Original Research Article

Evaluation of efficacy of addition of dexmedetomidine in USG guided Transverse Abdominis Plane (TAP) block for postoperative pain relief in open unilateral elective inguinal herniorrhaphy: A prospective, randomized, controlled study

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Abstract

Objective: Transversus abdominis plane (TAP) block under ultrasound (US) guidance has been proved to be an effective method for providing post surgical analgesia for lower abdominal surgeries. Dexmedetomidine, an α2 adrenergic agonist enhances the speed of onset, duration of analgesia and decreases the dose of local anesthetic used when coadministered with local anesthetics. In the current study we evaluated the efficacy of addition of dexmedetomidine in USG guided TAP block for postoperative pain relief in open unilateral elective inguinal herniorrhaphy. **Materials and Methods**: Fifty patients undergoing open unilateral inguinal herniorraphy surgeries were divided into two groups of each 25. In all patients, surgery was done under spinal analgesia using 3 ml 0.5% bupivacaine heavy. In Group A, 1.5 micg/kg dexmedetomidine was added to local anaesthetic solution and in Group B, 1ml saline was added to local anaesthetic solution. **Results**: Patients in group A had lower visual analogue scale (VAS) pain scores during 24 hours postoperative period compared with group B. Also there was a difference with regard to time of the first postoperative request of analgesia in group A than group B. There was no significant difference among both groups regarding adverse events such as bradycardia, hypotension, sedation, pruritis, and nausea and vomiting. **Conclusion**: In open inguinal herniorrhaphy, US guided TAP block with dexmedetodine and Bupivacaine provided superior analgesia than when bupivacaine administered alone.

Key words: Transversus Abdomins Plane block, Ultrasound Guided, Dexmedetomidine, Herniorrhaphy

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INTRODUCTION

The surgical treatment of inguinal hernia is one of the most commonly performed surgical procedures, around the world[1]. But however postoperative pain is now recognized as one of the major problems related to inguinal hernia repair, as it directly affects the quality of life of patients[2]. The major goal in the management of post-operative pain is minimizing the dose of medications to lessen side effects while still providing adequate analgesia[3]. The transversus abdominis plane (TAP) block is a novel, rapidly expanding regional anaesthesia technique that provides analgesia to

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the parietal peritoneum as well as the skin and muscles of the anterior abdominal wall following abdominal surgery[4]. It has become increasingly popular worldwide because of its relative simplicity and efficacy[5]. The use of ultrasound improves the success rate and accuracy of nerve blocks and prevents potential complications[6,7]. Addition of adjuvant to local anesthesia may prolong the block's duration[8]. Dexmedetomidine is a selective alpha-2 adrenergic agonist with both analgesic and sedative properties. When administered as a perineural adjuvant, dexmedetomidine reduces initial blocking time whilst prolonging sensory and motor blockade duration[9,10]. Currently, in view of the paucity of evidence supporting the use of dexmedetomidine in regional anaesthesia, a study was conducted in Aarupadai Veedu medical college from January 2019 to October 2019, to study the efficacy of addition of dexmedetomidine in TAP block using bupivacaine in prolonging the analgesia in elective open unilateral herniorhaphy surgeries.

