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Timing of Transversus Abdominis Plane Block (TAP) for Pain Control after Laparoscopic Radical Prostatectomy (LRP)

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Abstract

Introduction: Efficient post-operative pain management has an important role in facilitating rapid patient's recovery. We routinely apply TAP block for pain control following LRP. The objective of this study was to determine the effect of timing of TAP block and its influence on pain and analgesics consumed postoperatively. **Materials and Methods:** Data of men who underwent extra peritoneal LRP and received bilateral TAP block at the beginning versus at the completion of the surgery (Lidocaine 1% 10 mL and bupivacaine. 0.5% 10 mL on each side) were analyzed. Data compared included pain intensity using Visual Analogue Scale (VAS) and analgesics consumption. Data of patient who underwent intraperitoneal LRP were excluded. **Results:** A total of 60 patients were included, 30 received bilateral pre-operative TAP block, prior to the trocar incision (group 1), and 30 received bilateral post-operative TAP block after completion of the surgery (group 2). Pain intensity (median) on postoperative day (POD) 1, was lower in group 1 compared to group 2 ($P = 0.0087$). On POD2, VAS was similar in both groups ($P = 0.199$). Analgesics consumption (number of doses given) on POD1 was lower in groups 1 compared to group 2 ($P = 0.0212$). On POD2 there was no difference between both groups (0.3925). No one required opioids for pain management. **Conclusion:** Bilateral pre-operative TAP block reduces pain intensity and analgesics consumption compared to post-operative TAP block after laparoscopic radical prostatectomy.

Keywords

Pain Control, TAP Block, Radical Prostatectomy

1. Introduction

The wide spread application of advanced laparoscopic and robot-assisted technologies has resulted in improvement of oncological, functional and postoperative outcomes [1].

Laparoscopic radical prostatectomy (LRP) is a widely accepted minimally invasive method for treating localized prostate cancer. Research has confirmed its safety and highlighted several benefits over open surgery, such as a shorter hospital stay, faster recovery after the procedure, decreased blood loss, and less postoperative pain. These advantages have contributed to its popularity as an effective and less invasive alternative for patients undergoing prostate cancer surgery [2]-[4]. Although LRP is minimally invasive, it is still associated with postoperative pain which could be severe during the first 24 h following laparoscopic surgery [5] [6].

Effective pain control is essential during the perioperative phase. The purpose of administering analgesics is to support prompt postoperative recovery by minimizing discomfort, which helps patients regain mobility more quickly and improve their overall recovery experience [6] [7]. Pain experienced after laparoscopic surgery may arise from both somatic sources, such as the abdominal wall, and visceral sources, related to internal organs. The coexistence of these pain components contributes to the overall postoperative discomfort patients may experience [8]. The somatic pain is usually caused by the penetration of the abdominal wall and the insertion of trocars and sutures [9].

The Transversus Abdominis Plane (TAP) block is a regional anesthesia technique involving the injection of local anesthetic into the space between the internal oblique and transversus abdominis muscles. Research suggests that the TAP block not only effectively reduces postoperative pain but also has the potential to decrease the need for opioid medications following various surgeries, including general and gynecologic procedures such as hysterectomy, appendectomy, cesarean section, prostatectomy, and partial nephrectomy [10]-[12]. At our department, TAP block is routinely applied during LRP, partial and radical nephrectomy. TAP block can be delivered at the beginning or at the completion of the surgery.

There have been no studies assessing the effect of timing of TAP block for optimal postoperative pain control. The objective of this study was to determine the effect of timing of TAP block during LRP and its influence on pain and analgesics consumed postoperatively.

