

# Efficacy of Transversus Abdominis Plane (TAP) block for intraoperative and postoperative analgesia in patients undergoing abdominal hysterectomy under general anaesthesia- A randomised controlled study

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## Abstract

**Background:** To evaluate the effect of transversus abdominis block for intra and post-operative analgesia in patients undergoing abdominal hysterectomy under general anaesthesia.

**Methods:** Prospective, double-blind, randomized, clinical study on 80 patients of age 40-60 years undergoing total abdominal hysterectomy under general anaesthesia. Patients were randomly divided into 2 equal groups; Group N (n=40): TAP block with 30 ml of normal saline; Group B (n= 40): TAP block with 30 ml of 0.25% bupivacaine. All patients were given general anaesthesia followed by transversus abdominis plane block (TAP). All parameters like postoperative VAS Score, intraoperative haemodynamic changes (HR, SBP, DBP, MAP) were recorded. In the postoperative period diclofenac 1.5 mg/kg was given. If VAS  $\geq$  4 inj tramadol 2mg/kg i.v. was given as rescue analgesia. Total dose of diclofenac and tramadol in 24 hr post operative period was recorded.

**Result:** The time for first analgesic request was increased in Group B 134.67 $\pm$ 16.23 min as compared to Group N 42.85 $\pm$ 18.13 min (P value <0.05). Maximum VAS score up to 24 hrs postoperative was lower in the Group B (2.77  $\pm$  9.73) as compared to group N (5.6 $\pm$ 1.42) (P value <0.05). The rescue analgesic consumption within 24 hours post operatively was lower in Group B (105.75 $\pm$ 71.24 mg) compared to Group N (218 $\pm$ 40.01 mg) (P value <0.05).

**Conclusion:** TAP block provide significant postoperative analgesia in first 24 hour and excellent hemodynamic stability being a safe modality for intra and post operative analgesia for total abdominal hysterectomy.

**Keywords:** Postoperative analgesia, transverse abdominal plane block.

## 1. Introduction

Pain is a distressing feeling often caused by intense or damaging stimuli. Because it is a complex, subjective phenomenon, defining pain has been a challenge. "Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage." [1]

Role of transversus abdominis plane (TAP) block in patients undergoing surgery is to relieve pain, decrease VAS score, early mobilization and decrease hospital stay. [2-4]

Transversus abdominis plane (TAP) block is a regional anaesthesia technique which works by blocking the

thoraco-lumbar nerves (T6-L1) which supply sensory fibers to anterior abdominal wall. This technique is widely used to provide analgesia for various surgical procedures. [5-7]

Various gynecological surgeries are associated with severe pain postoperatively therefore an adequate analgesic regimen is required to ensure patient- comfort, early mobilization and to decrease the hospital stay.

During the last few years, interest has grown concerning the use of transversus abdominis plane (TAP) block as an alternative to epidural analgesia.[8-10] TAP block provides analgesia to the antero-lateral abdominal wall through blockade of the anterior and lateral cutaneous branches of T7 to L1.[11] Clinical trials have shown that a

bilateral single-shot TAP block reduces pain after total abdominal hysterectomy and large bowel resection.[12] Patients undergoing total abdominal hysterectomy suffer significant postoperative pain. Abdominal field block have been extensively used for many years as they are technically unchallenging.

In TAP block local anaesthetic is injected in the plane between internal oblique and transversus abdominis muscles to block the various nerves in this plane leading to interruption in innervation to abdominal skin, muscles and parietal peritoneum. [13,14] But if surgery traverses the peritoneal cavity, dull visceral pain (from spasm or inflammation following surgical insult) will still be experienced by the patient.

There have been various studies in the past to evaluate the effectiveness of TAP block in lower abdominal surgeries.[15,16]

These studies have evaluated different volume of drug in different concentration to find out the minimum effective dose. Therefore, to further evaluate the benefit of TAP block in lower abdominal surgeries which will lead to decrease use of analgesics and hence less likely adverse effects we choose this study to evaluate the analgesic efficacy of TAP block in patients undergoing total abdominal hysterectomy via a transverse lower abdominal wall incision.

