients (n = 30) received TAP block using 22 ml solution—consisting of 20 ml 0.25% bupivacaine and 0.25 mcg/kg dexmedetomidine dissolved in 2 ml normal saline.

Group BD2- Patients ($n = 30$) received TAP block using 22 ml solution—consisting of 20 ml 0.25% bupivacaine and 0.5 mcg/kg dexmedetomidine dissolved in 2 ml normal saline.

After the completion of the block, its success was assessed every 5 min by loss of cold sensation using an alcohol swab on the side of the block as compared with the opposite side. Any patient without the loss of cold sensation even after 30 min of block administration meant that the block had failed and that the patient was excluded from the study. Patients were monitored postoperatively in the postanesthesia care unit (PACU) for 24 h. The following parameters were recorded at 0, 5, 10, 15, 20, 25, 30, and 45 min and 1, 1 ½, 2, 2 ½, 3, 4, 6, 12 and 24 h:

1. HR
2. Mean arterial pressure (MAP)
3. Respiratory rate (RR)
4. SpO2
5. VAS
6. Ramsay sedation score (RSS)
7. Time to the first request of analgesia
8. Total analgesic consumption
9. Any other observations.

Slow IV diclofenac 75 mg was used as the first analgesia whenever the VAS was >3 in the 24 h, and its first requirement time was recorded. If VAS of >3 persisted after 30 min of diclofenac, then IV tramadol 1.5 mg/kg along with IV ondansetron 4 mg were given. Any clinically significant bradycardia and hypotension were treated.

Statistical analysis

All data were entered in a Microsoft Excel spreadsheet and analyzed using the Statistical Package for the Social Sciences (SPSS) software, version 21. Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean ± standard deviation (SD) and median. The normality of data was tested by the Kolmogorov–Smirnov test (KS test). If the normality was rejected, then a nonparametric test was used. Quantitative variables were compared using the independent T-test/Mann–Whitney U test (when the data sets were not normally distributed) between the two groups, and the analysis of variance (ANOVA)/Kruskal–Wallis test was applied between the three groups (B, BD1, and BD2), and paired t-test/Wilcoxon test was used for comparison within the group across follow-up. Qualitative variables were correlated using the Chi-Square test/Fisher exact test. A $P < 0.05$ was considered statistically significant.

Results

All the patients were comparable in terms of age, sex, height, weight, ASA-PS grade, preoperative vitals, comorbidities, duration of surgery, time between administration of SAB and TAP block, and time to block onset [Table 1].

There was a fall in the HR of patients who received dexmedetomidine in the TAP block, and the difference in the mean HR was significant with $P < 0.05$ at 45 min to 2 h in between the three groups and between groups B and BD1. The difference in the mean HR was significant at 45 min to 2½ h between groups B and BD2 with $P < 0.05$. The fall in the HR was higher in groups BD2 than BD1 at 1 to 2 h with $P < 0.05$, which was statistically significant. In group B, there was no fall in HR as compared with the baseline. In group BD1, there was a fall in the HR at 45 min to 2 h as compared with the baseline with $P < 0.0001$, which was highly significant. One patient had an HR of 56 at 45 min, eight patients had HR below 60 at 1 h, and three patients had HR below 60 at 1½ h. In group BD2, there was a fall in the HR at 45 min to 2 h as compared with the baseline with $P < 0.0001$, which was highly significant. One patient had an HR of 58 at 45 min, sixteen patients had HR below 60 at 1 h, three patients had HR below 60 at 1½ h, and one patient had HR of 58 at 2 h [Tables 2, 3 and Figure 1].

The mean values of MAPs were comparable within the three groups with $P > 0.05$ at all times of observation. In all the patients, the MAPs were lower than the preoperative values for the initial 30 min after the administration of the TAP block, and the difference between the means was statistically significant, with $P < 0.05$. However, in patients who received the TAP block with 0.5 mcg/kg dexmedetomidine (group BD2), it remained low until 2½ h, with $P < 0.05$, which was statistically significant, and in patients who received the TAP block with 0.25 mcg/kg dexmedetomidine (group BD1), it remained low until 1½ h, with $P < 0.05$, which was significant statistically. After 30 min in group B, 1½ h in group BD1, and 2½ h in group BD2, the mean values

