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# ADDITION OF DEXMEDETOMIDINE TO BUPIVACAINE IN USG GUIDED TRANSVERSUS ABDOMINIS PLANE BLOCK POTENTIATES POST-OPERATIVE PAIN RELIEF AMONG LOWER ABDOMINAL SURGERIES.

Anaesthesiology

**Dr. Vyas Madhuri S** Resident, Department of Anaesthesiology, B. J Medical College, Ahmedabad-380016. Gujarat, India

**Dr.Deepshikha** Resident, Department of Anaesthesiology, B. J Medical College, Ahmedabad-380016. Gujarat, India - Corresponding Author

**Dr. Patel Kiran B** Assistant Professor, Department of Anaesthesiology, B. J Medical College, Ahmedabad-380016. Gujarat, India

## ABSTRACT

This randomized, controlled double blind study was carried out using bupivacaine or bupivacaine with dexmeditomidine in tranversus abdominis plane block in lower abdominal surgeries to study the effectiveness of bupivacaine plus dexmedetomedine combination in post operative analgesia, to study adverse effect of bupivacaine and dexmedetomedine, to study the haemodynamic parameters in post-operative period.60 patients of either sex and age ranging from 18 to 60 years and physical status ASA risk I or II posted for routine lower abdominal surgery were divided into 2 groups(n=30), assigned to receive bupivacaine 0.25% 0.6ml/kg and 2 ml of normsal saline and other group 0.25% bupivacaine 0.6ml/kg and dexmedetomidine 0.5 mcg/kg dissolved in 2 ml of normal saline . The groups were compared in terms of pain relief, PONV score, Ramsay scale of sedation and Visual Analog Scale.In our study, the addition of dexmedetomidine to bupivacaine in TAP block led to further prolongation of analgesia, less requirement of rescue tramadol and lower VAS pain score.

## KEYWORDS

bupivacaine, dexemedetomidine, transverses abdominis plane block, post-op pain relief.

## INTRODUCTION

Inadequate control of post-operative pain leads to several unwanted adverse events ranging from patients' discomfort, prolonged immobilization to thromboembolic phenomenon, nosocomial infections and pulmonary complications[1] Patients undergoing total abdominal hysterectomy suffer significant postoperative pain. The transversus abdominis plane (TAP) block is a recently described approach to provide analgesia to the anterior abdominal wall[2] The TAP block, as a component of a multimodal analgesic regimen, provided superior analgesia when compared with placebo block up to 48 postoperative hours after elective cesarean delivery.[3] Incisional pain is particularly troublesome after lower abdominal surgical procedures. Because the sensory afferent nerves run behind abdominal muscle, by a method called Transversus Abdominis Plane(TAP) block, these nerves could be blocked and postoperative pain could be managed. It involves innervations of the anterolateral abdominal wall derived from T6-L1.[4] Unfortunately, TAP block duration is limited to effect of administered local anesthetics (LA). The use of an infusion catheter to administer LA is an option to prolong the block's duration.[5] Recently, adjuvant medications have been added to LA to prolong the effect of TAP block. Dexmedetomidine is more selective ∝2 agonist with 1600 times greater selectivity for ∝2 receptor compared with α1 receptor. It has become frequently used drug in anaesthesia due to its hemodynamic, sedative, anxiolysis, analgesic, neuroprotective and anaesthetic sparing effect. Its use with bupivacaine either epidurally or intrathecally associated with prolongation of the LA effect.[6] In a prospective double-blinded randomized study, we try to assess the analgesic effect of adding dexmedetomidine to bupivacaine on TAP block for patients undergoing lower abdominal surgeries.

## MATERIALS AND METHODS:

This study was carried out on 60 patients of either sex from age group 18-60 yrs of ASA risk 1 & 2 undergoing general anaesthesia for various laproscopic procedure.Eethical clearance was obtained from ethical comittee of our institution(ethical reference no-EC/certi/110/15). Vitals parameters like pulse, blood pressure, respiratory rate were checked and noted. Routine lab investigations like haemoglobin, random blood sugar, renal function test, s.bilirubin, x-rays & ECG were advised and reports were recorded. Written informed consent was taken after explaining patient about the procedure.

