Original Article

Analgesic Efficacy of Transversus Abdominis Plane Block vs Local Infiltration of Lignocaine and Bupivacaine in Post-operative Patients

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Abstract

Objective: To compare the effectiveness of Transversus Abdominis Plane (TAP) block vs Local Infiltration for pain management techniques in patients undergoing laparoscopic lower abdominal surgeries.

Methodology: This cross-sectional study was conducted at the Department of Surgery, Lahore General Hospital, in March 2024. It involved a total of 110 patients, divided into two groups of 55 each, between the ages of 20 to 60 years, diagnosed with indirect inguinal hernia by ultrasound. Chronic smokers, drug addicts, intravenous drug abusers, patients with a history of previous surgeries, with known drug allergies and with complicated hernia were excluded from this cross-sectional study. The Numerical Rating Scale (NRS) was used to see the pain variation and effectiveness of both techniques at 6, 12, 18 and 24 hours.

Results: The mean age in the TAP Block Group was 32.0 ± 9.92 years, and the mean age in the Local Wound Infiltration Group was 34.21 ± 10.01 years. There were 108 (98.18%) male and 2(1.81%) female cases with a higher male-to-female ratio. The results indicated that the TAP Block group consistently required fewer rescue analgesic doses than the local wound Infiltration group at all postoperative time points. At 6 hours, 23.63% of patients in the TAP Block group needed additional analgesia, compared to 38.18% in the Wound Infiltration group, though this difference was not statistically significant. However, at 12, 18, and 24 hours, the TAP Block group showed a significantly lower need for rescue analgesia, with p-values of 0.002, and 0.008, respectively.

Conclusion: In managing postoperative pain of Inguinal Hernia Repair, TAP Block is superior to Wound Infiltration of local anesthetic agent. After TAP Block NRS remains fewer and a smaller number of rescue doses are needed as compared to Wound infiltration.

Keywords: Inguinal hernia, TAP block, Laparoscopic surgery, Lignocaine, Bupivacaine, Post-operative patients.

Introduction

A significant portion of postoperative pain is derived from the surgical incision and visceral areas. Transversus Abdominis Plane (TAP) block first described by Rafi et al. in 2001 is an approach in which local anesthetic is injected into the plane between the internal oblique muscle and the transversus abdominis muscle layers to block the sensory nerve supply to the anterior inferior abdominal wall.[1] The TAP block has demonstrated postoperative pain relief following abdominal surgery, hysterectomy and following cesarean delivery in contrast to no intervention or placebo in prior meta-analysis. Infiltration of local anaesthetic at the site of surgery can help reduce pain after operation as one of the techniques of multimodal analgesia.[2] This easy, risk-free, minimally invasive and cost-effective procedure that is often carried out by the surgeon is regularly done in many centres for postoperative pain relief.[3] In this regard regional anesthesia techniques are well appreciated which provides pain relief with lesser side effects than general anesthesia and systemic analgesics. Of these, the TAP block technique has proven useful in controlling postoperative pain, especially in patients who have undergone abdominal surgeries.[4] TAP block leads to great relief from pain, and patients can move around more comfortably under reduced use of opioids.[5]

After its introduction in the mid-2000, the TAP block has been applied in a variety of different specialties including general surgery, gynaecology, urology and bariatrics. This has been confirmed by so many studies regarding post-operative pain management, and the fact that it is often used because it is easy to perform, and also safe, and may be performed under ultrasound guidance which enhances the accuracy of the block.[6] Nevertheless, the TAP block is not the only regional anesthesia technique applicable in postoperative pain control. Infiltration of anesthetics like Lignocaine and Bupivacaine have been used from time immemorial whereby the anesthetic agents are injected directly on the surgical site to minimize the sensation of pain during surgery.[7] Lignocaine is a shortacting local anesthetic while bupivacaine is a long-acting one, and both are given either alone or in combination to yield good pain relief. Local infiltration is where these anesthetics are directly administered into the tissues around the area of operation with a view of blocking the nerves that transmit pain.[8]

