



## COMPARISON OF DEXMEDETOMIDINE WITH BUPIVACAINE AND BUPIVACAINE ALONE FOR POST OPERATIVE ANALGESIA IN ULTRASOUND GUIDED TRANSVERSUS ABDOMINIS PLANE BLOCK IN PATIENTS UNDERGOING LOWER ABDOMINAL SURGERIES

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### ABSTRACT

Management of post operative pain remains one of the most important issue after surgery. Postoperative pain in lower abdominal surgeries, its management and complications is a challenge to anesthesiologist. Dexmedetomidine is a valuable adjuvant analgesic which can sufficiently prolong the duration of analgesia given in nerve blocks. We studied the effect of addition of dexmedetomidine to bupivacaine compared with bupivacaine alone in ultrasound guided transversus abdominis plane block in patients undergoing lower abdominal surgeries.

**Methods:** A total of 60 PATIENTS scheduled for lower abdominal surgeries divided into two equal groups in a randomized double blinded way. Group B received Transversus abdominis block with 20 ml bupivacaine (0.25%) - 30 patients.

Group BD -20 ml bupivacaine (0.25%) with dexmedetomidine (0.5mcg/kg) - 30 patients bilaterally. Base line Pulse rate, Blood pressure, Respiratory rate, Spo<sub>2</sub>, Duration of analgesia, Onset of pain by Visual analog scale(VAS), Ramsay sedation scale, Post operative pulse rate, Blood pressure, Respiratory rate, Spo<sub>2</sub>, dose of rescue analgesia used were noted.

**Results:** The time interval for requirement of first dose of rescue analgesia was prolonged in BD group [mean analgesic duration-488 min] than the B group [mean analgesic duration-290 min]. The total dose of rescue analgesic usage is decreased in group BD with injection Tramadol a mean dose of 65.00 mg and 183.33 mg in group B in the first 12hr among BD group there was a significant reduction in dose of rescue analgesia needed. It was also observed decreased opioid usage and hence the decreased side effects of it like pruritus, vomiting and nausea.

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### INTRODUCTION

Patient undergoing lower abdominal surgeries poses different set of challenges to the anaesthesiologist in the immediate postoperative period. Various modalities are available to control postoperative pain effectively like usage of opioids/Nonsteroidal anti-inflammatory drugs, regional techniques and field blocks. As a part of postoperative analgesic regimen, initially opioids are required for effective analgesia but opioids can cause side-effects like emesis, nausea, itching, sedation, and respiratory depression. Hence alternative regimen that reduces opioid requirements will be beneficial in these patients. Post-operative pain and discomfort may be anticipated due to skin incision and surgical trauma.

The pain felt in the postoperative period in lower abdominal surgeries is due to the surgical incision. Hence blocking sensory nerve supply of the anterior abdominal wall will provide effective postoperative analgesia. Transversus abdominal plane block is a novel type of peripheral block that

blocks the innervation of abdominal wall. Transversus abdominal plane block was first described by Rafi in 2001 in Ireland. Compared to the previous techniques of multiple injections into the anterior abdominal wall he delivered a single shot local anesthetics into the transversus abdominis plane which proved a noteworthy advance to the previous techniques.

McDonnell and his colleagues (2007) provided evidence for the anatomical basis of transversus abdominis plane block by demonstrating the sensory loss in the abdominal wall area after injecting local anesthetic into the transversus abdominal plane (4). It has been well proven by various studies that transversus abdominis plane block is a promising approach in providing good postoperative analgesia. Using an ultrasound for guidance in transversus abdominis plane block, gives a real time image during the procedure and the drugs can be given more exactly than that of a blind technique. Ultrasound increases the safety of the procedure.

Hyun Jung (2011) used 0.375% ropivacaine in ultrasound guided transversus abdominis plane block and concluded the decrease narcotic use and improved patient satisfaction.(5) Transversus abdominis plane has been performed with bupivacaine as local anesthetic, it produces longer duration of analgesia and provides effective pain relief in initial postoperative period.