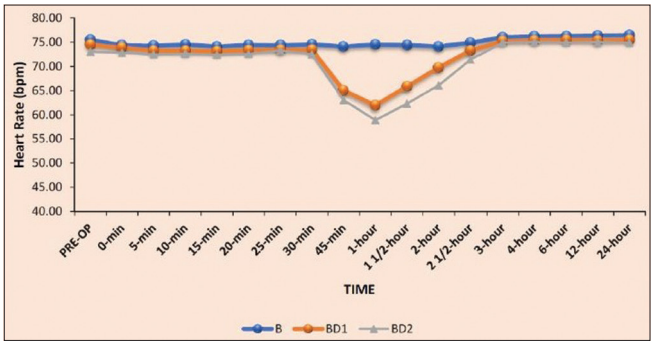

Figure 1: Mean heart rate among the three groups recorded at different time intervals. Mean heart rate recorded was lower in patients receiving dexmedetomidine (in both doses) as compared with plain bupivacaine ($P < 0.05$)

Table 1: Comparison of demographic variable, preoperative vitals, duration of surgery, and time between SAB and tap block

Mean±SD	B (*n*=30)	BD1 (*n*=30)	BD2 (*n*=30)	*P*	B vs BD1	B vs BD2	BD1 vs BD2
Age (in years)	39.17±11.16	38.03±10.39	36.3±9.1	0.554	0.685	0.28	0.495
Height (in cm)	164.27±6.45	163.3±5.35	165.7±6.34	0.31	0.53	0.389	0.119
Weight (in kg)	69.83±6.63	69.17±5.46	67.53±7.15	0.369	0.672	0.202	0.324
Pulse (bpm)	75.47±7.65	74.47±4.75	73.00±5.72	0.273	0.344	0.125	0.428
MAP (mmHg)	92.24±5.67	91.58±4.02	91.69±4.44	0.424	0.212	0.327	0.824
RR (per min)	12.23±0.63	12.13±1.01	12.00±0.53	0.352	0.43	0.091	0.734
SpO_2 (%)	99.20±0.61	99.20±0.48	99.27±0.52	0.868	0.915	0.714	0.591
Duration of Surgery (in min)	68.63±16.76	68±16.65	68.1±13.52	0.979	0.886	0.838	0.966
Time between SAB to TAP block	109.23±16.14	113.83±13.29	114.5±13.52	0.558	0.233	0.176	0.848
ASA-PS							
Grade - I	17 (56.67%)	19 (63.33%)	19 (63.33%)	0.829	0.598	0.598	1
Grade - II	13 (43.33%)	11 (36.67%)	11 (36.67%)				

**Significant. **highly significant ***very highly significant. SAB=Subarachnoid block, SD=Standard deviation, bpm=Beats per minute, MAP=Mean arterial pressure, RR=Respiratory rate, SpO2=Blood oxygen saturation, TAP=Transversus abdominis plane, ASA-PS=American Society of Anesthesiologist physical status*

Table 2: HR trend-intergroup comparison

Mean±SD (bpm)	B (*n*=30)	BD1 (*n*=30)	BD2 (*n*=30)	*P*	B vs BD1	B vs BD2	BD1 vs BD2
0 min	74.33±7.77	73.87±5.89	72.8±6.61	0.671	0.794	0.414	0.512
5 min	74.27±7.89	73.27±6.16	72.47±6.64	0.460	0.361	0.252	0.666
10 min	74.47±7.57	73.20±6.18	72.6±3.86	0.391	0.414	0.177	0.571
15 min	74.13±7.05	73.13±5.37	72.4±3.91	0.244	0.405	0.326	0.540
20 min	74.40±8.13	73.33±6.22	72.53±3.75	0.499	0.559	0.241	0.549
25 min	74.33±7.95	73.47±6.08	73.27±2.99	0.658	0.413	0.445	0.982
30 min	74.53±7.61	73.4±5.2	72.47±3.9	0.346	0.448	0.147	0.478
45 min	74.13±7.06	65±4.72	63±2.56	<.0001***	<.0001***	<.0001***	0.116
1 h	74.47±6.72	61.93±4.08	58.87±2.08	<.0001***	<.0001***	<.0001***	0.001***
1 ½ h	74.4±7.74	65.8±5.1	62.27±1.8	<.0001***	0.0001***	<.0001***	0.003***
2 h	74.13±7.06	69.73±4.2	66.07±2.55	<.0001***	0.005***	<.0001***	0.0001***
2 ½ h	74.87±7.51	73.27±6.2	71.4±2.11	0.060	0.305	0.025*	0.123
3 h	76.03±7.09	75.27±2.13	74.93±2.77	0.222	0.186	0.123	0.548
4 h	76.17±6.85	75.4±2.4	75.01±2.82	0.240	0.208	0.132	0.523
6 h	76.23±6.98	75.47±2.3	74.93±2.62	0.221	0.173	0.142	0.413
12 h	76.37±7.15	75.33±2.52	75.08±2.88	0.268	0.124	0.175	0.555
24 h	76.43±6.86	75.47±3.98	74.87±3.38	0.188	0.183	0.101	0.459