MATERIALS AND METHODS

Subsequent to receiving institutional ethical committee approval, registrations at clinical trials registry CTRI/2018/12/016815 [Registered on: 31/12/2018], and after obtaining written informed consent from patients, American Society of Anesthesiologists (ASA) I–II patients undergoing elective unilateral inguinal hernioplasty were enrolled into the study. Patients of 18–50 years of both genders with normal range of BMI were selected into the study. A controlled, randomized, prospective study was carried out, and blinding was applied both to participant and the outcome assessor. Patients with ASA III and above, Obese, underweight subjects(BMI), pregnant women, patients with bleeding and clotting disorders, allergic to local anesthetic agents, inadequate spinal blockade supplemented by other drugs, complicated surgeries and technically difficulty for TAP block were excluded from the study To assess pain, visual analogue scale (VAS) (0–10 cm) was utilized and instructions were given for all patients in the context of pain assessment from 0 to 10, with 0 indicating no pain and 10 indicating the worst pain imaginable during pre anaesthetic visit in the evening prior to surgery. Fifty patients were randomly assigned to two groups, group A and group B. The randomization was computer generated. The method of concealment was pre-numbered identical Containers. In both the groups, patients underwent a routine preoperative evaluation on the evening before surgery. Informed consent was obtained after explanation of the procedure to the patients. Patients were shifted to operation theater complex on the day of surgery. Noninvasive monitors such as an electrocardiogram, noninvasive blood pressure (BP), and pulse oximeter were connected. The subarachnoid block was performed by the operator using 26G Quincke's spinal needle in all patients in sitting position in L_3–L_4 space with 3 ml of 0.5% hyperbaric bupivacaine. Ultra sonography guided Transverse Abdominis Plane (TAP) block was performed at the end of the procedure. TAP block was performed under strict aseptic precautions after cleaning the site of injection with antiseptic solution. TAP block was performed using Sonosite M-Turbo machine, with linear array probe L38 (5–10 MHz). Muscle layers were identified in the midaxillary line, and using 22 G, 80 mm, SonoPlex cannula (Pajunk) was used for performing the block. The layers were first confirmed with hydrodissection using 5 ml of normal saline. Following this, the local anaesthetic was deposited in the fascial layer between transversus abdominis and internal oblique muscles. Group A received TAP block with 0.5% bupivacaine 15ml and dexmedetomidine 1.5 µg /kg. Group B received TAP block with 0.5% bupivacaine 15 ml and 1 ml saline. At the completion of the TAP block, sterile dressing was applied to the operative wound and patient blood pressure, heart rate and VAS were recorded. None of the patients in either group had any complications intraoperatively. Patient was then transferred to the recovery room, and baseline vital parameters were recorded. The outcome assessor and the patient were blinded about the randomization. Blood pressure, heart rate and Respiratory rateSpO2were monitored. Inj. Ephedrine 6 mg i.v. stat was given if the systolic blood pressure falls below 90 mmHg or below 20% of baseline systolic blood pressure. Inj. Atropine 0.6 mg i.v. will be given stat when the heart rate was less than 45/min and then inform the outcome assessor immediately. In the post-operative period, mean arterial pressure (MAP), heart rate and Respiratory rate were recorded in recovery room and in the postoperative period at 30min, 60 min, 90 min, 2hrs, 6 hrs, 12 hrs, 18 hrs and 24hrs. VAS score was measured at rest and on movement every 2 hrs for 24 hrs. Also, sedation score (RS), incidence of nausea and vomiting, pruritus were observed every 2 hours for 24 hours. The sedation score on a 6-point Ramsey scale was used.

1	Patient awake, anxious, agitated or restless
2	Patient awake, cooperative, oriented and tranquil
3	Patient Drowsy, with response to commands
4	Patient asleep, brisk response to glabella tap or loud auditory stimulus
5	Patient asleep, sluggish response to stimulus
6	Patient has no response to firm nail-bed pressure or other noxious stimuli

When the patient had a sedation score of >C3, supplement oxygen via facemask@6 L/min was administered and alert was given to the anaesthesiologist. Any patient complaining of pain or reporting VAS ≥4 at any time was administered tramadol 50 mg IV slowly over 2–3 min. If

pain was not relieved after 30 min and patients still complained of pain, additional doses of tramadol 50 mg IV were given, and this dose could be repeated every 30 min up to a total dose of 250 mg in 6 hours and maximum of 400 mg of tramadol over 24 h. Time of first rescue analgesic administration and total rescue analgesic consumed in 24 h post operative period was noted. Patients were also evaluated for any adverse effects such as hypotension, bradycardia, pruritus, sedation, nausea and vomiting were noted. IV ondansetron 4 mg was offered for any patient with nausea and vomiting. The observations were subjected to statistical analysis.

RESULTS

A total of 50 patients were included in this study, divided into two groups, group A and group B. There were no differences among the groups with regard to patient age, weight, height, BMI, ASA distribution, duration of surgery and duration of spinal analgesia .($p > 0.05$) (Table 1).

Table 1: Patients characteristics and clinical data:
Ratio or interval data are expressed as mean ± SD and ASA I or II is expressed as numbers

Variable	Group A (TAP D) (n=25)	Group B (TAP) (n=25)	P value	
Age (years)	40.84 ± 8.97	40 ± 9.8	0.316	>0.05
Weight(kg)	70.84 ± 6.49	72 ± 5	0.708	>0.05
Height (m)	1.63 ± 0.07	1.64 ±0.06	0.711	>0.05
BMI ($m^2.kg^{-1}$)	26.78 ± 1.27	26.77 ± 1.28	0.002	>0.05
ASA I/II (n)	4/21	5/20	0.1355	>0.05
Duration of surgery (min)	63 ± 8.29	62 ± 9.57	0.395	>0.05
Duration of spinal analgesia (min)	127.16 ± 8.85	124 ± 9.13	1.243	>0.05

Pain score at rest and on movement using VAS 0-10 assessed every 2 hrs from the end of surgery till 24 hrs. Post-operative resting VAS scores and VAS scores on movement were significantly lower in Group A than in group B till 8 hrs (<0.5). After 8 hrs, there was no statistically significant difference between the groups in VAS scores at rest and on movement (p > 0.05). But between 8 hr and 14hr interval, median was low in Group A and the VAS score range was wider in Group B.