Ammar(2012) used dexmedetomidine with bupivacaine in infraclavicular brachial plexus block for pain control in upper limb surgeries. (6) We proposed a prospective randomized double blind controlled clinical study, by comparing the effect of additives dexmedetomidine to local anesthetic for postoperative analgesia, under ultrasound guided transversus abdominis plane block, in lower abdominal surgery, in Indian population. We compare the effect of 0.25% bupivacaine with dexmedetomidine and 0.25% bupivacaine alone for post operative analgesia in ultrasound guided transversus abdominis plane block in lower abdominal surgeries.

## MATERIALS AND METHODS

This study was conducted in Vinayaka Missions Medical College, Karaikal after obtaining ethical committee approval from our institute. The duration of study was 12 months. Patient who fulfilled the inclusion and exclusion criteria undergoing lower abdominal surgeries were enrolled in our study, after written informed consent was obtained from each patient after explaining the purpose and details of study.

### Study Design

- It is a prospective, randomized, double blind controlled clinical study in patients undergoing lower abdominal surgery.
- Sample Size : 60 Patients
- Group B - Bupivacaine (0.25%) - 30 Patients
- Group BD - Bupivacaine (0.25%) + Dexmedetomidine (0.5mcg/kg) - 30 Patients

- Elective lower abdominal surgeries (Total abdominal hysterectomy, LSCS, B/L Inguinal hernia)

### Exclusion Criteria

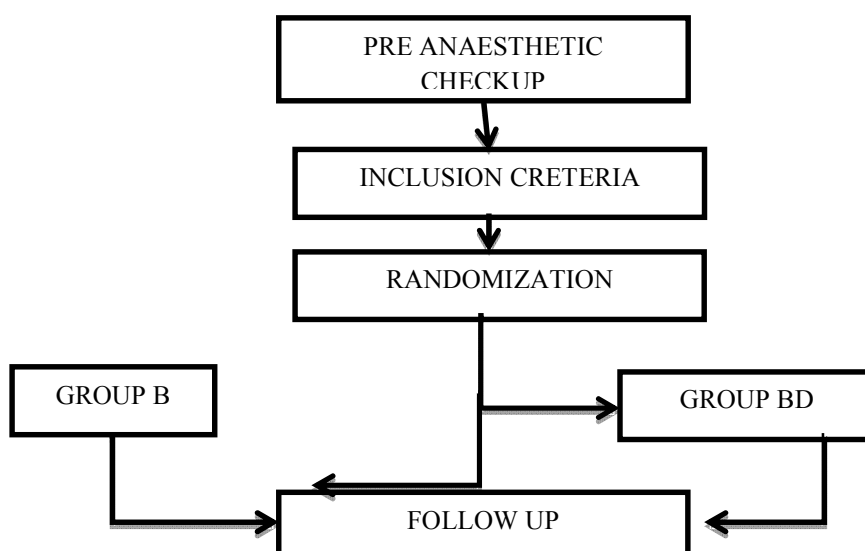
- Age < 18 year
- BMI > 30
- ASA Class III & IV (Severe PIH, Stenotic Valvular Heart disease)
- Emergency Surgery
- History of allergy to local anaesthetics
- Patients not willing for transversus abdominis plane block.
- Patients with a history of diabetes mellitus
- Patients undergoing a vertical midline skin incision
- Psychiatric patients
- Pre operative opioids & NSAIDS
- Bleeding diathesis
- Skin infection at puncture site

### Parameters Monitored

- Base line Pulse rate, Blood pressure, Respiratory rate, SpO<sub>2</sub>
- Duration of analgesia
- Onset of pain by Visual analog scale(VAS)
- Pain assessed by VAS score : with a time interval of 15min, 30min, 45min, 60min, 75min, 90min, 105min, 120min, 135min, 150min, 165min, 3hr, 4hr, 5hr, 6hr, 7hr, 8hr, 9hr, 10hr, 11hr, 12hr.
- Ramsay sedation scale
- Post operative Pulse rate, Blood pressure, Respiratory rate, SpO<sub>2</sub>
- Dose of rescue analgesia used

Under strict aseptic precautions lumbar puncture was performed at L3-4 interspace with 23G Quincke needle, after preparing with local infiltration of 2mL of 2% Lignocaine.