2. Materials and Methods

Data were retrospectively collected from an institutional registry of patients who underwent extraperitoneal laparoscopic radical prostatectomy (LRP) and received bilateral TAP blocks between April 2019 and July 2023. The study received approval from the local Institutional Ethics Committee (with IRB nr. 0149-17-WOMC) in accordance with the declaration of Helsinki. Written informed consent was obtained from the participants prior to the study. The TAP blocks were routinely performed using a total of 20 mL of a 50/50 mixture of 1% lidocaine and 0.5% bupivacaine on each side. The timing of the TAP block—either at the beginning of surgery or at the end—was documented. Included in the study were patients with clinically localized prostate cancer who underwent extraperitoneal LRP using four trocars (5 - 12 mm). Patients who had concomitant procedures or underwent transperitoneal or open prostatectomy were excluded. Participants were divided into two groups based on the timing of the TAP block: Group 1 received the block at the start of surgery (before incisions), and Group 2 received it after the surgery was completed and the wounds were closed. The choice of timing was made at the surgeon's discretion.

2.1. Anesthetic Technique

All patients received general anesthesia using propofol, fentanyl (1 to 3 micrograms per kilogram (mcg/kg) for induction and for maintenance 3 - 6 mcg/kg), and vecuronium for induction and sevoflurane for maintenance.

2.2. Surgical Technique

With the patient positioned in steep Trendelenburg, the extraperitoneal approach was utilized to perform the laparoscopic radical prostatectomy (LRP). Four trocars were inserted: a 12-mm trocar infraumbilically, two 5-mm trocars in the right lower quadrant, and one 5-mm trocar in the left lower quadrant. The pre-peritoneal space was then developed using a balloon dilator, and a blunt-tipped balloon trocar was placed. Pelvic lymph node dissection was carried out when indicated. Subsequently, the radical prostatectomy was performed following standard procedures. The excised specimen was contained in an entrapment bag and removed through the 12-mm port site. At the conclusion of the surgery, the skin was closed using subcuticular sutures [7] [10].

2.3. TAP Block Technique

A bilateral TAP block was performed using 20 mL of anesthetic mixture—comprising 10 mL of 1% lidocaine and 10 mL of 0.5% bupivacaine—on each side of the abdominal wall. The procedure was carried out either at the start of the operation or immediately after completing the laparoscopic radical prostatectomy (LRP).

An ultrasound transducer with a high-frequency probe was positioned transversely along the mid-axillary line, between the lower costal margin and the iliac crest (see **Figure 1**, Ultrasound-Guided Transducer Placement during Transverse Plane: Subcostal Margin and Iliac Crest Landmarks). Using ultrasound guidance, the operator identified and marked the subcutaneous fat, external and internal oblique muscles, transversus abdominis (TA) muscle, and the peritoneal cavity (**Figure 2**, Ultrasound-Guided TAP Block: Internal Oblique-Transversus Abdominis Plane Injection). After measuring the depth of the TAP, a 22-gauge needle was inserted and advanced in-plane into the space between the internal oblique and transversus abdominis muscles, where the thoracolumbar nerves (T10-L1) are located. Once proper needle placement was confirmed—visualized as a hypoechoic, lens-shaped space between the IO and TA—and after aspirating to ensure no blood vessel was punctured, a total of 20 mL of the anesthetic solution was injected on each side [10] [13].

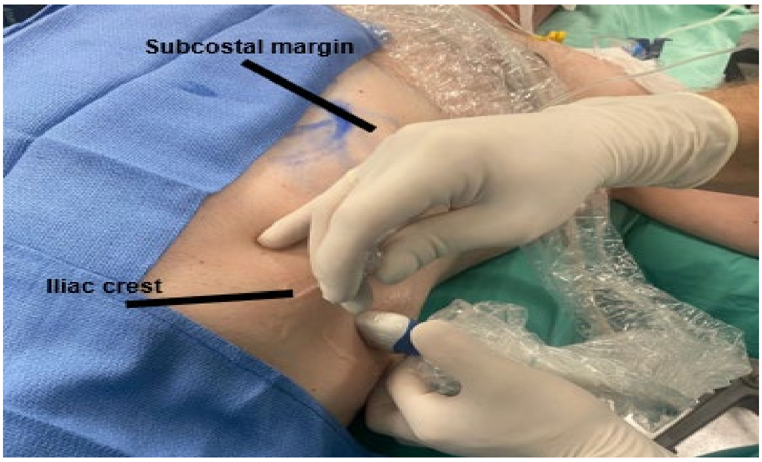

Figure 1. Ultrasound transducer was placed in the transverse plane at the mid-axillary line between the lower costal margin and the iliac crest.

