

**Original Research Article**

# **A prospective single blinded randomized study to assess post operative analgesia using ultrasound guided transverse abdominis plane block for laparoscopic appendectomy**

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## **Abstract**

**Introduction:** Pain is one of the most important factors that is responsible for many adverse outcomes during surgery and in postoperative period. Effective pain control can also facilitate rehabilitation and accelerate recovery from surgery.

**Aim:** To compare ultrasound-guided TAP block versus patients receiving no Transverse abdominis plane (TAP) block as regards the degree of pain relief in patients undergoing laparoscopic appendectomy.

**Materials and methods:** Prospective single blinded randomized control study. Patients were randomly allocated (computer coded sealed envelopes) to receive either TAP block or no TAP block with regular analgesia. Patient will be observed for 24 hours post operatively. 60 patients divided equally into 2 groups cases were TAP (transverse abdominis plane block) group (n =30), Control group (n= 30).

**Results:** The age between the two groups was analysed using student-t-test , the average age group in control group was found to be 32.64 years and TAP group 29.4 years. There was no significant difference in age between the two groups. The percentage of Males in TAP group was more when compare with Control, whereas in Control group the females were more but the difference was not

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statistically differ. Pain score between two groups was analysed using Mann-Whitney U test. The p-values of the Mann-Whitney U-test for the 2<sup>nd</sup>, 6<sup>th</sup> and 12<sup>th</sup> hours showed significant (p value – 0.000), which revealed that the mean rank for the pain scores of Control group was significant greater than the TAP group. Whereas for the 24<sup>th</sup> hour the mean rank for the pain score for both the groups were almost similar.

**Conclusions:** Ultrasound guided TAP block with 0.375% ropivacaine bilaterally can be used effectively for post operative analgesia for patients undergoing laparoscopic appendectomy.

## Key words

Laparoscopic appendectomy, Transverse abdominis plane (TAP) block, Pain scores.

## Introduction

One of the main objectives of anaesthesia is analgesia. Pain is one of the most important factor that is responsible for many adverse outcomes during surgery and in postoperative period also. Control of postoperative pain is one of the main concerns for both the patients and the surgical team. Advances in pharmacologic sciences and anaesthetic techniques have contributed to the development of the variety of therapeutic analgesics which are currently available.

The International Association for the Study of Pain defines pain [1] as, "the sensory and emotional experiences associated with actual or potential tissue damage". Pain is subjective in nature and there are no universally accepted means for its quantification. Pain responses and thresholds vary between individuals with fear and anxiety often accentuating the pain response [1]. In addition to the patient's perception and experience of pain, the healthcare provider's beliefs, biases, and attitudes must also be considered. In recent years an increasing number of surgical cases are being managed successfully by laparoscopic technique [2]. Although abdominal laparoscopic surgery, a widely performed surgery, is known for less pain compared to that of laparotomy, many patients actually still complain of considerable postoperative pain [3, 4]. The benefits of adequate analgesia include a reduction in the stress response of surgery, reduction in the perioperative morbidity improved surgical outcome. Effective pain control can also

facilitate rehabilitation and accelerate recovery from surgery [5, 6].

A substantial component of the pain experienced by patients after abdominal surgery is derived from the abdominal wall incision. The abdominal wall is innervated by nerve afferents that course through the transverses abdominis neurofascial plane. Abdominal field blocks have been used in anesthesia for surgery involving the anterior abdominal wall for several decades. Many blocks in this area are either difficult or high risk when performed blind, but ultrasound renders them very accessible and safe to perform [7]. The Transverse abdominis plane (TAP) block was first described in 2004 by McDonnell et al. <sup>8</sup> and ultrasound-guided technique was subsequently popularized by Hebbard et al. [7]. TAP block is a regional anesthetic technique that blocks neural afferents of the anterolateral abdominal wall. Using anatomical landmark guidance or with the aid of ultrasound (US), local anesthetic is injected into the transverse abdominis fascial plane, where the nerves from T6 to L1 are located [8].