**Significant **highly significant ***very highly significant. HR=Heart rate, SD=Standard deviation*

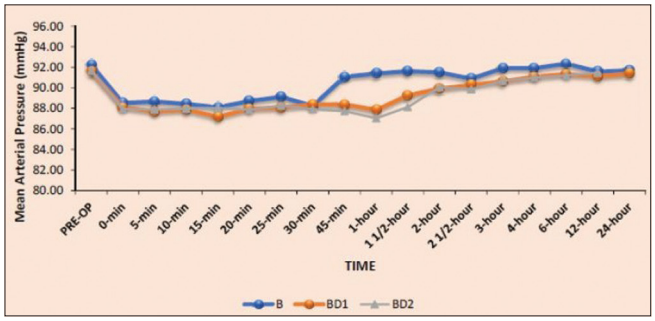

Figure 2: Mean arterial pressure among the three groups recorded at different time intervals. Mean arterial pressure recorded remained below the baseline in patients receiving dexmedetomidine (in both doses) for a long period as compared with plain bupivacaine ($P < 0.05$)

of the MAPs were comparable to the preoperative pressures, with $P > 0.05$, which was not significant statistically [Tables 4, 5 and Figure 2].

There was no episode of hypoxemia or respiratory depression in any patients during the study and all the patients were comparable.

No patient required any intervention for HR and MAP changes as all were clinically stable.

The patients in the dexmedetomidine group were more sedated at 1 h with median values of RSS of 3 (3–3) in group B, 4 (4–4) in group BD1, and 4 (4–4) in group BD2. The difference was statistically significant with *a P* value of 0.023 between the three groups, 0.040 between groups B and BD1, and 0.005 between groups B and BD2; however, it was not statistically significant between the groups BD1 and BD2 wit*h P* value of 0.321 [Table 6 and Figure 3].

Table 3: HR trend-intragroup comparison

Pulse	Group B		Group BD1		Group BD2	
	Mean±SD	*P*	Mean±SD	*P*	Mean±SD	*P*
Preop	75.47±7.65		74.47±4.75		73.00±5.72	
0 min	74.33±7.77	0.170	73.87±5.89	0.356	72.8±6.61	0.638
5 min	74.27±7.89	0.161	73.27±6.16	0.127	72.47±6.64	0.426
10 min	74.47±7.57	0.173	73.20±6.18	0.111	72.6±3.86	0.818
15 min	74.13±7.05	0.282	73.13±5.37	0.287	72.4±3.91	0.591
20 min	74.40±8.13	0.175	73.33±6.22	0.100	72.53±3.75	0.849
25 min	74.33±7.95	0.172	73.47±6.08	0.219	73.27±2.99	0.885
30 min	74.53±7.61	0.173	73.4±5.2	0.132	72.47±3.9	0.646
45 min	74.13±7.06	0.293	65±4.72	<.0001***	63±2.56	<.0001***
1 h	74.47±6.72	0.282	61.93±4.08	<.0001***	58.87±2.08	<.0001***
1½ h	74.4±7.74	0.173	65.8±5.1	<.0001***	62.27±1.8	<.0001***
2 h	74.13±7.06	0.467	69.73±4.2	0.0001***	66.07±2.55	0.0001***
2½ h	74.87±7.51	0.936	73.27±6.2	0.070	71.4±2.11	0.180
3 h	76.03±7.09	0.828	75.27±2.13	0.461	74.93±2.77	0.129
4 h	76.17±6.85	0.766	75.4±2.4	0.382	75.01±2.82	0.092
6 h	76.23±6.98	0.681	75.47±2.3	0.357	74.93±2.62	0.103
12 h	76.37±7.15	0.655	75.33±2.52	0.372	75.08±2.88	0.115
24 h	76.43±6.86	0.271	75.47±3.98	0.349	74.87±3.38	0.171