After taking the patient on OT table, IV line was established .Monitors in the form of ECG, pulse oximeter, NIBP were applied. All patients were pre-medicated with Inj. Glycopyrrolate 0.004 mg/kg, Inj. Fentanyl 0.002 mg/kg, Inj. Midazolam 0.03 mg/kg and Inj. Ondensetron 0.15mg/kg IV 15 to 30 minutes prior to induction. Patients were induced with Inj. Pentothal Sodium 7 mg/kg. Inj. Succinylcholine 2 mg/kg intravenously was given to facilitate tracheal intubation and intubation was done using proper sized endotracheal tube. Anaesthesia was maintained using O2, sevoflurane and vecuronium to maintain BIS value between 40 to 60. Controlled ventilation was used to ensure normocapnia. Randomization was done using a computer generated program to allocate patients to various study groups using method of random number.

A bilateral TAP block was performed under dynamic ultra sound guidance intra-operatively after skin closure, before extubation using a short bevelled needle. Following identification of three different layers of abdominal wall, block needle (22-G, 90 mm SonoPlex Stim cannula, Pajunk GmbH, Geisingen, Germany) was inserted in plane until its tip was located in between internal oblique and transverses abdominis muscles. After careful aspiration, injection of study medication was performed and hypoechoic layer would be detected. Patients of Group B received 0.25% bupivacaine 0.6 ml/kg and 2 ml of normal saline. Half the volume was injected on either side at level of umbilicus. Patients of Group BD were given TAP block on both side at level of umbilicus with 0.25% bupivacaine 0.6 ml/kg and dexmedetomidine 0.5 mcg/kg dissolved in 2 ml of normal saline. After completion of surgical procedure, patient was extubated after reversing neuromuscular blockade by Inj. Neostigmine 0.05 mg/kg and Inj. Glycopyrrolate 0.008 mg/kg intravenously. Patients were transferred to post anesthesia care unit(PACU). Throughout procedure and in post-operative period, heart rate, blood pressure and SPO2 were observed and noted. In PACU, time to first analgesia request was recorded from the completion of TAP block to first given tramadol dose. Visual Analogue Score (VAS) was used to assess post-operative pain (where 0 = no pain and 10 = worst imaginable pain) during rest and on coughing. Heart rate, Mean Arterial Pressure, VAS (at rest and on coughing), Ramsay Sedation Score, Time taken for first rescue analgesic, post operative nausea and vomiting were recorded on admission to PACU and at 2, 6, 12, 18, 24, 36, 48 hrs postoperatively by an observer who was unaware of study protocol. Patients were also observed for any side-effects or complications of the procedure as well as drugs used in the study.

## RESULTS

This randomized study was carried out on 60 patients. Patients were divided into 2 groups with both the groups having equal number of patients.

Group B : Inj. Bupivacaine 0.25% 0.6 ml/kg + Placebo (Normal Saline 0.9%) 2 ml

Group BD : Inj. Bupivacaine 0.25% 0.6 ml/kg + Inj. Dexmetedomine 0.6 mcg/kg 2 ml

**Table 1. Demographic data**

| Parameters | Group B | Group B+D | p- value |
|---|---|---|---|
| Mean Age | 30.8±11.90 | 30.1±14.08 | 0.83 |
| Gender(M/F) | 11/19 | 11/19 | 1.0 |
| Laproscopic surgeries | 30/60 | 30/60 | - |

Above table showed no significant difference between two groups of patients in terms of age, gender and type of surgeries.