### FLOW DIAGRAM



### Patient selection criteria

#### Inclusion criteria

- ASA I & ASA II
- AGE - 18 TO 65 YEARS
- BOTH MALE & FEMALE

After free flow of cerebrospinal fluid, according to surgery 0.5% hyperbaric bupivacaine given to patients of both the groups. After performing the surgery under spinal anaesthesia when the level of sensory blockade descends to T10 transversus abdominis plane block was performed.

The transversus abdominis plane block technique used was posterior approach. All sterile aseptic precautions were adapted and draped with sterile linen before performing the procedure.

The investigator was scrubbed and the ultrasound probe was covered with a sterile plastic cover and placed in the midaxillary line just superior to the iliac crest.

After identifying the abdominal layers, the transversus abdominal plane was reached by using an 23 gauge spinal needle. Correct placement of the needle tip was confirmed by injecting 1-2 ml of saline bilaterally.

A bolus dose of 20 ml of Drug solution was administered bilaterally for Group B and 20 ml of Drug solution was administered bilaterally for group BD. Patients vital parameters like Pulse rate, Respiratory rate, Saturation, Blood pressure were recorded.

**RESULTS**

**Statistical Analysis**

All statistical analyses were carried out using SPSS for Windows version 16.0. ANOVA - Two way

ANOVA – repeated measures

Cross tabs procedure

Chi square test for non parametric data.

A p value < 0.05 was considered as statistically significant.

**Table No 1** Age distribution

Group	N	Mean	Std. Deviation	Minimum	Maximum
Group – B	30	43.8333	9.31104	28.00	62.00
Group -BD	30	44.6667	10.34686	27.00	62.00
Total	60	44.2500	9.76786	27.00	62.00

p - value= 0.744 (statistically insignificant)

The mean age in Group B was 43.833 ± 9.3110 years. The mean age group in Group B D was 44.666 ± 10.3468 years. The age difference between the groups is not statistically significant.

**Table No 2** Distribution of sex between groups

Sex	Group				Total	
	Group - B		Group -BD			
	N	%	N	%	N	%
Male	9	30.0	9	30.0	18	30.0
Female	21	70.0	21	70.0	42	70.0
Total	30	100.0	30	100.0	60	100.0

p - value= 0.155 (statistically insignificant)

Distribution of sex in Group B was 30% males and 70% females similarly in Group BD had 30% males and 70% females. p – value = 0.155 (statistically insignificant)

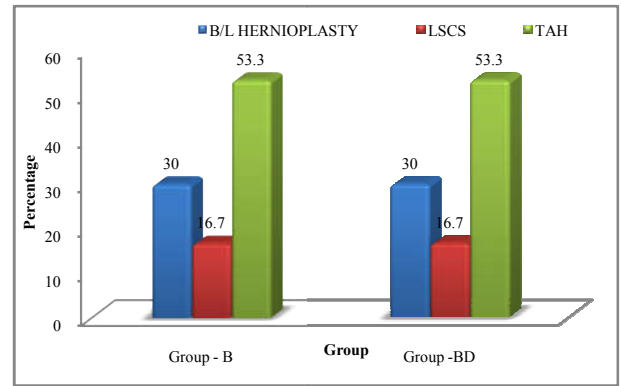
The mean BMI of group B is 28.1 and BD is 28.46. p - value is 0.284 which is statistically insignificant

The type of surgeries are equally distributed in both the groups with p value of 0.248 which is statistically insignificant.