Table 2: shows the VAS scores observed in both groups at rest and at movement

Time	VAS score at rest			VAS score on movement		
	Group A(TAPD) (n=25)	Group B(TAP) (n=25)	'p' value	Group A (TAPD) (n-25)	Group B(TAP) (n=25)	'p' value
	Median (min-max)	Median (min-max)		Median (min-max)	Median (min-max)	
2 hr	0(0-0)	0 (0-0)		0(0-0)	0(0-0)	
4 hr	0 (0-0)	1(0-2)	< 0.5	0(0-0)	1(0-2)	< 0.5
6 hr	0 (0-0)	2(1-5)	< 0.5	0(0-0)	2(1-5)	< 0.5
8 hr	0 (0-2)	5(2-5)	< 0.5	0(0-2)	5(0-5)	< 0.5
10 hr	2 (0-2)	0 (0-5)	>0.5	2(0-2)	0(0-5)	>0.5
12 hr	2(1-5)	2 (0-6)	>0.5	3(2-6)	2(0-6)	>0.5
14 hr	2(0-5)	2 (2-5)	>0.5	3(1-6)	2(0-6)	>0.5
16 hr	2(0-5)	2 (0-5)	>0.5	2 (0-6)	2(0-6)	>0.5
18hr	2(0-5)	2(0-7)	>0.5	2(0-6)	2(0-6)	>0.5
20 hr	2 (0-6)	2(0-6)	>0.5	2(1-6)	2(0-6)	>0.5
22 hr	2(0-5)	2(0-5)	>0.5	2(0-6)	2(0-6)	>0.5
24 hr	2(0-5)	4(0-5)	>0.5	2 (2-6)	6(0-6)	>0.5

The need for IV rescue analgesic for the first time was at 489.6 ± 84.29 minutes in Group B and at 885.6 ± 93.72 minutes in Group A [Table 3].Thus, the need for the first dose of rescue analgesia was earlier in Group B as compared to Group A and the difference was statistically significant ($P < 0.05$). The 24 hours analgesic requirement in Group A was lower 108 ±31.22 mg when compared with Group B with 178 ± 25.33 mg and the difference was statistically significant ($P < 0.05$).

Table: First analgesic request and total consumption of tramadol required

Variable	Group A	Group B	'p' value
First request (min)	885.6 ± 93.72	489.6 ± 84.29	< 0.001
Total tramadol consumption in 24 hrs (mg)	108 ± 31.22	178 ± 25.33	< 0.001
Data are expressed as mean ±SD			
'p' value <0.05 is considered a significant			

Dexmedetomidine group had fewer incidences of nausea and vomiting. There was no statistically significant difference between the groups in Mean Arterial Pressure, Pulse rate and Respiratory rate in all measurement intervals (p .0.5).

Table 4: Adverse event rates

Adverse event	Group A (TAPD) n =25	Group B (TAP) n = 25	Fisher Exact/ Chi square	P value
Hypotension	Nil	Nil		
Hypertension	Nil	Nil		
Tachycardia	Nil	Nil		
Bradycardia	Nil	Nil		
Postoperative sedation	Nil	Nil		
Nausea vomiting	6	9	0.875 (FE0.538)	<0.05
Pruritis	Nil	Nil		

None of the patients developed skin rash, respiratory depression, hypotension, hypoxemia, and there were no significant tachycardia or bradycardia. There was no observation of sedation score more than 3 in both groups but however in Group A had lower sedation score during first 12 hours and statistically significant (<0.5). After 12 hours there was no statistically significant difference in sedation scores among the groups

