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ORIGINAL ARTICLE

Transversus Abdominis Plane Block Versus Local Wound Infiltration for Postoperative Pain Management in Patient Undergoing Total Abdominal Hysterectomy

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ABSTRACT

Objective: To compare the outcomes of transversus abdominis plane (TAP) block versus local wound infiltration (LAI) for postoperative analgesia in patients undergoing total abdominal hysterectomy (TAH).

Methods: This randomized controlled trial was conducted at Dr. Ziauddin Hospital & Medical College, Karachi, Pakistan from December 2023 to May 2024. Female patients aged 18 to 50 years, and scheduled for TAH under general anesthesia were included. Patients were randomly allocated to the TAP group or the LAI group using sealed opaque envelopes. The primary outcome was pain score at different time intervals postoperatively. Pain score measured using the Visual Analogue Scale. Secondary outcomes included total analgesia consumption within 24 hours.

Results: Of total 100 patients, the median (IQR) age was 50.0 (47.2-55.0) years. At 8 hours postoperatively, the median pain score was significantly lower in the TAP group 0.0 (0.0-1.0) compared to the LAI group 1.0 (0.0-2.0) (p-value <0.001). Similarly, at 12 hours, the TAP group reported a median pain score of 2.0 (1.0-2.0), significantly lower than the LAI group 3.0 (2.0-4.0) (p-value <0.001). At 24 hours, the median pain score remained significantly lower in the TAP group 50.0 (50.0-70.0) compared to the LAI group 130.0 (120.0-140.0) (p-value <0.001). Total analgesia consumption was also significantly lower in TAP group as compared to LAI group i.e., 50.0 (50.0-70.0) vs. 130.0 (120.0-140.0) (p-value <0.001).

Conclusion: The TAP block provided superior postoperative pain control compared to LAI in patients undergoing TAH, evidenced by lower pain scores and reduced analgesia consumption.

Keywords: Analgesia, Hysterectomy, Postoperative Pain, Visual Analogue Scale

Clinical Trial Registry#: NCT06256302

INTRODUCTION

Postoperative pain management remains a critical aspect of patient care following major surgical procedures, such as total abdominal hysterectomy (TAH).[1] Effective pain control not only enhances patient comfort but also facilitates early mobilization, reduces hospital stay, and prevents the development of chronic pain syndromes.[1,2] In Pakistan, where healthcare resources are often limited and the burden of postoperative complications can be significant, optimizing pain management strategies is particularly important.[2]

Traditionally, postoperative analgesia has been managed using systemic opioids, which, despite their effectiveness, are associated with a range of adverse effects including nausea, vomiting, sedation, and respiratory depression.[3,4] These adverse effects can lead to extended hospital stays and increased healthcare costs, which are critical considerations in the Pakistani healthcare setting.[2] Therefore, there is a growing interest in regional anesthesia techniques that provide effective pain relief with fewer systemic side effects.

One such technique is the transversus abdominis plane (TAP) block, which involves the injection of local anesthetics into the plane between the internal oblique and transversus abdominis muscles. This method has

been shown to provide effective analgesia for abdominal surgeries by blocking the sensory nerves of the anterior abdominal wall.[5] Several studies have demonstrated the efficacy of TAP blocks in reducing postoperative pain and opioid consumption following abdominal surgeries.[6-8] In contrast, local wound infiltration (LAI) involves the direct injection of local anesthetics into the surgical wound, which also provides pain relief but is often considered less effective in managing deep visceral pain.[9]

Effective postoperative pain control is crucial for enhancing patient recovery, reducing the length of hospital stay, and minimizing postoperative complications. While LAI is a commonly used method, it may not provide adequate or prolonged pain relief, leading to increased use of painkillers and associated side effects. TAP block, by targeting specific nerve pathways, has shown potential in offering longer lasting and more effective analgesia. This study aims to determine which pain management technique provides superior analgesia, improves patient comfort, and reduces the need for additional pain medications. By identifying the most effective pain management strategy, this study aims to enhance postoperative care and improve patient outcomes for individuals undergoing TAH.

METHODS

This randomized controlled trial was conducted in the Department of Anaesthesia at Dr. Ziauddin Hospital & Medical College, Karachi, Pakistan from December 2023 to May 2024. Approval for the study was obtained from the Ethics Committee of Ziauddin University, Karachi, Pakistan. Informed consent was acquired from all participants meeting the inclusion criteria.