## 2. Material and methods

After ethical committee Clearance 80 ASA grade I/II patients aged between 40-60 years undergoing total abdominal hysterectomy under general anaesthesia were included in the study. Patients were randomly divided into 2 equal groups;

**Group N (n=40):-** The patients in this group received transversus abdominis block with 30 ml of normal saline.

**Group B (n= 40):-** The patients in this group will received transversus abdominis block with 30 ml of 0.25% bupivacaine.

Randomization procedures done by using closed envelop method. All patients were premedicated with Inj. Ranitidine 50mg i.v, Inj, Pentazocine 30mg i.v. Inj. Glycopyrrolate 0.2 mg i.v., Inj Midazolam 1mg i.v, Inj. Dexamethasone 4mg i.v, and preoxygenated. Induction of anaesthesia was done with Inj. Thiopentone 5mg/kg i.v. and Inj. Succinyl choline 1mg/kg i.v. and maintenance of general anaesthesia by oxygen, N<sub>2</sub>O and Inj. Vecuronium 0.1mg/kg was given according to standard protocol. After proper aseptic cleaning and draping transversus abdominis plane block (TAP) was given.

All the parameters like postoperative VAS Score, intraoperative haemodynamic changes (HR, SBP, DBP, MAP) was recorded by an independent anaesthetist who was blind to the nature of the drug. Duration of analgesia was measured by the time starting from the performance of

TAP block to the time when patient requested for pain relief.

In the postoperative period intramuscular diclofenac 1.5 mg/kg was given for analgesia according to institutional protocol. If VAS  $\geq$  4 inj tramadol 2mg/kg i.v. was given as rescue analgesia.

Total dose of diclofenac and tramadol in 24 hr post operative period was recorded. Any postoperative adverse events like post-operative nausea, vomiting etc was noted.

### 2.1 Statistical Analysis

All data was analysed using IBM SPSS Statistics 21 software. The qualitative data between two groups was compared using Chi Square test and for comparison of the continuous variables independent t- test was used. P < .05 was considered statistically significant. Power of study was 80 at 95% confidence interval.

## 3. Result

All the demographic characteristics were comparable between both the groups. (Table 1)

**Table 1: Demographic characteristics of two groups**

Patient characteristics	Group B	Group N	P Value
Age (Yrs)	45.25 $\pm$ 7.12	48.47 $\pm$ 7.54	P > 0.05
Weight (kg)	62.55 $\pm$ 5.53	61.55 $\pm$ 7.49	P > 0.05
Height (cm)	155.72 $\pm$ 4.19	155.75 $\pm$ 3.37	P > 0.05
ASA Grade I/II	25/15	19/21	
Duration of surgery (min)	70.80 $\pm$ 5.49	71.02 $\pm$ 4.98	P > 0.05

Values expressed as mean  $\pm$ SD or (range) or Number of patients  
Group N: Normal Saline Group B: Bupivacaine  
P Value <0.05 is considered significant, ASA: American Society of Anaesthesiologists

### 3.1 Heart rate (per minute) between two groups of patients

There were no significance in baseline heart rate and heart rate after 1 minute between the two groups after application of TAP Block. With P value > 0.05

But there were significant changes in heart rate between the two groups after 5min, 15min, 30 min and 30min after application of TAP block, With P value <0.05. (Table 2)

**Table 2: Comparison of Heart rate (per minute) between two groups of patients**

Heart Rate	Group B	Group N	P value
Base line	81.85 $\pm$ 9.02	78.75 $\pm$ 10.17	P>0.05
After 1 min	81.42 $\pm$ 8.78	83.07 $\pm$ 10.90	P>0.05
After 5 min	81.85 $\pm$ 7.70	87.65 $\pm$ 10.96	P<0.05
After 15 min	82.12 $\pm$ 6.42	94.4 $\pm$ 10.59	P<0.003
After 30 min	84.35 $\pm$ 5.07	102.02 $\pm$ 10.78	P<0.001
After 45 min	88.02 $\pm$ 5.95	109.9 $\pm$ 11.70	P<0.001

Values expressed as mean  $\pm$ SD or (range) or Number of patients  
Group N: Normal Saline; Group B: Bupivacaine  
P Value <0.05 is considered significant