DISCUSSION

Post operative pain control is of outmost important for improvement of quality of patient care. However, postoperative pain remains grossly undertreated with up to 70% of patients reporting moderate to severe pain following surgery[4]. Hence various methods have been tried to attain pain free recovery such as Local Anaesthetic Infiltration (LAI), epidural analgesia, peripheral nerve block, and intravenous patient-controlled analgesia. In lower abdominal surgeries, TAP block which can be easily performed under ultrasound guidance is used to decrease post surgical pain.[11] Dexmedetomidine, a centrally acting α2 agonist which has been used as a drug for intraoperative sedation during surgery under regional anesthesia and as a sedative drug in ICU settings has gained popularity in last 21 years.[12,13] Adding dexmedetomidine to the local anesthetic agents in various regional anesthetic procedures, such as subarachnoid, epidural, and caudal injections has been proved to be safe by various animal and human studies[11]. TAP block initially, had various complications like vascular injury, block failure, nerve and abdominal viscera injuries. However when TAP block was performed under ultrasound guidance, it allowed precise visualization of TAP plane, the needle and the injection spot, hence now it is considered clinically safer[11]. Similarly in our study also we did not encounter any complications. Likewise many of other studies also did not report any complications[6,11]. VAS pain score, which is considered as the golden standard of pain quantification was used to evaluate postoperative pain severity on a scale of 1 to 10 in all the studies, both at rest and with movement[11]. Study by Eldegwy *et al*[14]. demonstrated the VAS scores at rest and movement were significantly lower in group where dexmedetomidine was added to TAP block than group where TAP block was performed without adding dexmedetomidine. The results of the present study on the assessment of postoperative VAS scores both at rest and movement were observed to be lower in group A when compared with group B till 8 hours. The difference among the two groups were insignificant from 14 -24 hrs. VAS score among the two groups was not significantly different at 10th and 12th hour intervals, however the median VAS score was less in Group A than Group B and the minimum to maximum range in group A was 0-2 and 1-5 resp during 10th and 12th hours, while it was wider in group B 0-5 and 0-6 respectively.. This was also similar to study by Bicer *et al*[15]. where they also had no significant difference in VAS at rest between the two groups at 6th hour and also observed similarly their min-max range was however wider. Several human studies showed that the addition of dexmedetomidine to local anesthetic agents administered in central neuroaxial and peripheral blockades prolonged the local anesthetic action time and reduced analgesic requirement[16, 17, 18]. Another study by Bicer *et al*[15] revealed that adding dexmedetomidine to bupivacaine can improve the analgesic efficacy of paravertebral block in patients undergoing thoracic surgeries. Sharma *et al*[19] also evaluated analgesic efficacy of TAP block after abdominal

surgery and reported that the patients who received TAP block had reduced tramadol requirement for up to 48 hours. In our study, we found that the postoperative first request of tramadol was delayed in TAP with dexmedetomidine group when compared with control TAP group. Also our study showed that total tramadol requirement was reduced in TAP with dexmedetodine group. Thus our study demonstrated that adding dexmedetomidine to bupivacaine can improve the analgesic efficacy of TAP block in patients undergoing herniorrhaphy. Aniskevich *et al* [20] indicated that the incidence of nausea and vomiting was not significantly different between the TAP block with dexmedetomidine and control groups. Another study by Bharadwaj *et al*[21] also showed that the incidence of nausea and vomiting was not found to be statistically different among the two groups. The incidence of nausea vomiting was found to be lower in TAP block with dexmedetomidine group when compared with Control TAP block group. This observation may be possibly due the reduction in total tramadol requirement. Thus adding dexmedetomidine to bupivacaine for TAP block did not increase the incidence of nausea vomiting scores rather it reduces the incidence of nausea vomiting. In our study, no patient had pruritus, which is similar to other study by Bielka *et al*[22] showed that dexmedetomidine did not significantly influence the incidence of pruritus. Almarkabi *et al*[15] stated that side effects such as hypotension and bradycardia which are partially related to sedation, may be observed with high doses of dexmedetomidine. It was observed by Biswaas *et al*[23] that dexmedetomidine when added to levobupivacaine in supraclavicular block the systolic and diastolic blood pressure values of the Dexmedetomidine Group were lower in comparison with the Control Group and that the incidence of bradycardia was also higher in the Dexmedetomidine Group. However in contrast, study by Bielka *et al*[22] established that concerning the incidences of hypotension and bradycardia, no differences were found in their study and control group. Similarly, our study showed that there were no significant differences in incidences of hypotension and bradycardia among the two groups. Dexmedetomidine provides analgesia and sedation without respiratory depression[21] In our study there was no observation of sedation score more than 3 in both groups but however in Group A had lower sedation score during first 12 hours and statistically significant (<0.5). After 12 hours there was no statistically significant difference in sedation scores among the groups

CONCLUSION

The addition of dexmedetomidine to bupivacaine in TAP block decreased postsurgical pain scores and reduced tramadol requirements thus prolongs the duration of post operative analgesia, with less side effects in patients undergoing open inguinal herniorrhaphy. Thus TAP block under ultrasound guided administration of dexmedetomidine with bupicaine can be used safely for pain management in patients undergoing herniorrhaphy.

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