The effectiveness of local infiltration over more complicated regional techniques such as that of the TAP block is debatable. Local infiltration is easy and no specialized tools and personnel are required, hence it is

comparatively economical.[9] However, its effect may be short-lived, potentially necessitating additional doses or the use of supplementary agents to enhance the effects of Lignocaine. In addition, the efficacy of the local infiltration may be influenced by the area of surgery, type of the surgery performed, and the type of technique used.[10] Determination of the relative effectiveness between the TAP block and local infiltration of Lignocaine and Bupivacaine is important in order to compare which method of postoperative pain control is the most effective. It is useful to compare these methods mainly for surgeries of the abdominal wall, in which both techniques are often used. The consequences of making some of these comparisons are crucial in determining clinical practices on pain control measures, resource utilization and ultimately patient care plans.[11] The TAP block is not a new type of analgesia, but more and more researchers have applied this effective interventional technique in managing postoperative pain after abdominal operation.[12]

The objective of this study was to demonstrate the anesthetic technique effectiveness of pain control in patients after laparoscopic lower abdominal surgery by comparing two pain management techniques i.e TAP block and Wound Infiltration block, using an injection of Lignocaine 2% (3 mg/kg) mixed together with Bupivacaine 0.25% (2.5 mg/kg) in combination at the time of surgery.

Methodology

This cross-sectional study was conducted at the Department of Surgery, Lahore General Hospital, Lahore, in March 2024, IRB No.62/24, to compare the effectiveness of two pain management techniques i.e TAP block and wound infiltration block using an injection of Lignocaine 2% (3 mg/kg) mixed with Bupivacaine 0.25% (2.5 mg/kg).in patients undergoing lower abdominal surgery i.e. laparoscopic total extraperitoneal (TEP) or transabdominal preperitoneal (TAPP) laparoscopic surgery. The study involved a total of 110 patients, divided into two groups of 55 each. The Numerical Rating Scale (NRS) was used to see pain relief at 6,12,18 and 24 hours postoperatively and to see the effect of rescue doses. It consists of a segmented numerical scale with 11 points ranging from 0 to 10. Patients are asked to select a matching number to specify the pain intensity they are feeling. A unique benefit of the NRS is that it can be directed verbally, making it an appropriate tool for language, cultural, or cognitive barriers. Patients undergoing laparoscopic surgery for lower abdominal conditions, specifically laparoscopic, total extraperitoneal (TEP) or transabdominal preperitoneal (TAPP) procedures for indirect inguinal hernia, were selected for this study. The inclusion criteria required that patients be between the ages of 20 to 60 years, all patients with indirect Inguinal Hernia diagnosed by ultrasound and all patients who gave consent to surgery. Exclusion criteria included chronic smokers, drug addicts, intravenous drug abusers**,** patients with a history of previous surgeries, patients with known drug allergies**,** and patients with complicated hernia.

Data were collected into two groups: Group A: Patients in this group received a TAP block with an injection of Lignocaine 2% (3 mg/kg) mixed with Bupivacaine 0.25% (2.5 mg/kg). Group B: Patients in this group received local infiltration of the surgical wound with the same mixture of Lignocaine 2% (3 mg/kg) and Bupivacaine 0.25% (2.5 mg/kg). The local anesthetics (LAs) used in this study were Lignocaine and Bupivacaine, which function by reversibly inhibiting nerve transmission. They achieve this by binding to voltage-gated sodium channels within the nerve plasma membrane. These channels are integral membrane proteins that play a crucial role in nerve impulse propagation. By blocking these channels, LAs prevent the initiation and transmission of nerve impulses, thereby providing analgesia. The primary outcome variable was the need for rescue analgesia, measured by the number of doses required postoperatively. This variable was used to assess the efficacy of pain control in both groups. Data were analyzed using SPSS v29. P-values <0.05 were considered significant.