Patients aged 18 to 50 years, classified as American Society of Anesthesiologist (ASA) I or II, and scheduled for TAH under general anesthesia were included. Exclusion criteria comprised hepatic failure (assessed through clinical signs, elevated liver enzymes, and ultrasound findings indicating liver texture loss), renal failure (GFR ≤ 15), allergies or contraindications to the study drugs, drug abuse or addiction, and bleeding tendencies.

OpenEpi software is used for the estimation of sample size, taking confidence interval 95%, power of the test 80%, margin of error 5%, mean ±SD of TAP group (2.1 ± 1.2) and LAI group (4.8 ±1.5).[10] The sample size was estimated to be 8, i.e., 4 in each group. Although the initial calculation suggested a small sample size, we included a total of 100 patients, with 50 patients in each group, to ensure robust analysis. Participants were randomly allocated to either the TAP block group (Group A) or the LAI group (Group B) using a sealed opaque envelope method. Figure 1 provides a Consolidated Standards of Reporting Trials (CONSORT) flow diagram of the patient recruitment process. The surgeries were performed under general anesthesia by surgeons with at least two years of experience. The TAP block was administered by an anesthesiologist with at least two years of experience.

Throughout the surgery and postoperative period, heart rate, noninvasive blood pressure, and peripheral oxygen saturation were continuously monitored. Pain assessments as main outcome was conducted at 8 hours, 12 hours, and 24 hours post-surgery by an anesthesiologist blinded to group assignments using the Visual Analogue Scale (VAS). Patients were instructed on the use of the VAS before surgery. Rescue analgesia with intravenous tramadol (1.5 mg/kg) was administered to patients reporting a VAS score of 4 or above. Total analgesic consumption over the 24-hour postoperative period was recorded. This information along with baseline characteristics, including age, duration of surgery, and comorbid conditions such as diabetes mellitus and hypertension, were recorded.

Data entry and statistical analysis were done using the Statistical Package for the Social Sciences (SPSS) version 24. The normality of the data was checked through the Shapiro-Wilk test. The data were not normally distributed therefore, we applied non-parametric test. Median (IQR) were calculated for all the quantitative variables like age, weight, height, BMI, pain score, and duration of surgery. Relevant description statistics, percentages and frequencies were calculated for all the qualitative variables such as pain levels and comorbidities like diabetes mellitus and hypertension. Inferential statistics were explored using the Mann-Whitney U test for quantitative variables between-group comparison of baseline characteristics of patients. While for qualitative variables Chi-square test was applied. The p-value ≤0.05 was taken as significant.

RESULTS

Of total 100 patients, the median (IQR) age, weight, height, and BMI were 50.0 (47.2-55.0) years, 71.5 (68.0-78.0) kg, 1.5 (1.5-1.58) m, and 29.8 (28.8-32.9) kg/m^2 respectively. There were 51 (51.0%) patients who had BMI ≤30 kg/m^2 and 49 (49.0%) patients had BMI more than 30 kg/m^2. Most of the patients had a duration of surgery >120 minutes, i.e., 66 (66.0%). Comorbidities

like hypertension and diabetes mellitus were noted in 51 (51.0%) and 57 (57.0%) patients, respectively. Between group comparison showed no significant median differences with age (p-value 0.091), weight (p-value 0.136), and BMI (p-value 0.720). Duration of surgery more than 20 minutes found significantly higher in TAP group as compared to LAI group i.e., 39 (59.1%) vs. 27 (40.9%) (p-value 0.011) (Table 1).

Table 2 presents the median pain scores at 8, 12, and 24 hours postoperatively. At 8 hours postoperatively, the median pain score was significantly lower in the TAP group 0.0 (0.0-1.0) compared to the LAI group 1.0 (0.0-2.0) (p-value <0.001). Similarly, at 12 hours, the TAP group reported a median pain score of 2.0 (1.0-2.0), significantly lower than the LAI group 3.0 (2.0-4.0) (p-value <0.001). At 24 hours, the median pain score remained significantly lower in the TAP group 50.0 (50.0-70.0) compared to the LAI group 130.0 (120.0-140.0) (p-value <0.001). Total analgesia consumption was also significantly lower in TAP group as compared to LAI group i.e., 50.0 (50.0-70.0) vs. 130.0 (120.0-140.0) (p-value <0.001).