Patients were randomized by computer generated random table.

ASA I and II patients were included in the study. In group B ASA I patients comprises 10% and in BD 23.3%. ASA II patients comprises 90% in B and 76.7% in BD. They are

equally disturbed in both the groups with p value of 0.166 which is statistically insignificant.



**Graph No 1** Procedure

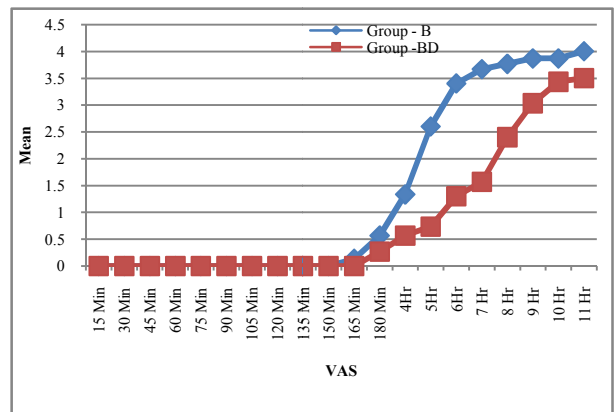
Mean Heart rate changes were comparable in both the groups and was found to be statistically insignificant.

Mean systolic blood pressure changes were comparable in both the groups and was found to be statistically insignificant. There is no gross fluctuation of SBP in both the groups. None of the patients in both the group received any interventions.

Mean diastolic blood pressure changes were comparable in both the groups and was found to be statistically insignificant. Patients of both the group didn't have any hemodynamic instability.

SPO<sub>2</sub> were comparable in both the groups and was found to be statistically insignificant. None of the patients had desaturation or respiratory depression in both the groups.

Mean Respiratory rate changes were comparable in both the groups and was found to be statistically insignificant. No patients had respiratory depression or none received any interventions.



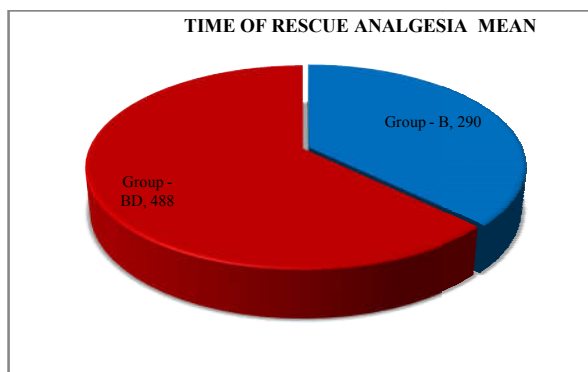
**Graph 2** Visual Analogue Scale

p - value = <0.005( statistically significant)

VAS score shows the average score 3 in which patients perceives pain is delayed in group BD which is statistically very significant. Group B patients had pain very early, which in turn increases the requirement of analgesic.

**Table No 3** Time of Rescue Analgesia

Group	N	Mean	Std. Deviation	F	Sig.
Group - B	30	290.00	19.82684	602.286	0.000
Group -BD	30	488.00	39.49247		
Total	60	389.00	104.53205		



Graph No 3 Time of Rescue Analgesia

p - value = <0.005 (statistically significant)

The time interval for requirement of first dose of rescue analgesia was prolonged in BD group [mean analgesic duration-488 min] than the B group [mean analgesic duration-290 min].

p - value = <0.005 (statistically insignificant) none of the patient from both groups had a sedation score of >3.