**significant **highly significant ***very highly significant. HR=Heart rate, Preop=Preoperative, SD=Standard deviation*

Table 4: MAP trend-intergroup comparison

Mean±SD (mmHg)	B (*n*=30)	BD1 (*n*=30)	BD2 (*n*=30)	*P*	B vs BD1	B vs BD2	BD1 vs BD2
0 min	88.51±5.6	88.11±4.4	87.93±4.6	0.246	0.199	0.213	0.112
5 min	88.67±5.1	87.69±4.6	87.89±4.1	0.220	0.317	0.126	0.370
10 min	88.44±5.2	87.87±4.7	87.98±3.9	0.197	0.418	0.100	0.224
15 min	88.11±4.9	87.18±5.7	88.02±3.7	0.341	0.768	0.319	0.122
20 min	88.71±5.4	87.96±5.3	87.87±4.4	0.262	0.678	0.125	0.224
25 min	89.11±6.1	88.07±4.6	88.27±4	0.092	0.761	0.054	0.081
30 min	88.24±5.1	88.38±4.5	87.91±3.5	0.314	0.764	0.303	0.081
45 min	91.07±5.8	88.4±4.4	87.73±4.2	0.539	0.495	0.573	0.299
1 h	91.38±5.5	87.84±4.3	87.04±5	0.837	0.870	0.568	0.672
1 ½ h	91.62±5.4	89.27±4.7	88.13±4.6	0.199	0.568	0.080	0.232
2 h	91.51±5.6	89.91±4.9	90.07±4.6	0.764	0.727	0.514	0.603
2 ½ h	90.89±4.7	90.27±4.4	89.84±4.8	0.558	0.315	0.603	0.489
3 h	91.91±5.7	90.64±4.8	90.69±4.4	0.369	0.431	0.624	0.144
4 h	91.91±5.4	91.07±4.7	91.13±4.4	0.138	0.056	0.603	0.159
6 h	92.36±4.5	91.33±4.9	91.2±4.3	0.328	0.139	0.265	0.388
12 h	91.58±4.8	91.13±5.2	91.49±4.8	0.517	0.281	0.959	0.367
24 h	91.71±4.7	91.36±5.2	91.13±5.2	0.322	0.131	0.509	0.411

**significant **highly significant ***very highly significant. MAP=Mean arterial pressure, SD=Standard deviation*

The pain perceived by the patients in terms of the VAS started rising after 1½ h in group B, 2 h in group BD1, and 2½ h in group BD2. The difference was statistically significant between the three groups at 1½ to 6 h with $P < 0.05$ and groups BD1 and BD2 at 2 to 6 h [Table 7 and Figure 4].

The time to block onset was comparable between the three groups with mean values of 21 ± 2.75 min in group B, 19.33 ± 2.86 min in group BD1, and 20.33 ± 3.46 min in group BD2.

There was a significant difference in the duration of analgesia with the time to the first analgesia required in group B being 341.5 ± 46.22 min, group BD1 536.5 ± 60.35 min, and group BD2 874.48 ± 118.28 min and $P < 0.0001$, which was highly significant. The total consumption of diclofenac was significantly reduced in group BD2 (80.17 ± 19.34 mg) as compared with group B (150 ± 0 mg) and group BD1 (147.5 ± 13.69 mg), with $P < 0.001$ between the three groups, groups B and BD2, and groups BD1 and BD2, which was significant statistically. The difference between group B and BD1 was not significant with *P* value of 0.317. Out of