The distribution of pain severity at different time intervals is illustrated in Figure 2. At 8 hours postoperatively, majority of the patients experienced mild pain in LAI group i.e., 34 (68.0%). While, at 12 and 24 hours most of the patients experienced mild pain in TAP group i.e., 49 (98.0%) and 42 (84.0%) respectively.

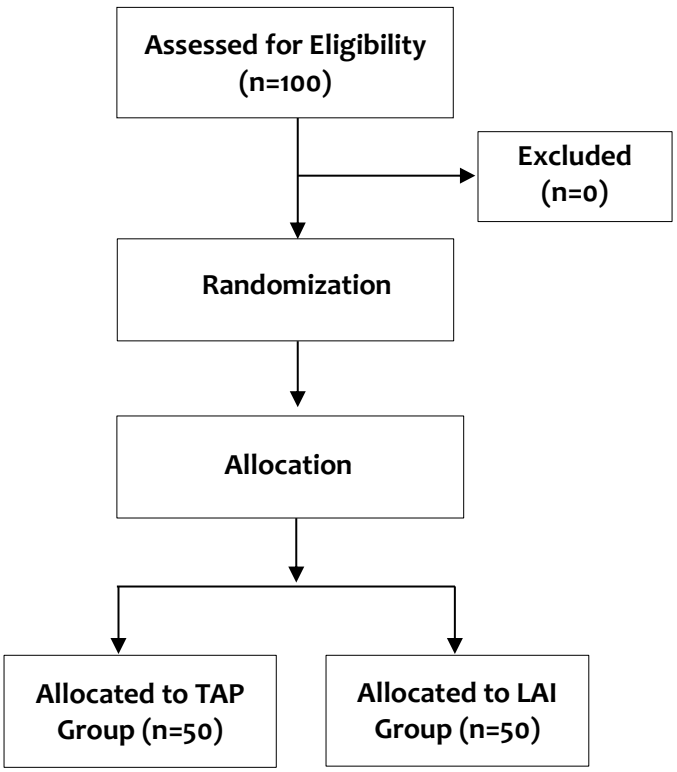
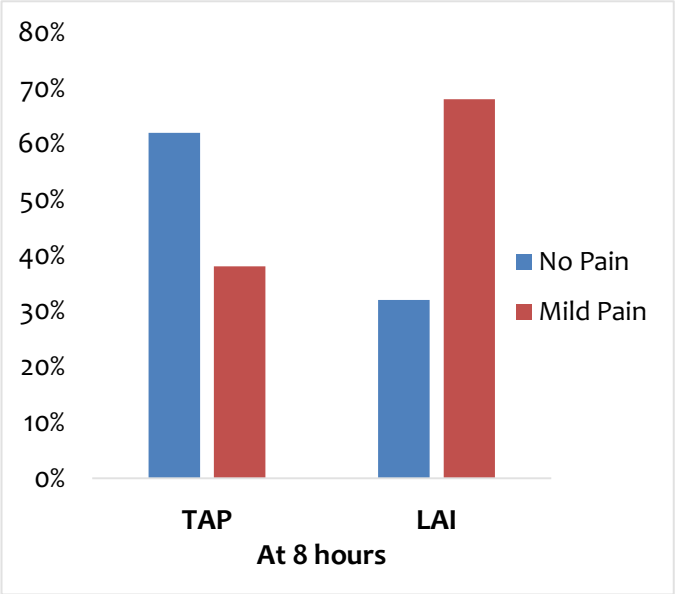
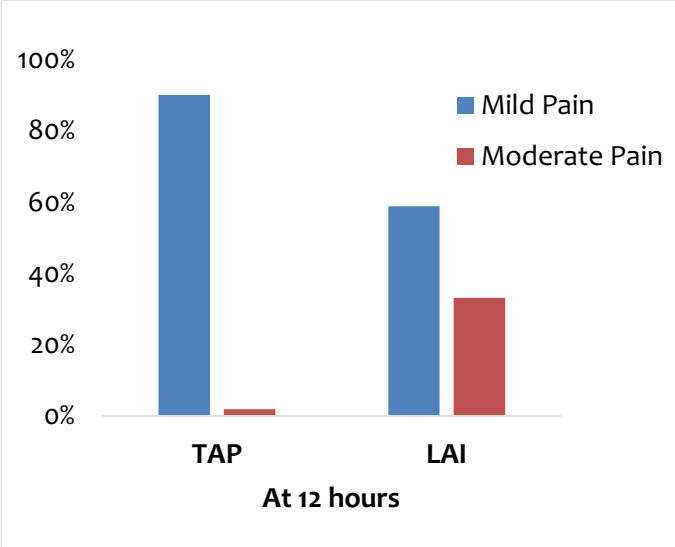


Figure 1: CONSORT flow diagram showing recruitment of patients.