Laparoscopic appendectomy is a frequent surgical procedure performed in our hospital. The aim of this study is to compare ultrasound-guided TAP block versus patients receiving no TAP block as regards the degree of pain relief in patients undergoing laparoscopic appendectomy.

## Materials and methods

Prospective single blinded randomized control study conducted in Tirumala Hospital in patent

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department for a period of 5 months from January 2106 to May 2016. 60 patients were enrolled in the study who were scheduled for laparoscopic appendectomy.

### **Inclusion criteria**

ASA grade of 1 and 2, age of 20-60 years, all patients posted for laparoscopic appendectomy

### **Exclusion criteria**

ASA grade 3 and 4, age >60 years, Patient refusal, patients allergy to Ropivacaine, patients having coagulopathy, skin infection at site of needle insertion, BMI more than 35 kg/m<sup>2</sup>, surgery duration more than 1 hour, ultrasound abdomen showing appendicular perforation or appendicular mass, retrocecal appendix and pelvic appendix and Pregnant women

60 patients divided equally into 2 groups cases were TAP (transverse abdominis plane block) group (n =30), Control group (n= 30)

Patients were randomly allocated (computer coded sealed envelopes) to receive either TAP block or no TAP block with regular analgesia. Patient will be observed for 24 hours post operatively.

After the institutional ethics committee approval and written informed consent sixty ASA one or two patients of either sex aged between 20-60 years scheduled to undergo 3 port laparoscopic appendectomy were enrolled.

Following a comprehensive pre anaesthetic evaluation all patients were explained about visual analogue scale for pain (0 – no pain, 10 – worst imaginable pain) in their own vernacular language. They were electively fasted 6 hours pre operatively and were pre medicated with oral ranitidine 150 mg and alprazolam 0.25 mg in the evening before and morning before the surgery.

In the operating room routine monitoring was applied and venous access was secured. Following pre oxygenation , all patients received glycopyrolate 0.2 mg intra venous ,Injection

fentanyl (2 mcg/kg) and anaesthesia was induced with thiopental Sodium 5 mg/kg and vecuronium 0.1 mg/kg intra venous was utilized to facilitate tracheal intubation.