Results

The mean age in this study was 33.10 ± 9.98 years with minimum and maximum ages as 20 and 60 years. The mean age in the TAP Block Group was 32.0 ± 9.92 years with minimum and maximum age of 20 and 51 years and the mean age in the Local Wound Infiltration Group was 34.21 ± 10.01 years with a minimum and maximum age of 20 and 60. There were 108(98.18%) male and 02(1.81%) female cases with higher male-to-female ratio. In the TAP Block Group there were 54 (98.18%) male and 01 (1.81%) female cases while in the Local Wound Infiltration Group, there were 54(98.18%) male and 01(1.81%) female cases. The gender distribution in both groups was statistically the same, p-value > 0.05. (Table 1)

Table 1: Demographic data of participants

Characteristic	Overall (n=110)	TAP Block Group (n=55)	Local Wound Infiltration Group (n=55)
Age (years)			
- Mean ± SD	33.10 ± 9.98	32.0 ± 9.92	34.21 ± 10.01
- Range	20 - 60	20 – 51	20 – 60
Gender			
- Male	108 (98.18%)	32 (98.18%)	30 (98.18%)
- Female	02 (1.81%)	01 (1.81%)	01 (1.81%)
BMI (kg/m²)			
- Mean ± SD	26.5 ± 4.3	26.0 ± 4.1	27.0 ± 4.5
- Range	18.5 - 35.0	18.5 - 34.0	19.0 - 35.0

Characteristic	Overall (n=110)	TAP Block Group (n=55)	Local Wound Infiltration Group (n=55)
American Society of Anesthetists (ASA) Physical Status Classification			
- ASA I	45 (40.9%)	24 (43.6%)	21 (38.1%)
- ASA II	50 (45.4%)	24 (43.6%)	26 (47.2%)
- ASA III	15 (13.6%)	7 (12.7%)	8 (14.5%)
Smoking Status			
- Non-smoker	72 (65.4%)	36 (65.4%)	36 (65.4%)
- Former smoker	25 (22.7%)	14 (25.4%)	11 (20.0%)
- Current smoker	13 (11.8%)	5 (9.0%)	8 (14.5%)

The results demonstrate that patients in the TAP Block Group experienced significantly better pain relief compared to those in the Wound Infiltration Group at all observed time points. At 6 hours postoperatively, 34.54% of patients in the TAP Block Group reported no pain, compared to only 12.72% in the Wound Infiltration Group, with a significant p-value of 0.004. This trend continued at 12, 18, and 24 hours, where the TAP Block Group consistently showed higher percentages of patients with no pain or mild pain (Table 2). The statistical significance of the pain relief in favour of the TAP Block Group was confirmed by chi-square tests at each interval, with p-values all below 0.05, indicating a clear advantage of the TAP Block over wound infiltration for postoperative pain management.

Table 2: Numeric Rating Scale (NRS) postoperatively at different time intervals for both groups

