



# International Journal of Medical Anesthesiology

E-ISSN: 2664-3774  
P-ISSN: 2664-3766  
[www.anesthesiologypaper.com](http://www.anesthesiologypaper.com)  
IJMA 2023; 6(3): 33-36  
Received: 25-04-2023  
Accepted: 30-05-2023

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## Study of analgesic efficacy of ultrasound-guided Transversus Abdominis plane block for robotic nephrectomy

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DOI: <https://doi.org/10.33545/26643766.2023.v6.i3a.410>

### Abstract

**Background:** Ultrasound-guided lateral Transversus Abdominis Plane (TAP) block is an efficient method of providing pain relief in anterior abdominal wall surgeries. However, its efficacy in robotic nephrectomy is uncertain. Our study is aimed to evaluate the analgesic efficacy of lateral TAP block for robotic partial/ radical nephrectomy.

**Materials and Methods:** A Retrospective study was done on patients who underwent Robotic nephrectomy (partial and radical). In this Retrospective study, eligible patients were divided into two groups: the IV analgesia group (group 1) and the TAP block group (group 2). In the IV ANALGESIC group, Tramadol 1 mg/Kg IV and Paracetamol 15 mg/Kg IV was given, and the TAP Block group received ultrasound-guided TAP Block with 20ml of 0.375% Ropivacaine. The post-operative VAS (Visual Analogue Scale) score, the time of first rescue analgesia, and the incidence of postoperative nausea and vomiting were noted. Patients were carefully picked up from medical records to avoid any bias.

**Results:** The group that received ultrasound-guided TAP block had better postoperative analgesia, with a delayed time of first rescue analgesia and a lesser incidence of PONV. Hence, an ultrasound-guided TAP Block provided a better postoperative outcome in terms of pain management.

**Conclusion:** Our study concludes that patients receiving TAP block had better pain relief. Also, the time requirement for first rescue analgesia was delayed, and the incidence of postoperative nausea and vomiting was reduced. Hence, TAP block is an effective modality of pain relief in patients undergoing robotic nephrectomy.

**Keywords:** Ultrasound-guided Transversus abdominis plane block, Analgesia, Robotic Nephrectomy, Post-operative nausea, vomiting, VAS score, rescue analgesia

### Introduction

Modern surgical techniques emphasize minimally invasive methods to increase patient outcomes and satisfaction while lowering surgical morbidity and mortality. The most recent development in minimally invasive surgery is robotic-assisted surgery. Robotic-assisted surgery has many benefits, including increased precision and accuracy of the movements that may improve patient outcomes. Fewer conversions to laparotomy were observed in studies comparing the outcomes of robotic surgery to conventional laparoscopy<sup>[1]</sup>.

Even though robotic nephrectomy procedures result in less post-operative pain than open nephrectomy procedures, the pain remains the most frequent issue, especially in the first 24 hours. The ability to handle pain effectively is a crucial requirement for early hospital discharge. Even day-care discharge of patients is possible with proper pain relief<sup>[2]</sup>.

Transversus Abdominis Plane (TAP) block, a regional nerve blockade technique, is gaining popularity as a part of a multimodal strategy for enhancing post-operative pain relief. TAP block was initially introduced in 2001, and the first Ultra Sound Guided TAP block procedure was performed in 2007. The USG TAP block was found to be both more efficient and secure than blind blockade techniques<sup>[3]</sup>.

TAP block has been shown to decrease the need for opioids and NSAIDs. Opioid-based conventional pain relief increases the possibility of side effects like excessive sedation and postoperative nausea and vomiting (PONV). The use of NSAIDs is avoided in patients undergoing nephrectomy.

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Different analgesics or local anaesthetics may be used in multimodal analgesia techniques to mitigate pain and adverse postoperative consequences.

### **Aims and Objectives**

The current study aimed to retrospectively compare the efficacy of TAP Block in patients who underwent Robotic nephrectomy. Primary objective visual analogue scale (VAS) at 0.5, 1, 2, 6, 8, and 12 hrs. A secondary objective was time for the requirement of the first rescue analgesic in the postoperative period and the incidence of postoperative nausea and vomiting.

### **Materials and Methods**

In our hospital, robotic nephrectomy is done by different surgeon teams and different groups of anesthesiologists. One group of anesthesiologists uses IV Analgesics for pain relief, and the other group uses TAP block for postoperative pain relief. In this Retrospective study, eligible patients were divided into two groups: The IV analgesia group (Group 1) and the TAP block group (Group 2). Post-surgery, for group 2, an ultrasound-guided TAP block was performed with 20 ml of 0.375% ropivacaine. For the group 1, Tramadol 1 mg/Kg IV and Paracetamol 15 mg/Kg IV were administered as standard to patients in this group 30 min before Extubation in coordination with the surgical team. The patient's data was carefully picked up from the medical records of those satisfying the inclusion criteria, and the rest were excluded.

### **Study Design and patient population**

This retrospective study analyzed data from consecutive patients that underwent Robotic nephrectomy between October 2022 and March 2023 at Apollo Main Hospital, Chennai. The study's sample was composed of patient file information screened between the study dates. About 50 patients satisfied the inclusion criteria in the above period. Data was meticulously collected to prevent any bias.