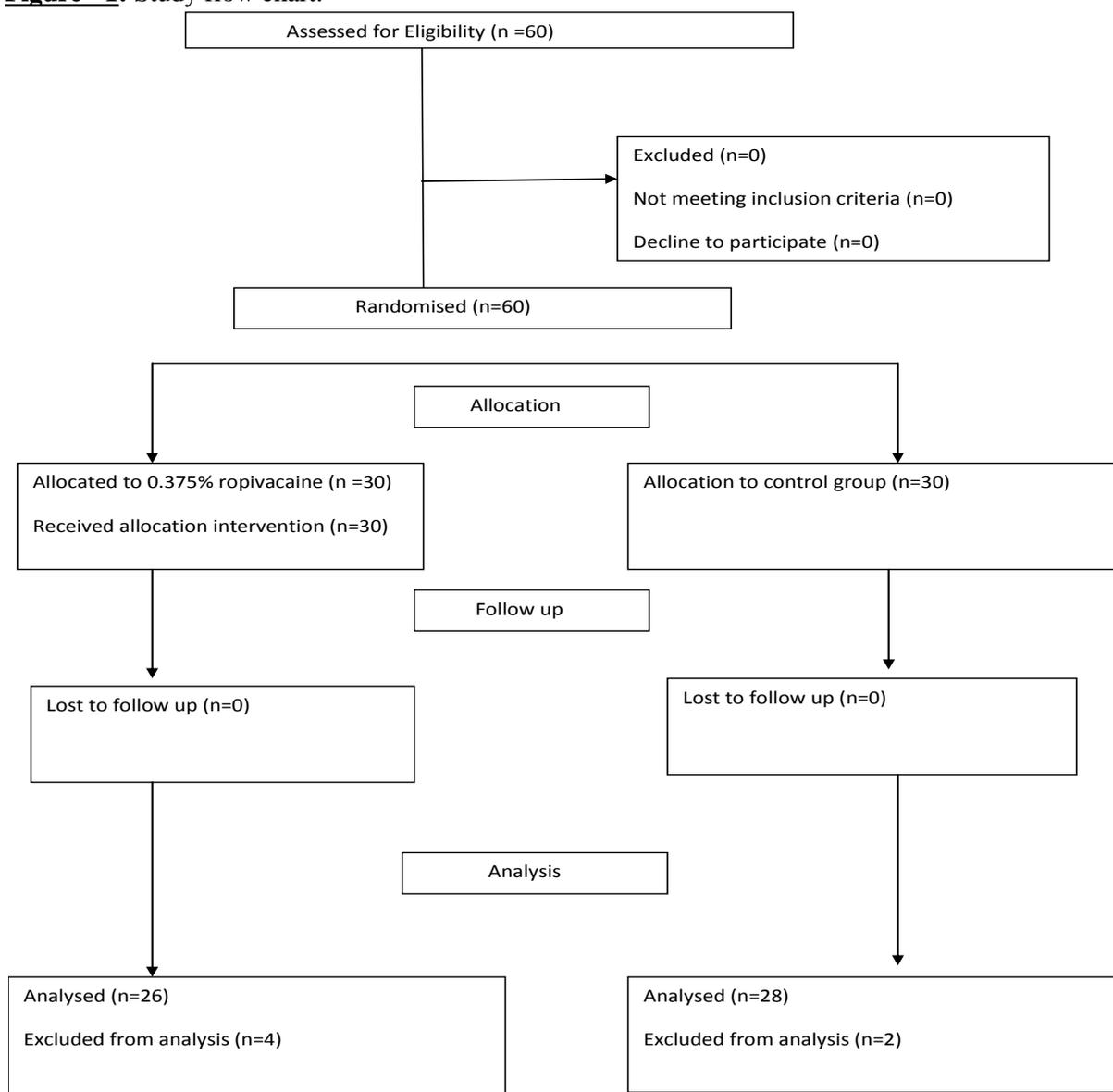
After that ensuring full asepsis ultrasound guided TAP block was administered using lateral TAP block approach under real time guidance with a high frequency (5-10 MHz) ultrasound probe . After confirming negative aspiration of blood TAP group received 20 ml of 0.375% of ropivacaine bilaterally and control received no TAP block as per the randomization

Anesthesia was maintained with nitrous oxide (60%) and isoflurane (0.5%- 1%) in oxygen. The intra abdominal pressure was maintained at 12 mmHg in both groups throughout the procedure. The residual neuromuscular block was antagonized by IV neostigmine and glycopyrrolate. Trachea was extubated once the patients were wide awake. Patients were shifted to post anaesthesia care unit (PACU). They were moved to step down after ensuring adequacy of pain relief (VAS score < 5) and absence of any overt side effects

In the PACU the patients were monitored for vital parameters, pain (vas scale) at 2 hour, 6 hour, 12 hour, 24 hour. Rescue analgesia ( diclofenac 75 mg IV diluted and given slowly if VAS score > 5 and ondansetron 0.1 mg IV were given to patients who complain nausea At all times patients were monitored for any signs for LA toxicity, and site of injection of TAP block were also inspected to detect haematomas and local infections. The data recorded in respective case report form.

In post operative analgesia for control group Paracetmol 1 gm I.V 8<sup>th</sup> hourly and tramadol 2mg/kg I.V BD. TAP group received no analgesia during post operative period. When pain score exceeded 5 on visual analogue scale, the patient was given rescue analgesia. Patients receiving rescue analgesia were eliminated from the study both from TAP group and control group (**Figure – 1**).

**Figure - 1:** Study flow chart.



**Visual analogue scale is used to measure pain**

- 0 – means no pain
- 5- moderate pain
- 10- worst possible pain

**Results**

Out of 30 patients in TAP group, 26 were analyzed. Out of 30 patients in control group, 28 patients were analyzed.

As the demographic variable age is a continuous variable and it was assumed to be normal, student-test was administered to check the whether there was a significant difference is observed between the two groups. Small

significance values (<.05) indicated that the two groups have different significantly.