### 3.2 Comparison of Systolic Blood Pressure (mmHg), Diastolic Blood Pressure and Mean Blood Pressure between two groups of patients

There were no significance in Systolic BP, Diastolic BP and Mean BP after 1 minute between the two groups after application of TAP Block. With P value > 0.05

But there were significant changes in systolic BP, Diastolic BP and Mean BP between the two groups after 5min, 15min, 30 min and 30min after application of TAP block, With P value <0.05. (Table-3)

**Table 3: Comparison of Systolic Blood Pressure (mmHg) between two groups of patients**

Blood Pressure	Group B	Group N	P Value	
Baseline	SBP	128.0±6.83	124.90±7.99	P>0.05
	DBP	82.15±4.11	80.35±6.73	P>0.05
	Mean BP	97.40±4.67	95.20±5.89	P>0.05
After 1 min	SBP	126.85±6.0	130.55±8.14	P>0.05
	DBP	82.85±4.85	83.55±6.20	P>0.05
	Mean BP	97.51±4.68	99.22±5.30	P>0.05
After 5 min	SBP	126.20±5.93	136.65±8.14	P<0.05
	DBP	80.90±4.14	86.70±6.09	P<0.05
	Mean BP	96.0±3.71	103.35±5.09	P<0.05
After 15 min	SBP	128.20±5.82	140.35±8.90	P<0.005
	DBP	81.35±4.20	89.15±6.40	P<0.005
	Mean BP	96.96±3.55	106.22±5.46	P<0.005
After 30 min	SBP	128.85±6.27	144.55±8.10	P<0.003
	DBP	82.25±4.30	91.95±6.33	P<0.003
	Mean BP	97.8±4.02	109.48±5.26	P<0.003
After 45 min	SBP	130.10±6.04	150.20±7.60	P<0.001
	DBP	83.60±4.22	95.20±5.99	P<0.001
	Mean BP	99.10±3.89	113.53±5.12	P<0.001

Values expressed as mean ±SD or (range) or Number of patients  
Group N: Normal Saline; Group B: Bupivacaine  
P Value <0.05 is considered significant, SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure

### 3.3 Time for first analgesic request (minutes) between two groups

The time for first analgesic request (min) in Group B (Bupivacaine) was 134.67±16.23 min and time for first analgesic request (min) in Group N (Normal saline) was 42.85±18.13 min and was significance among two groups (P value <0.05).(Table-4)

**Table 4: Comparison of time for first analgesic request (minutes) between two groups of patients**

	Group B	Group N	P value
Time for first analgesic request (min)	134.67±16.23 (90-160)	42.85±18.13 (15-99)	P<0.001

Values expressed as mean ±SD or (range) or Number of patients  
Group N: Normal Saline; Group B: Bupivacaine  
P Value <0.05 is considered significant

### 3.4 Highest pain score between two group of patients

On statistical analysis, the maximum VAS score in the group B (Bupivacaine) was lower as compared to group N (Normal Saline) up to 24 hours post operatively (2.77 ± 9.73 in group B and 5.6±1.42 in group N, P value <0.05) (Table-5)

**Table 5: Comparison of Highest pain score between two group of patients**

	Group B	Group N	P value
Highest pain score (VAS Scale)	2.77±0.973	5.6±1.42	P <0.05

Values expressed as mean ±SD or (range) or Number of patients  
Group N: Normal Saline; Group B: Bupivacaine  
P Value <0.05 is considered significant

### 3.5 Total dose (mg) of rescue analgesic within 24 hours post-operatively between two groups

The total dose of rescue analgesic (mg) within 24 hours post operatively in Group B (Bupivacaine) was 105.75±71.24 mg and dose of rescue analgesic (mg) within 24 hours post operatively in Group N (Normal saline) was 218±40.01 mg and was significance among two groups (P value <0.05).(Table 6)

**Table 6: Comparison of total dose (mg) of rescue analgesic within 24 hours post-operatively between two groups of patients**

	Group B	Group N	P Value
Total dose of rescue analgesic within 24hr postop (mg)	105.75±71.24 (0-250)	218±40.01 (150-300)	P<0.001

Values expressed as mean ±SD or (range) or Number of patients  
Group N: Normal Saline; Group B: Bupivacaine  
P Value <0.05 is considered significant

### 3.6 Complications If Any in Post Operative 24 Hr

Incidence of nausea in Bupivacaine group was 5% and incidence of nausea in Normal Saline group was 7.5% with p Value >0.05. No incidence of vomiting and itching was seen in any group.