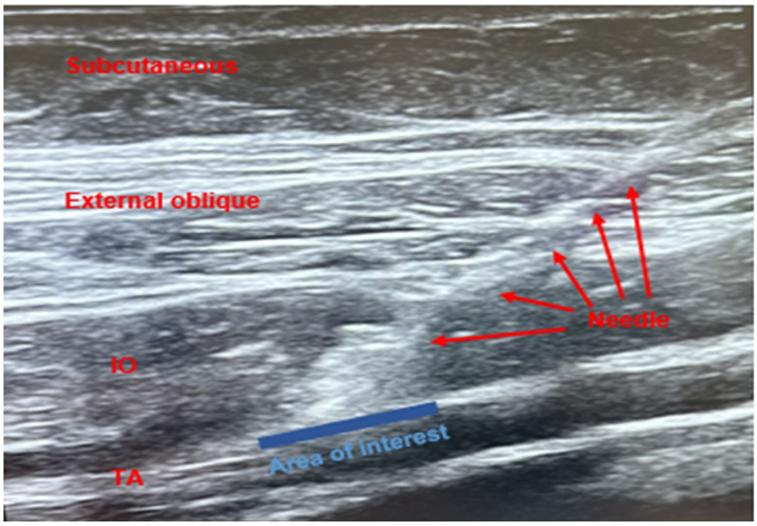

Figure 2. Injection of anesthetic solution between internal oblique (IO) and transversus abdominis (TA) muscle.

2.4. Postsurgical Analgesia Protocol

During the study, standard institutional postoperative pain management protocols were followed. These included administering dipyrone (1 g orally) for mild pain, paracetamol (1 g intravenously) for moderate pain, and tramadol (100 mg intravenously) for severe pain, as needed. Pain levels were assessed using a validated visual analog scale (VAS), which ranges from 0—indicating no pain—to

10—representing the worst possible pain [14]. was routinely charted every 4 hours in the postoperative period [10] along with routine vital signs assessment. No narcotics were routinely prescribed.

2.5. Postoperative Measurement and Endpoints

The VAS pain scores were averaged for each postoperative day (POD) for analyses. We compared postoperative pain intensity on POD 1 and 2 between the two groups.

To accurately reflect analgesic exposure, postoperative analgesic consumption was recorded and analyzed separately for each medication. Rather than combining disparate drugs into a single "dose" count, we compared the total cumulative dose (in milligrams) and the total number of administrations of dipyrone, paracetamol, and tramadol independently between the two groups during their hospital stay.

2.6. Statistics

Data analysis was performed using SPSS v16 (SPSS Inc, Chicago, Illinois, USA). Continuous data were summarized as mean, standard deviation, and were compared with unpaired student's t-test (Age, operative time, ASA score). Non-parametric data analysis was performed using Mann-Whitney U test to compare VAS score and analgesic consumption. P-Value of <0.05 was considered statistically significant.

3. Results

A total of 60 patients who underwent LRP and received TAP block were included in the study, 30 patients received bilateral TAP block at the beginning of the surgery, prior to the trocar site incision (group 1), and 30 received bilateral TAP block after completion of the surgery (group 2). Patient characteristics were summarized in **Table 1**.