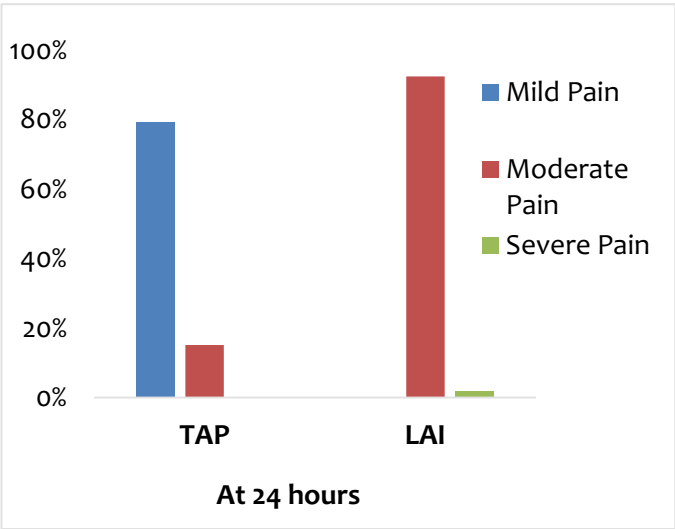


Figure 2: Pain severity in both groups at different time intervals

Table 1: Between group comparison of baseline characteristics of patients undergoing total abdominal hysterectomy (n= 100)

Variables	Total	Group		p-value
		TAP (n=50)	LAI (n=50)	
Age (years)	50.0 (47.2-55.0)	50.0 (46.0-53.0)	52.0 (48.0-60.0)	0.091~
≤50	52	30 (57.7)	22 (42.3)	0.109^
>50	48	20 (41.7)	28 (58.3)	
Weight (kg)	71.5 (68.0-78.0)	70.5 (68.0-78.0)	74.0 (68.0-80.5)	0.136~
Height (m)	1.5 (1.5-1.58)	1.5 (1.5-1.6)	1.6 (1.5-1.6)	0.003~*
BMI (kg/m^2)	29.8 (28.8-32.9)	29.8 (28.9-32.7)	30.1 (28.6-33.9)	0.720~
≤30	51	27 (52.9)	24 (47.1)	0.548^
>30	49	23 (46.9)	26 (53.1)	
Duration of Surgery (minutes)	130.0 (110.0-140.0)	13.0 (120.0-145.0)	130.0 (100.0-14.0.0)	0.050*~
≤120	34	11 (32.4)	23 (67.6)	0.011^*
>120	66	39 (59.1)	27 (40.9)	
Diabetes Mellitus				
Yes	57	28 (49.1)	29 (50.9)	0.840^
No	43	22 (51.2)	21 (48.8)	
Hypertension				
Yes	51	26 (51.0)	25 (49.0)	0.841^
No	49	23 (46.9)	26 (53.1)	

-Quantitative variables described by median (IQR), Categorical variables described by frequencies (percentages)
*p-value ≤ 0.05 (~Mann-Whitney U test and ^Chi-Square test)
BMI: Body mass index, LAI: Local wound infiltration, n: number, TAP: Transversus abdominis plane,IQR: Interquartile range

Table 2: Median comparison of pain score and analgesia consumption in between groups (n=100)

Variables	Total	Group		p-value
		TAP (n=50)	LAI (n=50)	
	Median (IQR)	Median (IQR)	Median (IQR)	
Pain score at 8 hours	1.0 (0.0-1.0)	0.0 (0.0-1.0)	1.0 (0.0-2.0)	<0.001*
Pain score at 12 hours	2.0 (2.0-3.0)	2.0 (1.0-2.0)	3.0 (2.0-4.0)	<0.001*
Pain score at 24 hours	4.1 (2.4-4.8)	2.4 (1.8-3.0)	4.8 (4.7-5.1)	<0.001*
Total Analgesia Consumption, mg$^{\$}$	130.0 (100.0-140.0)	50.0 (50.0-70.0)	130.0 (120.0-140.0)	<0.001*