Table 5: MAP trend-intragroup comparison

	Group B		Group BD1		Group BD2	
	Mean±SD	*P*	Mean±SD	*P*	Mean±SD	*P*
Preop	92.24±5.6		91.58±4.02		91.69±4.44	
0 min	88.51±5.6	<.0001***	88.11±4.4	0.0002***	87.93±4.6	<.0001***
5 min	88.67±5.1	<.0001***	87.69±4.6	0.0003***	87.89±4.1	<.0001***
10 min	88.44±5.2	<.0001***	87.87±4.7	<.0001***	87.98±3.9	<.0001***
15 min	88.11±4.9	<.0001***	87.18±5.7	0.0001***	88.02±3.7	<.0001***
20 min	88.71±5.4	0.0002***	87.96±5.3	0.001***	87.87±4.4	<.0001***
25 min	89.11±6.1	0.0003***	88.07±4.6	0.0003***	88.27±4	0.0001***
30 min	88.24±5.1	<.0001***	88.38±4.5	0.001***	87.91±3.5	<.0001***
45 min	91.07±5.8	0.056	88.4±4.4	0.001***	87.73±4.2	<.0001***
1 h	91.38±5.5	0.130	87.84±4.3	0.0002***	87.04±5	<.0001***
1½ h	91.62±5.4	0.267	89.27±4.7	0.015*	88.13±4.6	<.0001***
2 h	91.51±5.6	0.225	89.91±4.9	0.073	90.07±4.6	0.019*
2½ h	90.89±4.7	0.189	90.27±4.4	0.130	89.84±4.8	0.002*
3 h	91.91±5.7	0.283	90.64±4.8	0.264	90.69±4.4	0.085
4 h	91.91±5.4	0.237	91.07±4.7	0.588	91.13±4.4	0.293
6 h	92.36±4.5	0.969	91.33±4.9	0.680	91.2±4.3	0.767
12 h	91.58±4.8	0.379	91.13±5.2	0.553	91.49±4.8	0.223
24 h	91.71±4.7	0.138	91.36±5.2	0.713	91.13±5.2	0.318

**significant **highly significant ***very highly significant. MAP=Mean arterial pressure, SD=Standard deviation*

Table 6: RSS among the three groups

Mean±SD	B (*n*=30)	BD1 (*n*=30)	BD2 (*n*=30)	*P*	B vs BD1	B vs BD2	BD1 vs BD2
0 min	2±0	2±0	2±0	1.000	1.000	1.000	1.000
5 min	2±0	2±0	2±0	1.000	1.000	1.000	1.000
10 min	2±0	2±0	2±0	1.000	1.000	1.000	1.000
15 min	2±0	2±0	2±0	1.000	1.000	1.000	1.000
20 min	2±0	2±0	2±0	1.000	1.000	1.000	1.000
25 min	2±0	2±0	2±0	1.000	1.000	1.000	1.000
30 min	2±0	2±0	2±0	1.000	1.000	1.000	1.000
45 min	2±0	2.03±0.18	2.1±0.31	0.442	0.326	0.092	0.310
1 h	2±0	2.13±0.35	2.27±0.45	0.023*	0.040*	0.005**	0.321
1 ½ h	2±0	2±0	2±0	1.000	1.000	1.000	1.000
2 h	2±0	2±0	2±0	1.000	1.000	1.000	1.000
2 ½ h	2±0	2±0	2±0	1.000	1.000	1.000	1.000
3 h	2±0	2±0	2±0	1.000	1.000	1.000	1.000
4 h	2±0	2±0	2±0	1.000	1.000	1.000	1.000
6 h	2±0	2±0	2±0	1.000	1.000	1.000	1.000
12 h	2±0	2±0	2±0	1.000	1.000	1.000	1.000
24 h	2±0	2±0	2±0	1.000	1.000	1.000	1.000

**Significant **highly significant ***very highly significant. RSS=Ramsay sedation score, SD=Standard deviation*

30 patients in each group, all 30 patients (100%) required 2 doses of diclofenac in group B, 29 patients (96.67%) required 2 doses and 1 patient (3.33%) required 1 dose of diclofenac in group BD1 and 28 patients (93.33%) required 1 dose, 1 patient (3.33%) required 2 doses and 1 patient (3.33%) did not require any analgesia in group BD2.

Two patients required tramadol in group B with a mean consumption of 115 ± 7.07 mg and one patient required tramadol in group BD2 with consumption of 100 mg, and the difference was not significant with the *P* value of 0.221. No patient required tramadol in group BD1 [Table 8].