**Table 2. post operative mean pulse and blood pressure changes.**

| Pulse | | | | | Bloodpressure(SYSTOLIC/DIASTOLIC) | | | |
|---|---|---|---|---|---|---|---|---|
| Time (hrs) | GroupB | Group BD | P value | Significance | GROUP B | GROUP BD | P value | Significance |
| 0 | 80.8 ± 7.72 | 88.13 ± 8.28 | 0.0008 | Significant | 122.87 ± 9.83 / 80 ± 7.007 | 125.20 ± 7.85 / 80.13 ± 6.70 | 0.314 / 0.9417 | Not-significant |
| 2 | 80.83 ± 8.0 | 75.60 ± 7.02 | 0.0097 | Significant | 120.80 ± 8.40 / 78.20 ± 6.28 | 110.73 ±6.52 / 72.86 ± 5.86 | <0.0001 / 0.0012 | Significant |
| 4 | 80.73 ± 8.30 | 74.20 ± 13.86 | 0.0054 | Significant | 121.27 ± 8.30/ 79.07 ± 6.38 | 109.13 ±6.40 / 72.73 ± 4.54 | <0.0001 / <0.0001 | Significant |
| 6 | 80.37 ± 8.07 | 75.06 ± 6.11 | 0.0057 | Significant | 121.33 ± 8.90 / 79.77 ± 5.79 | 110.80 ±7.23 / 73 ± 4.29 | <0.0001 / <0.0001 | Significant |
| 12 | 79.30 ± 7.29 | 80.30 ± 5.77 | 0.5567 | Not-significant | 122.06 ± 9.04 / 80 ± 5.68 | 119.67 ± 7.12 / 77.46 ± 5.75 | 0.2600/ 0.0905 | Not-significant |
| 24 | 79.10 ± 8.80 | 80.13 ± 7.11 | 0.6190 | Not-significant | 121.40 ± 8.60 / 79.47 ± 6.16 | 121.80 ± 6.67 / 80.80 ± 3.98 | 0.8412 / 0.3247 | Not-significant |
| 36 | 79.94 ± 8.71 | 80.60 ± 5.81 | 0.7310 | Not-significant | 121.60 ± 8.47/ 79.47 ± 6.21 | 122.80 ± 6.40 / 79.10 ± 5.62 | 0.5383 / 0.8097 | Not-significant |
| 48 | 80.34 ± 7.12 | 82.33 ± 6.48 | 0.2620 | Not-significant | 121.40 ± 7.28 / 78.20 ± 6.75 | 122.80 ± 6 .38 / 81.07 ± 4.77 | 0.4315 0.4315 / 0.6220 | Not-significant |

Above Table shows changes in pulse and blood pressure at different time interval. In our study, statistically significant difference was noted between two groups in terms of pulse rate & blood pressure up to 6 hrs, no statistically difference noted afters 6 hrs.

**TABLE 3: POST OPERATIVE VAS SCORE**

| Time (hrs) | Group B (mean ± SD) | Group B+D (mean ± SD) | p - value | Significance |
|---|---|---|---|---|
| 0 - 6 | 1.03 ± 0.71 | 0.5 ± 0.62 | 0.0032 | Significant |
| 6 - 24 | 2.94 ± 0.73 | 1.87 ± 0.73 | <0.0001 | Significant |
| 24 - 48 | 3.17 ± 0.64 | 2.23 ± 0.56 | <0.0001 | Significant |

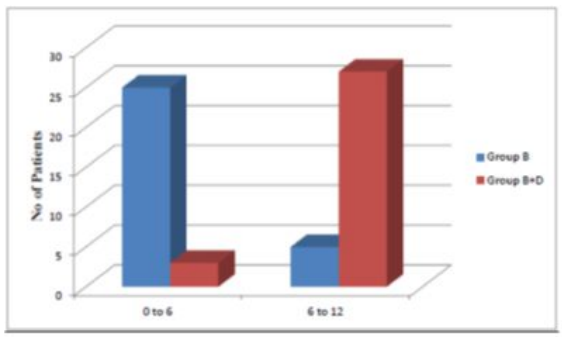
Above table shows changes in VAS score at different time interval. In our study, statistically significant difference in VAS score was noted between two groups from 0 to 48 hours.