$Analgesia was given to only those patients in whom complain of pain on VAS score was 4 and above during 24 hours of surgery, there were only 6 patients in TAP block who reported pain on VAS score of 4 and above
*p-value ≤ 0.05 (Mann-Whitney U test)
IQR: Interquartile range, LAI: Local wound infiltration, n: number, TAP: Transversus abdominis plane

DISCUSSION

The present study aimed to compare the efficacy of TAP block versus LAI for postoperative analgesia in patients undergoing TAH. Our findings indicate that the TAP block significantly reduces postoperative pain scores and analgesia consumption compared to LAI. Our study found that patients in the TAP block group had significantly lower mean pain scores at 24 hours post-surgery compared to the LAI group. This result aligns with the findings of previous studies,[11-14] that demonstrated that TAP blocks provide superior pain control in patients undergoing laparoscopic surgery. Additionally, Abdallah *et al.*[15] reported that TAP blocks effectively reduce pain and opioid consumption in patients undergoing lower abdominal surgeries, further supporting our results.

The significant reduction in total analgesia consump-

tion in the TAP block group compared to the LAI group is consistent with the findings of Petersen *et al*.[16] Their review highlighted that TAP blocks can substantially decrease the need for postoperative opioids, which is crucial for minimizing opioid-related adverse effects such as nausea, vomiting, and respiratory depression.[17]

Our study's findings are particularly relevant in the context of the Pakistani healthcare setting, where optimizing pain management strategies is essential due to resource constraints and the high burden of postoperative complications.[10] The effectiveness of TAP blocks in reducing both pain scores and analgesia consumption suggests that this technique could be a valuable addition to postoperative care protocols in Pakistan, potentially improving patient outcomes and reducing healthcare costs.

Previous researches have also indicated that TAP blocks are associated with fewer side effects compared to systemic opioids, making them a safer alternative for postoperative pain management.[18,19] The reduced incidence of opioid-related side effects in our study supports this conclusion, emphasizing the benefits of regional anesthesia techniques in enhancing patient recovery and satisfaction.

In contrast, LAI, while effective in providing pain relief at the incision site, appears to be less effective in managing deep visceral pain associated with TAH. It is reported that while LAI is beneficial for superficial pain control, its limited reach makes it less effective for more profound postoperative pain, which aligns with our findings.[20]

Given the context of the Pakistani healthcare system, where resources are often limited, the implementation of TAP blocks could lead to improved patient outcomes and reduced healthcare costs. The reduced need for systemic opioids and their associated side effects further underscores the potential benefits of adopting TAP blocks as a standard practice in postoperative pain management for abdominal surgeries.

This study has several limitations that should be acknowledged. Firstly, the relatively short follow-up period of 24 hours post-surgery limits our ability to assess long-term pain outcomes and the potential development of chronic pain. Longer follow-up periods would provide a more comprehensive understanding of the sustained effectiveness of TAP blocks versus LAI. Secondly, this study was conducted in a single center, which may affect the generalizability of the findings. The specific practices and patient population of Dr. Ziauddin Hospital, Karachi, may not fully represent other healthcare settings in Pakistan or internationally. Thirdly, although we used a randomized controlled trial design, potential confounding factors such as variations in surgical techniques and individual pain thresholds may still influence the results. While randomization helps to mitigate these issues, residual confounding cannot be entirely ruled out. Lastly, the subjective nature of pain assessment using the VAS could introduce bias. Although VAS is a widely accepted tool, pain perception is inherently subjective and can be influenced by various psychological and social factors.

Future research should aim to explore the long-term benefits of TAP blocks and their impact on chronic pain development, as well as conduct multicenter studies to confirm the generalizability of these findings across different healthcare settings. Overall, TAP blocks represent a promising and effective analgesic technique that can significantly improve the quality of postoperative care for patients undergoing TAH.

CONCLUSION

Our study demonstrates that TAP block provides superior postoperative pain control compared to LAI in patients undergoing TAH. The findings indicate that patients receiving TAP blocks experience significantly lower pain scores and reduced analgesia consumption within the first 24 hours post-surgery.

ETHICAL APPROVAL: The study protocol was approved by the Ethical Review Board of Ziauddin University (Reference # 7861023MAANE, dated: 27th November 2023)

AUTHORS' CONTRIBUTIONS: MA & SW: Conception and Designing of Study. MA, KN & AR: Data Collection, Analysis & Interpretation. MA & HM: Drafting & Manuscript. MA, AR & ZM: Critical Review of Manuscript. All authors approved final version of manuscript to be published.

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