## 4. Discussion

In our study we evaluated the effect of transversus abdominis block (blind technique) for intra and post-operative analgesia in patients undergoing abdominal hysterectomy under general anaesthesia.

In our study we observed that maximum VAS score was lower 2.77±0.973 in Group B (Bupivacaine) as compared to 5.6±1.42 in Group N (Normal Saline) (Table-5) McDonnell et al[17] found in their study on statistical analysis, maximum VAS score in TAP group was lower (1±1.4) as compared to (6.6±2.8) Control group. This is in agreement with our study. Similar results were noted by Sivapurapu et al [18] in their study in which average VAS score in Group T (TAP Group) was lower (4.12±1.4) and

average VAS score in Group I (Infiltration) was higher ( $5.58 \pm 1.98$ ). Study conducted by Tarekegn *et al* [19] also shows significant reduction in VAS score in TAP group as compared to control group. All these results are similar to results obtained in our study. In a study conducted by Sandman *et al* [20] the median pain scores recorded were lower for the TAP group in the recovery ward (median score 0 compared with 2, 95% CI 0–3,  $P=0.03$ ) this is in agreement with our study. But they found similar pain scores at all other time interval, this could be possibly due to the reason that a) laparoscopic appendectomy b) age group- 7-16 years c) port site infiltration with ropivacaine in all the cases.

From the analysis of intraoperative hemodynamic parameters, we in our study found that pulse rate was significantly higher in Group N (Normal Saline) after 5 min of application of TAP block and found a significant p-value of  $<0.05$  (from 5 minutes to 45 minutes after application of TAP block) (Table 2) as compared to group B. In study conducted by Bhattacharjee *et al* [21] they found that pulse rate was significantly higher in placebo group ( $95.9 \pm 11.2$  bpm vs.  $102.9 \pm 8.8$  bpm with p-value = 0.001). In study conducted by Aksu R *et al* [22] significant decrease in heart rate were found in group B (Bupivacaine, n=31) and group BD (Bupivacaine+ dexmedetomidine, n=31) as compared to placebo at 10<sup>th</sup>, 30<sup>th</sup>, 45<sup>th</sup>, and 60<sup>th</sup> minutes of the operation with p-value  $< 0.05$ . Kai Li *et al* [23] in their study on TAP block in gastric cancer patients found that the changes in heart rate were significantly less in group R (Rupivacaine) as compared to placebo with p-value  $< 0.01$ . These results are similar to results obtained in our study.

Intraoperative blood pressure (SBP, DBP and Mean BP) were found to be significantly higher in group N (Normal Saline) as compared to group B (Bupivacaine) after 5 min of application of TAP block and found a significant p-value of  $<0.05$  (from 5 minutes to 45 minutes after application of TAP block) (Table 3). Bhattacharjee *et al* [21] also found significant higher blood pressure in placebo group. These results are in agreement with our study. Aksu *et al* [22] found a significant decrease in mean blood pressure in group B (Bupivacaine, n=31) in the 10<sup>th</sup> min, 30 min, 45min and 60 min of operation with p-value  $< 0.05$ . Kai Li *et al* [23] in their study on TAP block in gastric cancer patients in it was found that there was significant decrease in SBP and DBP in group R (Rupivacaine) as compared to placebo with p-value  $<0.01$ . These results are similar to results obtained in our study.