**TABLE 4:POST OPERATIVE RAMSAY SCORE**

| Time (hours) | Group B (mean ± sd) | Group B+D (mean ± sd) | p - value | Significance |
|---|---|---|---|---|
| 0 - 6 | 1.17 ± 0.37 | 1.9 ± 0.30 | <0.0001 | Significant |
| 6 - 24 | 1 ± 0 | 1.27 ± 0.44 | 0.0014 | Significant |
| 24 - 48 | 1 ± 0 | 1 ± 0 | 1.0 | Not-Significant |

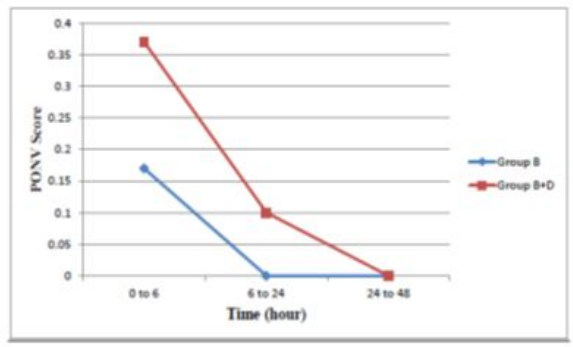
Above table shows post operative sedation score at different time interval. In our study, statistically significant difference was noted between two groups of patients in terms of sedation score from 0 hour to 24 hours. No statistically difference was noted after 24 hours.

**GRAPH 1: TIME OF GIVING FIRST RESCUE ANALGESIC**




Mean time of first analgesic is statistically significant in both groups and the number of patients require rescue analgesia in first six hours are higher in Group B as compared to Group BD, in which number of patients requiring analgesia in 6 to 12 hours are higher, which is also statistically significant.

**GRAPH 2 :PONV SCORE**




Above graph shows post operative nausea and vomiting score at different time interval which is not statistically significant between this two groups.

## DISCUSSION

Laparoscopic surgery, also called minimally invasive surgery is a modern surgical technique used for various surgeries like cholecystectomy, appendicectomy, hernia repair. There are numerous arguments for a procedure-specific assessment of the evidence of analgesia treatment after laparoscopic surgery. Postoperative pain is reduced compared with open traditional surgeries but effective analgesic treatment after laparoscopic surgeries have remained a clinical challenge. Patients undergoing laparoscopic surgery tend to expect a painless postoperative period because of common beliefs about this type of surgery. So, it is an essential task to provide adequate post operative analgesia. The transverse abdominis plane (TAP) block is a peripheral nerve block designed to anesthetize the nerves supplying the anterior abdominal wall (T6 to L1). It was first described in 2001 as a traditional blind landmark technique using the lumbar triangle of Petit.[7] Local anesthetic is then injected between the internal oblique and transverse abdominis muscles just deep the fascial plane , the plane through which the sensory nerves pass. Along with local

anaesthetic, use of dexmedetomidine($\propto_2$ agonist) as an adjuvant in laparoscopic surgery is deemed to be safe, improve patient's comfort, shorten the length of stay in the post operative care unit and decrease the total analgesic requirement in the ward. Our study shows demographic profile in form of age, sex, type of surgery. It shows that both the groups were comparable in their demographic profiles. There was no statistically significant difference between two groups of patients in terms of age, gender and type of surgery. Age distribution range in group B was 18-55 years with a mean 30.8 years. Range in group BD was 18-60 years with mean 30.1 years (p Value=0.83). Thus we see that both the groups were comparable in terms of age profile and no statistically significant difference was observed in both groups. It is mentioned in table which shows the changes in pulse rate & blood pressure at different time interval post operatively. To determine the statistical significance, unpaired t-test was applied using GRAPHPAD software and p-value was calculated. P value less than 0.005 is statistically significant and more than 0.005 is not significant. In our study, there is statistically significant difference between two groups of patients in terms of pulse rate & blood pressure up to 6 hour. There is no statistically difference noted after 12 hours. In our study, we notice a significant fall in the heart rate following administration of dexmedetomidine in group BD, opposite to the control group B. This effect persisted for 6 hrs, but without any hemodynamic instability. The decrease in pulse rate might be related to the post-synaptic activation of central α2 adrenoceptors, leading to decreased sympathetic activity and slower HR.[8]