Discussion

Dexmedetomidine is an α-2 agonist that has numerous beneficial effects when added as an adjuvant in neuraxial blocks, peripheral nerve blocks, or intravenous regional anesthesia. The exact mechanism by which dexmedetomidine and other α2 agonists potentiate LAs is not well-understood. The effect of α2 agonists maybe because of spinal,

supraspinal, or peripheral mechanisms. At the spinal level, the α2 agonists inhibit pain by inhibiting release of substance *P* in the nociceptive pathway at the level of the dorsal root neurons.[16,17] The α2 agonists produce analgesia by activating α2-adrenoreceptors in locus coeruleus at the supraspinal level.[18] The local vasoconstrictive effects of dexmedetomidine because of α2 agonism may prolong the duration of analgesia by reducing the systemic absorption of the LA from the effect site.[19] Masuki, *et al.*[20] in 2005 also suggested that dexmedetomidine delays the absorption of the LA; hence, it prolongs its effect by possibly causing local vasoconstriction via α2 adrenoceptors around the site of injection in the human forearm. Several studies have shown that the addition of dexmedetomidine to the LA in a TAP block helps achieve better analgesia and decreases the total dose of analgesics required postoperatively without any side effects.

Most studies[10,15,21] have used either 1 mcg/kg or 0.5 mcg/kg of dexmedetomidine as an adjuvant to the LA in a TAP block. However, we have selected different doses of dexmedetomidine to evaluate whether the addition of a lesser dose of

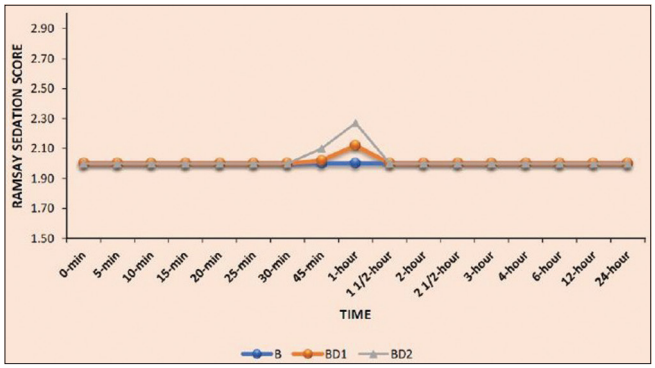

Figure 3: Ramsay sedation score among the three groups recorded at different time intervals. Patients receiving dexmedetomidine (in both doses) were more sedated at 1 h as compared with plain bupivacaine ($P < 0.05$)

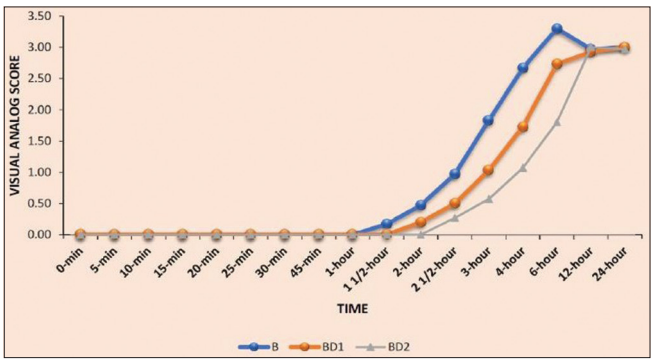

Figure 4: Visual analog score among the three groups recorded at different time intervals. The visual analog scores started rising after 1½ h in group B, 2 h in group BD1, and 2½ h in group BD2

Table 7: VAS among the three groups

Mean±SD	B (*n*=30)	BD1 (*n*=30)	BD2 (*n*=30)	*P*	B vs BD1	B vs BD2	BD1 vs BD2
0 min	0±0	0±0	0±0	1.000	1.000	1.000	1.000
5 min	0±0	0±0	0±0	1.000	1.000	1.000	1.000
10 min	0±0	0±0	0±0	1.000	1.000	1.000	1.000
15 min	0±0	0±0	0±0	1.000	1.000	1.000	1.000
20 min	0±0	0±0	0±0	1.000	1.000	1.000	1.000
25 min	0±0	0±0	0±0	1.000	1.000	1.000	1.000
30 min	0±0	0±0	0±0	1.000	1.000	1.000	1.000
45 min	0±0	0±0	0±0	1.000	1.000	1.000	1.000
1 h	0±0	0±0	0±0	1.000	1.000	1.000	1.000
1 ½ h	0.17±0.38	0±0	0±0	0.005**	0.021*	0.021*	1.000
2 h	0.47±0.57	0.2±0.41	0±0	0.0002***	0.048*	0.0001***	0.010**
2 ½ h	0.97±0.67	0.5±0.51	0.27±0.45	<.0001***	0.006**	<.0001***	0.045*
3 h	1.83±0.65	1.03±0.56	0.57±0.5	<.0001***	<.0001***	<.0001***	0.002*
4 h	2.67±0.61	1.73±0.52	1.07±0.45	<.0001***	<.0001***	<.0001***	<.0001***
6 h	3.3±0.65	2.73±0.45	1.8±0.48	<.0001***	0.0004***	<.0001***	<.0001***
12 h	2.97±0.41	2.93±0.37	3±0.59	0.870	0.748	0.807	0.617
24 h	3±0	3±0	2.97±0.18	0.368	1.000	0.317	0.317