We in our study observed that time for first analgesic request was significantly prolonged in Group B (Bupivacaine) as compared to Group N (Normal saline) ( $134.67 \pm 16.23$  min in Group B and  $42.85 \pm 18.13$  min in Group N respectively) (Table 4). In a study conducted by Sivapurapu *et al* [18], the time for first analgesic request was prolonged ( $148 \pm 46.7$  min) in Group T (TAP) as

compared to ( $83.38 \pm 38.07$  min) Group I (Infiltration). In a study conducted by McDonnell *et al* [17] time for first analgesic request was significantly prolonged in TAP block (n=16) as compared to Control Group (n=16)  $157.2 \pm 27.9$  min in TAP group and  $24.1 \pm 6.9$  min in Control group respectively. Bhattacharjee *et al* [21] conducted a study and found that the median duration of first analgesic request was significantly higher in patients belonging to Group B (Bupivacaine) (290 min vs. 16 min,  $P = 0.000$ , Mann–Whitney U-test). All the results obtained in these studies are in agreement with the result obtained in our study.

In our study we observed that total dose of analgesic consumed in 24 hours postoperatively was significantly lower in group B as compared to group N ( $105.75 \pm 71.24$  mg in group B and  $218 \pm 40.01$  mg in group N,  $P$  value  $< 0.001$ ) (Table 6). In Sivapurapu *et al* [18] study they found that total dose of analgesic (morphine) consumed in 24 hours postoperatively and comparable results were found in group T ( $22.15 \pm 4.14$  mg) and group I ( $29.15 \pm 3.93$  mg) with  $P$  value  $< 0.001$ . In a study conducted by Bhattacharjee *et al* [21] found that median requirement of intraoperative fentanyl was significantly higher in patients receiving placebo as compared to bupivacaine in TAP block (81 mcg vs. 114 mcg,  $P = 0.000$ , Mann–Whitney U test). Carney *et al* [24] in their study found that total morphine requirements in the first 48 postoperative hours were reduced in TAP block as compared to placebo ( $27 \pm 20$  mg vs  $55 \pm 17$  mg with  $P < 0.001$ ). All these results are similar to the results obtained in our study.

Side effects that were analyzed in our study were nausea, vomiting and itching. Nausea was noted in 2 patients in Group B and 3 patients in Group N; hence incidence of nausea was comparable in both groups. No other side effects were noted in our study. In study by Urfahoglu *et al* [25] itching was found in one case of ultrasound guided TAP (n=38) block and nausea was observed in four patients in each UT (ultrasound guided TAP Group, n=38) and ST (surgical TAP group, n=37) group. These results are similar to results seen in our study. In contrast to our study, Sivapurapu *et al* [18] in their study found that post-operative nausea and vomiting (PONV) incidence was significant ( $P = 0.043$ ) in Group I (infiltration group) and required antiemetic administration. Carney *et al* [24] in their study did not observe any reduction in the incidence or severity of post op nausea vomiting (PONV) in TAP block as compared to placebo group in patients undergoing total abdominal hysterectomy. This result is similar to result found in our study.

Other complications of TAP block which were seen various studies conducted by Jankovic *et al* [26], Scherrer *et al* [27], Naidu *et al* [28], Manatakis *et al* [29] are seizure, ventricular arrhythmia, and transient femoral nerve palsy; Though no such incidence of complications were noted in our study.

The concentration and volume of drug chosen in our study, in an article by Karim Mukhtar [13] on TAP block suggested the use of 20-30 ml of any local anaesthetic, its reason being this block relies on local anaesthetic spread rather than concentration. Bhattacharjee et al [21] in their study on TAP block had taken bupivacaine 0.25% and volume on the basis of body weight i.e. 0.5 ml/kg on each side. Ng A et al in their study on TAP block take 50ml of 0.25% Bupivacaine, of this 50 ml, 20ml was given in abdominal wall and 30 ml in the peritoneal cavity. McDonnell et al [17] in their study had taken 0.375% concentration of levobupivacaine and given 20 ml of TAP block in each side. Molla et al [30] conducted a study on TAP block using 20 ml of 0.25% bupivacaine.

Therefore to limit LA toxicity, a low concentration (0.25%) of LA (Bupivacaine) with high volume (30ml on each side) was chosen in our study.

## 5. Conclusion

Our study reveals that Transversus Abdominis Plane block provide significant postoperative analgesia in first 24 hour and excellent hemodynamic stability. Thus it is a safe modality for total abdominal hysterectomy as far as intraoperative hemodynamic effects and postoperative analgesia is concerned.

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