The Average age in control group was 32.64 years and in TAP group was 29.4years (**Table – 1**). The P-value (0.093) of the student t-test (1.712) revealed that there was no significant difference in age between the two groups at 5% level of significance i.e., the sample taken from both the groups with regard to age is more or less unanimous (**Table – 1, Figure - 2**).

The variables gender was discrete so the non-parametric test chi-square test was used. The chi-square test revealed that whether there was a

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significant association between the two variables. Small significance values (<.05) indicated that the two groups had different significantly.

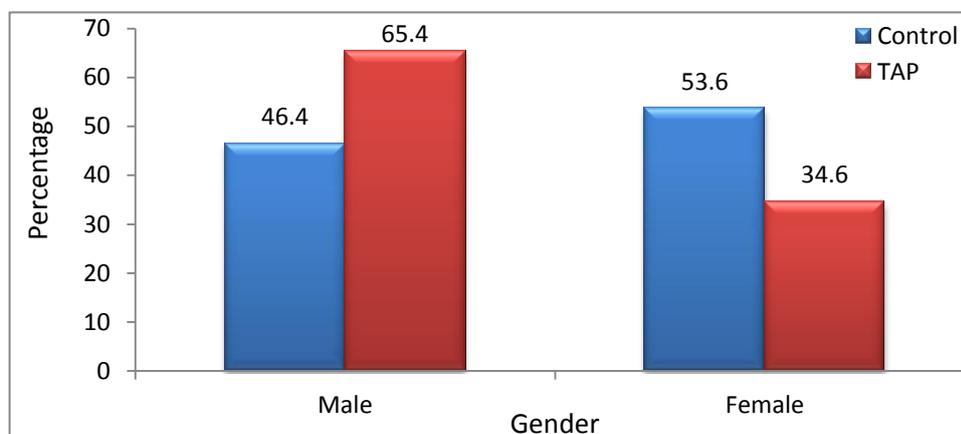
The variables ASA grade was discrete so the non-parametric test chi-square test is used. The

chi-square test revealed that whether there was a significant association between the two variables. Small significance values (<.05) indicate that the two groups have different significantly (**Table – 2**).

**Table - 1:** Statistical comparison of age between TAP group and control group using student-t- test.

	N	Mean	SD	T-Value	P-Value
Control	28	32.6429	7.44965	1.712	0.093
TAP	26	29.4231	6.26210		

**Figure - 2:** Bar diagram showing comparison of gender between Groups.



**Table - 2:** Statistical analysis of ASA grade between groups.

		ASA Grade		Total
		I	II	
Group	Control	16 57.1%	12 42.9%	28 100.0%
	TAP	20 76.9%	6 23.1%	26 100.0%
Total		36 66.7%	18 33.3%	54 100.0%

As the data did not follow normal distribution, non-parametric test i.e., Mann Whitney U-test was applied for the Pain score in different hours.

The p-values of the Mann-Whitney U-test for the 2<sup>nd</sup>, 6<sup>th</sup> and 12<sup>th</sup> hours shows significant which reveals that the mean rank for the pain scores of Control group was significant greater than the TAP group. Whereas for the 24<sup>th</sup> hour the mean rank for the pain score for both the

groups were almost similar to each other at 5% level of significance i.e., the TAP group performing well up to 12<sup>th</sup> hour with less pain score when compare with control group and the difference between the two groups with regard to the pain score was statistically significant till 12<sup>th</sup> hour and not significant at 24<sup>th</sup> hour (**Table – 3, Figure - 3**). The TAP group performing well up to 12<sup>th</sup> hour with less pain score when compare with control group and the difference between