We included patients aged between 18 and 70 years who underwent elective Robotic radical or partial nephrectomy. Patients who met any of the following criteria were excluded: 1. Long-term use of other analgesic medications or a persistent opioid addiction, 2. Any allergy to local anaesthetics, 3. Who had a language barrier, severe dementia, or end-stage disease that hinders communication; 4. any nerve block contraindication, such as an infection at the puncture site or severe coagulation dysfunction; and 5. who had a history of local anaesthetic allergy. 6. Patients who were discharged before 12 hours 7. Patients who did not comprehend the VAS scale 8. Those patients whose VAS scores were not recorded.

### **Methodology**

Preoperative assessment was done for all patients, including a detailed history and general physical and systemic examination, and all investigations necessary for the conduct of anaesthesia were done and optimized before surgery. Patients were kept nil oral from midnight before the

day of surgery. A pulse oximeter, non-invasive blood pressure monitors, and ECG monitors were attached to the operating theatre, and baseline values were recorded. IV access was secured with an IV cannula. Preoxygenation was done for 3 minutes with 100% oxygen before the induction of anaesthesia. The patient was induced with Inj. Propofol 2 mg/kg IV, Inj. Fentanyl 12 mcg/kg IV and muscle relaxation were provided with Inj. Atracurium 0.5 mg/kg IV, followed by infusion at 0.3 mg/kg/hr. The patient was intubated with an appropriate-sized endotracheal tube. Maintenance was achieved with sevoflurane 1 MAC, along with a mixture of 50% oxygen and 50% air. Inj. Ondansetron, 4 mg IV, was given before Extubation in both groups. The practice of conducting anaesthesia was the same between both groups of anesthesiologists.

### **TAP Block Group**

In the TAP Block group, post-surgery ultrasound-guided bilateral TAP block was performed with 20 ml of 0.375% ropivacaine (Group 2). The ultrasound probe is positioned in a transverse plane on the lateral abdominal wall in the midaxillary line between the lower costal margin and the iliac crest. 20 ml of 0.375% Ropivacaine is deposited in the plane between the internal oblique and Transversus Abdominis muscle under ultrasound guidance.

Ultrasound helps in the accurate deposition of the local anaesthetic in the proper neurovascular plane.

### **IV Analgesic Group**

For the analgesia group, Tramadol 1 mg/Kg IV and Paracetamol 15 mg/Kg IV were administered as standard to patients in this group 30 minutes before Extubation in coordination with the surgical team.

Pain was assessed by the VAS scale at 0.5, 1, 2, 6, 8, and 12 hours postoperatively in both groups. Pain scores were recorded as 0 (no pain) to 10 (worst pain ever). We also assessed the time required for the first rescue analgesic in the postoperative period and the incidence of postoperative nausea and vomiting in both groups.

### **Statistical Analysis**

Descriptive statistics were presented with Mean  $\pm$  SD and frequency (percentage) for the continuous and categorical factors, respectively. Median (IQR) was presented while the data follows the non-normal distribution. The normality of the data was checked by using the Shapiro-Wilk test. Student's t-test/Mann Whitney U test was used to find out the significant difference between parameters and group. Chi-square/Fisher's exact test was used to determine the association between ASA, gender, and group. The Friedman test was used to determine the significant changes over time. Wilcoxon Sign rank test was performed as a post-hoc analysis and compared the VAS score pairwise. A P-Value  $< 0.05$  is considered as statistical significance. All analysis was done by using the statistical software SPSS (IBM, 28.0)

### **Results**

**Table 1:** Comparison of demographic profile, ASA (American Society of Anesthesiology) physical status classification between the two groups

Parameters	Group, N (%)		Overall, (N=50)	P-Value
	IV Analgesia, (N=23) Group 1	TAP Block, (N=27) Group 2		
<b>Age (In years)</b>				
Mean±SD	52.4±11.5	55.9±8.1	54.3±9.9	0.205*
Range	33-68	36-69	33-69	
<b>Gender</b>				
Male	15(65.2)	20(74.1)	35(70)	0.548#
Female	8(34.8)	7(25.9)	15(30)	
<b>Height</b>				
Mean ± SD	164.8±6.7	164.6±7.4	164.7±7.0	0.894*
Range	150-170	149-178	149-178	
<b>Weight</b>				
Mean ± SD	67.4±7.9	67.4±5.7	67.4±6.8	0.974*
Range	55-90	54-80	54-90	
<b>ASA</b>				
2	14(60.9)	14(51.9)	28(56)	0.577#
3	9(39.1)	13(48.1)	22(44)	

\*- Student's t-test/Mann Whitney U test; #- Chi-square/Fisher's exact test

About 50 patients were included in our study. 23 patients belonged to Group 1 (IV Analgesia Group), and 27 patients belonged to Group 2 (TAP Block). In the IV Analgesia group, 15 patients underwent Robotic partial nephrectomy, and 8 patients underwent Robotic radical nephrectomy. In the TAP block group, 16 patients underwent Robotic partial nephrectomy, and 11 patients underwent Robotic radical nephrectomy.