Pain intensity, as measured by VAS score was lower in group 1 compared to group 2 on POD1 ($P < 0.05$). In addition, analgesic consumption (number of doses given) was lower in group 1 compared to group 2 on POD1 ($P < 0.05$). There was no statistical difference in VAS score and analgesic consumption between the groups on POD2. None of the patients required opioids (Tramadol). **Table 2** summarizes the comparison of pain and analgesic consumption.

4. Discussion

Pain is a critical aspect of the postoperative period that requires prompt and effective management. Most surgical procedures are associated with clinical pain, and a significant number of patients experience severe pain following surgery. Managing this pain can be challenging and often presents difficulties for healthcare providers. [15]. Multimodal analgesia is a concept of combined multiple analgesic preparations for pain control, for example, non-steroidal anti-inflammatory treatment

Table 1. Patients' characteristics.

	Overall (n = 60)	Group 1	Group 2	P value < 0.05
Age, years, median (IQR)	69 (63.71)	67 (63.69)	69 (61.72)	0.391
ASA score*, n (%)				0.302
ASA 1	6 (10)	4 (13.3)	2 (6.6)	
ASA 2	41 (68.33)	17 (56.6)	25 (83.3)	
ASA 3	13 (21.66)	9 (30)	3 (10)	
Operative time, min, median (IQR)	208.5 (186.5, 227.5)	200 (180, 212)	216.5 (192, 232)	0.015
PSA, median	8.1	7.8	8.36	0.186
LND, n (%)	40 (66.66)	22 (73.3)	18 (60)	0.188
GGR*, n (%)				0.338
GGR 1	7 (11.6)	3 (5)	4 (6.66)	
GGR 2	23 (38.32)	10 (16.66)	13 (21.66)	
GGR 3	13 (21.66)	6 (10)	7 (11.66)	
>GGR 3	17 (28.33)	9 (15)	8 (13.3)	
Pathologic TNM, n (%)				0.401
T2b	9 (15)	6 (10)	3 (5)	
T2c	23 (38.33)	10 (16.66)	13 (21.66)	
T3a	27 (45)	13 (21.66)	14 (23.33)	
T3b	1 (1.66)	1 (1.66)	0	

*ASA-American Society of Anesthesiology; *GGR-Grade Group.

Table 2. Comparison of pain control and analgesics consumption between pre-(Group 1) and post-operative (Group 2) TAP block.

	Group 1	Group 2	P value < 0.05
Number of patients n (%)	30 (50%)	30 (50%)	
VAS* on POD1$_{x}$, median (IQR)	0 (0.4)	4 (0.4)	0.0087
VAS on POD2, median (IQR)	0 (0.8)	0 (0.4)	0.199
Number of analgesic doses given on POD1, median (IQR)	0 (0.1)	1 (0.1)	0.0212
Number of analgesic doses given on POD2, median (IQR)	0 (0.1)	0 (0.1)	0.3925

*VAS-Visual Analogous Score; $_{x}$POD-Post-operative Day.

with intravenous morphine [16]. Epidural catheter with extended release of morphine, wound infiltration and TAP block are additional methods for controlling pain [16] [17].

Over the past decade, increasing evidence has demonstrated the effectiveness of the TAP block for various abdominal surgeries. However, its use remains relatively less common in urologic procedures. With advancements in ultrasound technology, performing the TAP block has become more technically feasible and safer, potentially encouraging wider adoption in urological surgical practices. [13]. TAP block can be used unilaterally or bilaterally depending on the surgical sites and is usually performed at the end of the surgery. The objective of our study is to compare postoperative pain scores and opioid consumption between patients receiving preoperative versus postoperative TAP blocks. The literature regarding the effect of timing of TAP block (pre- or post-operative) is scarce.