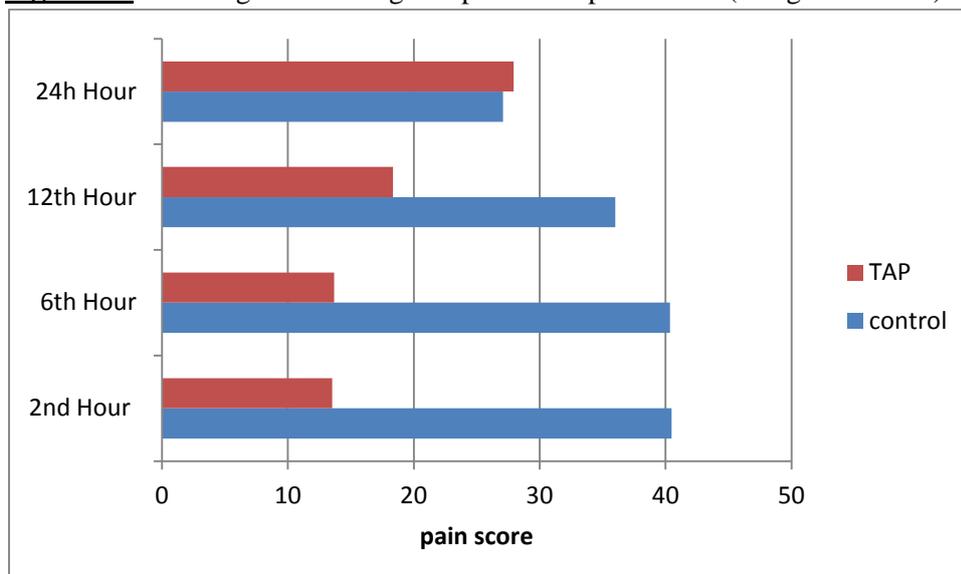
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the two groups with regard to the pain score was significant at 24<sup>th</sup> hour. statistically significant till 12<sup>th</sup> hour and not

**Table - 3:** Analysis of pain scores using VAS between groups using Mann-Whitney U- test.

Hours	Group	N	Mean Rank	Sum of ranks	Mann Whitney-U	P-Value	Decision
2 <sup>nd</sup> Hour	Control	28	40.48	1133.50	0.5	0.000	Significant
	TAP	26	13.52	351.50			
6 <sup>th</sup> Hour	Control	28	40.34	1129.50	4.5	0.000	Significant
	TAP	26	13.67	355.50			
12 <sup>th</sup> Hour	Control	28	36.00	1008.00	126	0.000	Significant
	TAP	26	18.35	477.00			
24 <sup>h</sup> Hour	Control	28	27.09	758.50	352	0.733	Not Significant
	TAP	26	27.94	726.5			

**Figure – 3:** Bar diagram showing comparison of pain scores (using VAS scale) between groups.



## Discussion

The present study showed that when administered via ultrasound guided TAP block the plain solution of ropivacaine (0.375%) provide more effective pain relief in immediate post operative period as compared to regular post operative analgesia (tramadol 2 mg/kg IV BD plus paracetamol 1 gm IV TID).

The age between the two groups was analysed using student-t-test, the average age group in control group was found to be 32.64 years and TAP group 29.4 years. The P-value (0.093) of

the student t-test (1.712) revealed that there was no significant difference in age between the two groups. The sample taken from both the groups with regard to age was more or less unanimous. The percentage of Males in TAP group was more when compare with Control, whereas in Control group the females were more but the difference is not statistically differ. Insignificant p-value of the chi-square test, it was revealed that group and ASA grade were independent to each other at 5% level of significance

Pain score between two groups was analysed using Mann-Whitney U test. The p-values of the

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Mann-Whitney U-test for the 2<sup>nd</sup>, 6<sup>th</sup> and 12<sup>th</sup> hours shows Significant (p value – 0.000), which revealed that the mean rank for the pain scores of Control group was significant greater than the TAP group. Whereas for the 24<sup>th</sup> hour the mean rank for the pain score for both the groups were almost similar to each other at 5% level of significance (p- value 0.733) i.e., The TAP group performing well up to 12<sup>th</sup> hour with less pain score when compare with control group and the difference between the two groups with regard to the pain score was statistically significant till 12<sup>th</sup> hour and statistically not significant till 24<sup>th</sup> hour

TAP block is a regional analgesic technique where in effective pain relief is achieved by blocking the nerves of abdominal wall (inter costal nerves: T7-T12 and ilioinguinal and iliohypogastric nerves: L1) which traverse the plain intervening plane between the internal oblique and transverse abdominis muscle [9].