**significant **highly significant ***very highly significant. VAS=Visual analog score, SD=Standard deviation*

Table 8: Time to first analgesic requirement and consumption of diclofenac and tramadol

Mean±SD	B (*n*=30)	BD1 (*n*=30)	BD2 (*n*=30)	*P*	B vs BD1	B vs BD2	BD1 vs BD2
Time to the first analgesia required	341.5±46.22	536.5±60.35	874.48±118.28	<.0001***	<.0001***	<.0001***	<.0001***
Diclofenac consumption	150±0	147.5±13.69	80.17±19.34	<.0001***	0.317	<.0001***	<.0001***
Tramadol consumption	115±7.07	0±0	100±0	0.221	-	0.221	-

**significant **highly significant ***very highly significant. SD=Standard deviation*

dexmedetomidine (0.25 mcg/kg) is as effective as 0.5 mcg/kg in terms of the quality of analgesia.

The major finding of our study was that the addition of dexmedetomidine provides better analgesia by prolonging the duration of analgesia, decreasing the dose of analgesic required, and providing better VASs. However, the dose of 0.5 mcg/kg as compared with 0.25 mcg/kg significantly prolongs the duration of analgesia. In addition, it decreases the dose of additional analgesics required with better VASs but at the cost of a significant fall in the HR and BP with more sedation, which requires close monitoring. However, all the patients were hemodynamically stable and none required any intervention for the fall in the HR and BP in any of the three groups.

Our results were similar to the study of Rai *et al*.[15] in which the mean value of VAS was significantly reduced during the first 8 h; the time to first analgesia was prolonged (280 vs 190 min); there was a reduction in total tramadol consumption (71 vs 98 mg); and there was more sedation in ropivacaine with dexmedetomidine group as compared with ropivacaine group, with $P < 0.05$, which was statistically significant.

Kaki and Almarakbi[10] also found a significantly lower VAS in the first 8 h, prolonged analgesia (470 vs 280 min), and lesser consumption of morphine (19 vs 29 mg) when bupivacaine was used with dexmedetomidine than bupivacaine alone. The patients in the dexmedetomidine groups were having lower HRs after 60 min of the block and this continued for 4 h.

After going through the literature, we could not find any study about proper assessment of success of TAP block, which was given either after induction of general anesthesia or regional anesthesia, prior to incision or postsurgically. We administered TAP block postoperatively when the level of SAB regressed to T10, enabling proper assessment of block onset and comparison with opposite side for success of block. However, we could not find any statistically significant difference in the three groups in the mean time to the block onset, suggesting that the addition of dexmedetomidine does not have a significant effect on the onset of the TAP block.

Our study has some limitations. First, we could not visualize the realtime administration of the TAP block because of the lack of an ultrasound machine for regional anesthesia in our institute. Second, we could not comment whether the action of dexmedetomidine was related to its systemic absorption or pure local effect because of unavailability to estimate its plasma concentration.

Although we did not encounter any failure in our study, because the block was performed by experienced hands, the use of ultrasonography (USG) is beneficial as it improves the efficacy and reliability of block. As dexmedetomidine has shown to improve the duration and quality of postoperative analgesia, we strongly feel that there is a scope for further research using different concentrations of dexmedetomidine with bupivacaine to define optimal and safe dose with large sample size.

Conclusion

Dexmedetomidine as an adjuvant to bupivacaine in the TAP block prolongs the duration of analgesia with improvement in the VAS. Thus, dexmedetomidine in a dose of 0.5 mcg/kg is better than a dose of 0.25 mcg/kg as an adjuvant to 0.25% bupivacaine in a TAP block for postoperative pain relief in unilateral inguinal hernioplasty.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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