Table No 4 Total Dose of Rescue Analgesia used

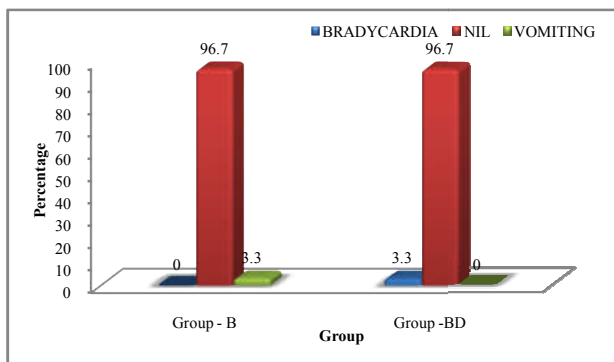
Group	N	Mean	Std. Deviation	F	Sig.
Group - B	30	183.33	35.55795	232.415	0.000
Group -BD	30	65.0000	23.30458		
Total	60	124.17	66.69667		

P - value = <0.005 (statistically significant) The total dose of rescue analgesic usage is decreased in group BD with a mean dose of 65.00 mg and 183.33 mg in group B in the first 12hr among BD group there was a significant reduction in dose of rescue analgesia needed.

Table No 5- Side Effects

SIDE EFFECTS	Group				Total	
	Group - B		Group -BD		N	%
	N	%	N	%		
BRADYCARDIA	0	.0	1	3.3	1	1.7
NIL	29	96.7	29	96.7	58	96.7
VOMITING	1	3.3	0	.0	1	1.7
Total	30	100.0	30	100.0	60	100.0

Chi-Square Tests			
	Value	df	Sig.
Pearson Chi-Square	2.000	2	0.368



Graph No 4 Side Effects

one patient had vomiting in group B(3.3%),in group B one patient had bradycardia (3.3%),in group BD with a p- value of 0.368 which was stastically insignificant.

## DISCUSSION

Management of post operative pain still remains an enigma. Paradoxically after all the efforts taken to make the intra-operative period pain free and stress free. patient is left to fend themselves in the postoperative period.

In recent times, transversus abdominis plane block for the relief of postoperative pain promises a new platform in abdominal surgeries. Based on the observation and results obtained in our study involving 60 patients with 30 patients in each group ,results of this study was discussed in detail by comparing with the obtained data and available evidence in the literature. The use of ultrasound-guided sensory block of the anterior abdominal wall with local anaesthesia for postoperative pain relief is an attractive method because of its simplicity, safety, and less failure rate.

The major finding of this study is that addition of dexmedetomidine to bupivacaine in Transversus abdominis plane block provides prolonged post-operative analgesia and better pain control than LA alone. The duration of LA was longer, VAS was lower and the need for rescue analgesia doses was less when dexmedetomidine was added to bupivacaine.

Masuki *et al.* suggested that dexmedetomidine induces vasoconstriction through an action on  $\alpha_2$  adrenoceptors in the human forearm and this might contribute to the longer duration of action (8). Other investigators have supported a third mechanism of action through  $\alpha_2$  adrenoceptors agonist effect rather than vasoconstriction. They contributed that to the direct effect on the peripheral nerve activity. Whatever the mechanism of dexmedetomidine's action, it seems that it potentiates the local anaesthetic effect and prolongs the analgesic duration.

In our study the mean age in group B was 43.8333 +/- 9.3110 years with a sex distribution of 30% males and 70% females. Similarly in the group BD the mean age was 44.6667 +/- 10.3468 and the sex distribution was 30% males and 70% females. P value for age between groups was 0.744 which was stastically insignificant. Sex distribution between groups was comparable and was not stastically significant. As per BMI distribution group B mean weight was 43.8333 +/-9.3110kgs compared to group BD mean weight 44.666 +/-10.3468,p value of 0.744 which was statistically insignificant. There were no significant differences between the two groups regarding the ASA Physical status in group B ASAI:II distribution of patients was 10:90 and in group BD 23.3:76.7. with a p Value of 0.166.

Ozalp *et al.* have compared dexmedetomidine -ropivacaine mixture to ropivacaine alone in patient controlled interscalene analgesia and they reported similar pain scores in both groups without any advantageous effect of dexmedetomidine.(7)

Transversus abdominis plane block is an expanding regional anesthesia technique that provides good analgesia to the skin and musculature of the anterior abdominal wall in patients undergoing various abdominal surgeries.