Group 1 had a mean age of 52.4±11.5 years, while Group 2 had a mean age of 55.9±8.1 years. Group 1 comprised 15 males and 8 females, while Group 2 comprised 20 males and 7 females. The mean height of Group 1 was 164.8±6.7 cm, and the mean weight was 67.4±7.9 Kg, with Group 2 showing a mean height of 164.6±7.4 cm and a mean weight of 67.4±5.7 Kg. The demographic factors and ASA class were comparable in both groups in our study.

**Table 2:** Distribution among surgical groups

Surgery	Group, N (%)		Overall, (N=50)	P-Value
	IV Analgesia, (Group 1), (N=23)	TAP Block, (Group 2), (N=27)		
Robotic Partial nephrectomy	15(65.2)	16(59.3)	31(62)	0.786#
	8(34.8)	11(40.7)	19(38)	

#- Chi-square/Fisher's exact test

**Table 3:** VAS Score

VAS Score	Group, Median (IQR)		Overall, (N=50)	P-Value*
	IV Analgesia, (N=23)	TAP Block, (N=27)		
At 30 Minutes	0(0-0)	0(0-0)	0(0-0)	0.025
At 1 hour	0(0-1)	0(0-0)	0(0-0)	< 0.001
At 2 hours	3(2-3)	0(0-0)	0.5(0-3)	< 0.001
At 6 hours	3(3-3)	2(2-3)	3(2-3)	0.003
At 8 hours	3(3-3)	2(1-2)	2(2-3)	< 0.001
At 12 hours	3(3-3)	3(2-3)	3(2-3)	< 0.001
P-Value <sup>F</sup>	< 0.001	< 0.001	< 0.001	

\*- Student's T-Test/Mann Whitney U Test, <sup>F</sup>- Friedman test, Boldface indicates statistical significance

Table 3, the median VAS score was lesser in the TAP block group than in the IV analgesia group, and the difference was statistically significant each time (P-Value < 0.001). Over the time, the VAS score was slightly increasing in both the

IV analgesia group and the TAP block group (P-Value < 0.001). The group which received the TAP block had better analgesia with lesser pain scores.

**Table 4:** Time for the requirement of rescue analgesia and PONV

Parameters	Group, n (%)		Overall, (N=50)	P-Value
	IV Analgesia, (N=23)	TAP Block, (N=27)		
Time for rescue analgesia Median (IQR)	3(3-4)	7(6-7)	5(3-7)	< 0.001*
<b>PONV</b>				
No	11(47.8)	24(88.9)	35(70)	< 0.002#
Yes	12(52.2)	3(11.1)	15(30)	

\*- Student's t-test/Mann Whitney U test, #- Chi-square/Fisher's exact test, Boldface indicates statistical significance

Table 4. The median time for the requirement of the first rescue analgesic was 3 hrs. in the IV Analgesia group compared to 7hrs in the TAP Block group. Hence TAP Block delays the time of requirement of first rescue analgesia. ( $p<0.001$ )

There is also a significant difference in the incidence of Post-operative nausea and vomiting (PONV), ( $p<0.002$ ) with a lesser incidence of patients who received TAP block.

### Discussion

Effective pain management is a keystone to early recovery and discharge after surgery. The analgesic regimen should be reliable, secure, and free from adverse effects. In recent years, there has been an increase in interest in ultrasound-guided regional nerve block procedures with promising efficacy outcomes, as they lessen the requirement for additional analgesics and hence the incidence of drug-related adverse effects [4].

In the Aniskevich, *et al.* [5] study, TAP block reduced the overall pain scores compared to placebo, similar to our study. In a study by Belavy, *et al.* [6], there was improved satisfaction with their pain relief in the TAP Block group, similar to our study. Srivastava, *et al.* [4] study found that the time of rescue analgesia was significantly longer in the TAP block group. Aniskevich, *et al.* [5] study concluded that the requirement for additional IV analgesics was reduced in the TAP block group.

In Tekeli, *et al.* [3] study, the incidence of Post-operative nausea and vomiting was considerably lower in the TAP block group than in the IV analgesic group. Our study concluded with similar results: Pain scores in the TAP group were lower, the timing for needing rescue analgesia was delayed, and the incidence of postoperative nausea and vomiting was also reduced.

### Limitations

There are certain limitations in our study. The study could have been multicentre. The sample size in our study was 50. A larger sample size might yield more reliable results. Pain relief beyond 12 hours was not compared. A prospective study could add further evidence in the future.

### Conclusion

Our study concludes that patients receiving TAP block had better pain relief. Also, the time requirement for first rescue analgesia was delayed, and the incidence of postoperative nausea and vomiting was reduced. Hence, TAP block is an effective modality of pain relief in patients undergoing robotic nephrectomy and can be used as a part of multimodal analgesia.

### Conflict of Interest

Not available

### Financial Support

Not available

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#### How to Cite This Article

Rajendran H, Ganesan A, Chirravur P. Study of analgesic efficacy of ultrasound-guided Transversus Abdominis plane block for robotic nephrectomy. *International Journal of Medical Anesthesiology*. 2023;6(3):33-36.

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