The use of ultrasound has virtually surpassed the limitation of the conventional blind technique of anatomical landmark facilitated approach by providing direct visualisation of the target plane [7]. In a study involving rats it has been seen that ropivacaine at equipotent doses of bupivacaine has lesser toxicity profile and is a safer drug [10].

As the number of studies using ropivacaine were less compared to bupivacaine we decided to use ropivacaine as the drug for this study. There are studies with conflicting evidence which report higher pain scores in patients receiving TAP block with ropivacaine (0.375-0.75%) for various non laparoscopic abdominal or gynaecological surgeries [11, 12].

But a metaanalysis published on TAP block used for various abdominal surgeries has also reported statistically significant reduction in post operative opioid consumption at 6 hours and 24 hours which is independent of the timing of injection or block approach adopted [13].

Various studies showed similar results. In a clinical study done in non laparoscopic

gynecological surgeries [13], 0.375% ropivacaine was used for TAP block and the reported pain scores were lower when compared for the patients who did not receive TAP block; higher VAS scores were observed when 0.75% of ropivacaine was used in TAP block, attributed to different pain profile in the open large incision used for the surgery.

Kadam (2011) conducted a study on 20 patients undergoing major abdominal surgeries to test the efficacy of TAP block using 15 ml 0.5 % ropivacaine with continuous infusion 0.2 % ropivacaine bilaterally in 10 patients and no TAP in 10 patients and found that reduced pain scores and fentanyl consumption in patients receiving TAP block [14].

Tolchard (2012) conducted a study on 43 patients undergoing laparoscopic cholecystectomy to test the efficacy of TAP block using 1 mg/kg bupivacaine unilaterally in 21 patients and Local infiltration to port sites only in 22 patients and found Reduced VAS scores and fentanyl requirement in PACU [15]. Tan (2012) conducted a study on 40 patients undergoing cesarean sections to test the efficacy of TAP block using 20 ml of 0.25% levobupivacaine bilaterally in 20 patients and no TAP in 20 patients and found reduction in morphine consumption and patient satisfaction in TAP group [16].

Sinha (2013) conducted a study on 100 patients undergoing laparoscopic bariatric surgery to test the efficacy to TAP block using 20 ml of 0.375% ropivacaine bilaterally in 50 patients and no TAP block in patients and found reduced opioid requirement and VAS score in TAP group [17]. Walter (2013) conducted a study on 68 patients undergoing laparoscopic colorectal surgery to test the efficacy of TAP block using 20 ml of 0.2% levobupivacaine bilaterally in 33 patients and no TAP block in 35 patients and found reduced opioid use in first 24 hours in TAP group [18].

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Wu (2013) conducted a study on 82 patients undergoing radical gastrectomy to test the efficacy of TAP block using 20 ml 0.375 % ropivacaine bilaterally in 27 patients, Thoracic epidural in 29 patients and GA only 26 patients and found TAP reduced opioid consumption than GA alone; equivocal pain scores. Thoracic epidural less opioid consumption than TAP block; equivocal pain scores [19]. Parikh (2013) conducted a study on 60 Donor nephrectomy to test the efficacy of TAP block using 25 ml 0.375% bupivacaine unilaterally in 30 patients and placebo control with saline in 30 patients and found reduced tramadol consumption in the 1st 24 hours [20].

## Conclusion

We concluded that use of ultrasound for placement of TAP block has proven efficient and is beginning to solidify its place in clinical practice. The TAP block under ultrasound guidance was easy to perform and provided reliable and effective analgesia in adults undergoing laparoscopic appendectomy. No intra operative and post operative complications were observed.

We recommend based on our study that ultrasound guided TAP block with 0.375% ropivacaine bilaterally can be used effectively for post operative analgesia for patients undergoing laparoscopic appendectomy.

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