McDonnell *et al.* in their study correlated the prolonged effect of ropivacaine in Transversus abdominis plane block to the

relatively poorly vascularised Transversus abdominis plane resulting in a slower rate of drug clearance (9). In this study, the addition of dexmedetomidine to bupivacaine in Transversus abdominis plane block led to further prolongation of analgesia, less requirement of rescue analgesia and lower VAS pain scores. Similar to our finding, many investigators reported that the addition of dexmedetomidine to different types of LA agents in various types of peripheral nerve blocks resulted in prolongation of analgesic effect.

On statistical analysis of vitals compared between group B and group BD for heart rate, systolic blood pressure, diastolic blood pressure, respiratory rate, spo2 (every 15 min till 180 minutes and from then every hour till 12 hours) no significant difference was noted.

Visual Analogue Scale for pain were assessed between group B and group BD with a vas score was significantly lower than the group B. A VAS score of >3 was found to be early in group B compared to that of group BD. This demonstrates that the addition of dexmedetomidine to bupivacaine in transversus abdominis plane block in BD group provides effective & prolonged analgesia in the postoperative period compared to that of bupivacaine alone in group B. This study very well correlates with the study of Siddiqui et al. who in his analysis of Seven randomized, double-blinded studies of both blind and ultrasound guide transversus abdominis plane technique for postoperative analgesia in infra umbilical surgeries demonstrated average and significant reduction in IV PCA requirement as a part of multimodal analgesic regimen. He also demonstrated reduced VAS score both at rest and movement in the postoperative period. In our Study, the time interval for requirement of first dose of rescue analgesia was prolonged in BD group [mean analgesic duration-488 min] than the B group [mean analgesic duration-290 min]. The total dose of rescue analgesic usage is decreased in group BD with injection Tramadol a mean dose of 65.00 mg and 183.33 mg in group B in the first 12hr among BD group there was a significant reduction in dose of rescue analgesia needed. This correlates with studies of PATEL et al., who found that there was a 34% reduction in oral narcotic dosing in patients who received a transversus abdominis plane block (10). They also observed decreased opioid usage and hence the decreased side effects of it like pruritus, vomiting and nausea. This block also facilitates early ambulation, no urinary retention, and a more active state of the patient.

In our study there were no complications during the procedure, one patient had vomiting in group B, in group bd one patient had bradycardia with a p Value of 0.368 which was statically insignificant. The adverse effects pertaining to the transversus abdominis plane block have been reported in the literature. There was a case report of liver trauma and peritonitis with Ultra Sound guided- transversus abdominis plane block in a patient who underwent hernioplasty. This incidence was due to failure to accurately image the entire needle while imaging, resulting in excessive penetration of the needle. Therefore, when the exact direction and depth of the needle is under real time images of the ultrasound, this complication can be avoided. So far USG guided- transversus abdominis plane block has been used for very few surgical procedures only. But the Ultrasound guided - transversus abdominis plane block could be applied more widely, warranting further researches in this field. If this block is developed more, it can be used for treating the patients pain more effectively.

## CONCLUSION

In patients undergoing ultrasound guided transversus abdominis plane block the addition of Dexmedetomidine with Bupivacaine significantly provides prolonged duration of post operative pain relief after lower abdominal surgeries.

The dose of rescue analgesia is significantly reduced without producing any adverse or toxic effects.

Dexmedetomidine induces vasoconstriction through an action on  $\alpha_2$  adrenoceptors, This might contribute to the longer duration of action.

Dexmedetomidine is also said to have third mechanism of action through  $\alpha_2$  adrenoceptors agonist effects like analgesia, mild sedation, decreased release of norepinephrine rather than vasoconstriction.

Dexmedetomidine contributed to the direct effect on the peripheral nerve activity. The mechanism of dexmedetomidine's action, seems to potentiate the local anaesthetic effect and prolongs the analgesic duration.

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