In our study, we measured postoperative VAS score up to 48 hours and there was statistically significant difference between both groups up to 48 hours. In group BD, VAS score is low as compared to Group B up to 48 hours. The addition of dexmedetomidine to bupivacaine in TAP block led to further prolongation of analgesia and lower VAS pain scores through vasoconstriction effect or effect on the peripheral nerve activity. This was similar to the observations of a study performed by Mc Donnell *et al*[4] on cesarean section delivery, where VAS at rest and on movement was found to be significantly low till 12 h in patients who had received TAP block with local anesthetic. Study performed by Niraj *et al*. on open appendicectomy and Neerja Bharti *et al*.[9] on colorectal surgery also showed similar results.

In our study it shows post operative sedation score at different time interval. There is statistically significant difference between two groups of patients in terms of sedation score from 0 to 24 hours . There is no statistically difference after 24 hours. Our study shows group BD patients who receives dexmedetomidine have higher sedation levels as compared to other group. It is proved in other studies also that, dexmedetomidine when compared with conventional sedatives and opiates has been demonstrated to be associated with both sedative and analgesic effects, reduced delirium and agitation, minimal respiratory depression and predictable and desirable cardiovascular effects.[10] Stimulation of parasympathetic outflow and inhibition of sympathetic outflow from the locus coeruleus in the brainstem plays a prominent role in sedation and anxiolysis.[11] Decreased noradrenergic output from the locus coeruleus allows increased firing of inhibitory neuron (GABA). Centrally acting $\alpha_2$ adrenergic agonists also activate central sympatholytic effects, leading to decreased heart rate and blood pressure.[10] Primary analgesic effects and potentiation of opioid induced analgesics result from the activation of the $\alpha_2$ adrenergic receptor in the dorsal horn of the spinal cord and inhibition of substance P release.

As described in graph, we can see that mean time period of requirement of first rescue analgesia, tramadol in group B is 5.27 hours while in group BD it is 8.23 hours. Numbers of patients who require rescue analgesia in group B, in 0-6 hours postoperatively is 25 as compared to only 3 patients who require rescue analgesia in first 6 hours in group BD.

In our study, the addition of dexmedetomidine to bupivacaine in TAP block led to further prolongation of analgesia, less requirement of rescue tramadol and lower VAS pain scores. Similar to our finding, many investigators reported that the addition of dexmedetomidine to different types of local anaesthetic agents in various types of peripheral nerve blocks resulted in prolongation. In our study, the addition of dexmedetomidine to bupivacaine in TAP block led to further of analgesic effect.[12,13] On the other hand, Masuki *et al*. suggested that dexmedetomidine induces vasoconstriction through an action on α2 adrenoceptors in the human forearm,[14] and the later might contribute to the longer duration of action. Other investigators have supported a third mechanism of action through α2 adrenoceptors agonist effect rather than vasoconstriction. They contributed that to the direct effect on the peripheral nerve activity.[15] Whatever the mechanism of dexmedetomidine's action, it seems that it potentiates the LA effect and prolongs duration of analgesic. Post operative nausea and vomiting also observed in our study, but no any significant changes observed between both the groups. Patients in group BD are higher in numbers who expierenced nausea in first few hours, as compared to other group. One limitation of this study is lack of proper assessment of success rate of TAP block procedure as it was performed following completion of surgeries before reversal of anaesthesia instead of performing block immediately after induction before start of surgery and we depend upon the skills of the investigators and the use of ultrasonography guided block for proper placement of blocking needle. A second limitation is the inability to assess dexmedetomidine plasma concentration among study patients to determine whether its action was related to systemic absorption or pure local effect.

## CONCLUSION:

Addition of dexmedetomidine to bupivacaine in TAP block achieves better local anesthesia conditions and provides better pain control post-operatively without any major side-effects. Thus proved itself as remarkably safe and cost effective option for post operative analgesia.

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