Herein we report the first comparative study on the timing of TAP block in patients who underwent LRP. The findings of our study indicate that administering the pre-operative TAP block is more effective than performing it at the end of surgery, particularly on the first postoperative day (POD). Patients who received the TAP block before surgery experienced lower VAS scores and used fewer analgesics on POD1, with statistical significance ($P < 0.05$). A similar trend was observed on POD2, although it did not reach statistical significance. Notably, none of our patients required opioid therapy. This study demonstrates that pre-operative TAP block can effectively reduce both pain scores and analgesic use in patients undergoing laparoscopic radical prostatectomy (LRP). The rationale behind our research was to enhance postoperative pain management to promote early recovery, minimize the risks of analgesic toxicity and dependency, and shorten hospital stays.

The results of our study support the effectiveness of pre-operative TAP block, aligning with previous research by Rodriguez *et al.*, who found that pre-operative TAP blocks were associated with reduced pain and decreased intraoperative analgesic consumption during pancreatoduodenectomy [18]. In addition, Ozciftci *et al.* demonstrated the efficacy of preoperative TAP block in reducing pain intensity and analgesics treatment in patient who underwent surgery for acute appendicitis [19].

Conversely, there are conflicting findings in the literature. For example, a previous study involving patients who underwent laparoscopic cholecystectomy reported that postoperative TAP block was associated with reduced pain and lower analgesic consumption during the postoperative period compared to pre-operative TAP block. [20]. In another study, Escudero-Fung *et al.* also failed to demonstrate a difference in pain control and analgesics consumption with different timing of TAP block administration [21]. In our study, a significant between-group difference in operative time was observed, which is a clinically relevant factor that may influence postoperative pain outcomes and the efficacy of the transversus abdominis plane (TAP) block. Prolonged operative times can impact the success of the block in several ways. First, administering the block at the conclusion of a lengthy procedure may be influenced by surgeon fatigue, potentially affecting the precision of the technique compared to blocks performed at the beginning of surgery. Second, extensive and prolonged surgical manipulation often leads to edema and the disorganization of the abdominal fascial planes. This architectural alteration makes the ultrasound-guided identification of the correct anatomical planes significantly more difficult, which may compromise the optimal spread of the local anesthetic and, consequently, the analgesic efficacy of the TAP block.

5. What's Known on the Subject? And What Does the Study Add?

TAP block Proven effective in reducing pain in several studies in various fields of surgery. Our study adds several important contributions:

- Evidence of superior analgesia: Demonstrates that administering TAP blocks bilaterally pre-surgery provides better pain control, likely translating to lower pain scores in the immediate and early postoperative period.
- Opioid-sparing benefit: Shows a reduction in perioperative opioid requirements, which may decrease opioid-related side effects (nausea, vomiting, sedation, ileus) and improve recovery.
- Enhanced recovery potential: Improved pain control and reduced opioid use can support faster mobilization, shorter hospital stays, and enhanced overall recovery protocols.

6. Study Limitations

The present study has some limitations. First, the retrospective nature of our work should undoubtedly be taken into consideration, further prospective research is warranted in this field. Second, the number of patients included in the study is small. Third, the absence of randomization and inherent biases were possible. Fourth, the absence of post-discharge data of VAS score and analgesics consumption.

With the aforementioned limitations in mind, the result of our study suggests that pre-operative TAP block provides an advantage over post-operative TAP block in terms of post-operative pain control and analgesic consumption.

7. Conclusion

In this retrospective study, the use of bilateral pre-operative TAP block was associated with lower post-operative pain scores and reduced analgesic consumption compared to post-operative TAP block.

Author Contributions

Tarek Taha (First Author/Department of Urology): Contributed to patient care, data collection, literature search, and drafting the initial manuscript.

Jeffry Mattar: Assisted in clinical data collection, reviewing the literature and drafting the initial manuscript.

Mubarak Dahamshy: Contributed to manuscript drafting, image preparation, and proofreading.

A. Ami Sidi: Provided senior urological oversight, patient management supervision, and critical revision of the manuscript for intellectual content.

Alexander Tsivian: Conceived the manuscript performed/supervised the main urological surgeries, coordinated the team, critically revised the manuscript, and approved the final version for submission.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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