Time (Hours)	Pain Intensity (NRS)	TAP Block Group (n=55)	Wound Infiltration Group (n=55)	Total (n=110)	Chi-square Test	P-value
6 Hours	0 = No Pain	19 (34.54%)	07 (12.72%)	26 (23.63%)	0.028	0.004
	1-3 = Mild Pain	24 (43.63%)	26 (47.27%)	50 (45.45%)		
	4-6 = Moderate Pain	11 (20%)	18 (32.72%)	29 (26.36%)		
	7-10 = Severe Pain	01 (1.8%)	04 (7.27%)	05 (4.54%)		
12 Hours	0 = No Pain	24 (43.63%)	13 (23.63%)	37 (33.63%)	0.044	0.009
	1-3 = Mild Pain	23 (41.81%)	23 (41.81%)	46 (41.81%)		
	4-6 = Moderate Pain	7 (12.72%)	18 (32.72%)	25 (22.72%)		
	7-10 = Severe Pain	01 (1.8%)	01 (1.8%)	02 (1.8%)		
18 Hours	0 = No Pain	31 (56.36%)	21 (38.18%)	52 (47.27%)	0.018	0.004
	1-3 = Mild Pain	22 (40%)	21 (38.18%)	43 (39.09%)		
	4-6 = Moderate Pain	2 (3.63%)	12 (21.8%)	14 (12.72%)		
	7-10 = Severe Pain	0	1 (1.8%)	1 (0.9%)		
24 Hours	0 = No Pain	28 (50.9%)	14 (25.45%)	42 (38.18%)	0.003	0.001
	1-3 = Mild Pain	25 (45.45%)	30 (54.54%)	55 (50%)		
	4-6 = Moderate Pain	2 (3.63%)	11 (20%)	13 (11.81%)		
	7-10 = Severe Pain	0	0	0		

The results indicate that the TAP Block group consistently required fewer rescue analgesic doses than the Wound Infiltration group at all postoperative time points. At 6 hours, 23.63% of patients in the TAP Block group needed additional analgesia, compared to 38.18% in the Wound Infiltration group, though this difference was not statistically significant. However, at 12, 18, and 24 hours, the TAP Block group showed a significantly lower need for rescue analgesia, with p-values of 0.002, 0.002, and 0.008, respectively. This suggests that the TAP Block is more effective in providing sustained postoperative pain relief.

Discussion

Our study aims to review the analgesic outcome of two different techniques so that patients have a better experience of inguinal repair surgery. This study intended to evaluate the efficiency of two pain management techniques—TAP block and Local Wound Infiltration—in patients undergoing laparoscopic lower abdominal surgery for indirect inguinal hernia. Conducted at the Department of Surgery, Lahore General Hospital, in March 2024, this cross-sectional study involved a sample size of 110 patients, with 55 patients in each group, aged 20 to 60 years. Patients were divided into two groups to receive either the TAP block or local wound infiltration. Pain variation and technique effectiveness were evaluated using the Numerical Rating Scale (NRS) at 6, 12, 18, and 24 hours post-surgery. Results demonstrated that the TAP block group had a constantly lesser need for rescue analgesics at the majority time points postoperatively, showing noteworthy differences at 12, 18, and 24 hours, thus demonstrating the superiority of TAP block over local infiltration for managing postoperative pain in inguinal

Table 3: Comparison of rescue analgesic doses required postoperatively at different time intervals for both groups:

Time (Hours)	Rescue Analgesic Doses Required	TAP Block Group (n=55)	Wound Infiltration Group (n=55)	Total (n=110)	Chi-square Test	P-value
6 Hours	Yes	13 (23.63%)	21 (38.18%)	34 (30.9%)	0.099	0.074
	No	42 (76.36%)	34 (61.81%)	76 (69.09%)		
12 Hours	Yes	7 (12.72%)	21 (38.18%)	28 (25.45%)	0.002	0.002
	No	48 (87.27%)	34 (61.81%)	82 (74.54%)		
18 Hours	Yes	2 (3.63%)	13 (23.63%)	15 (27.27%)	0.002	0.002
	No	53 (96.36%)	42 (76.36%)	95 (86.36%)		
24 Hours	Yes	2 (3.63%)	11 (20%)	13 (11.81%)	0.008	0.008
	No	53 (96.36%)	44 (80%)	97 (88.18%)		

In the TAP Block Group, 38 (69%) didn't require any rescue analgesic dose, 10 (18%) required a single dose, 7 (13%) required 2 doses in the first 24 hours postoperatively, while no patient required 3 or 4 doses in first 24 hours post operatively. In the Local Wound Infiltration Group 20 (36%) didn't require any rescue analgesic dose, 17 (31%) required a single dose, 7 (13%) required 2 doses, 9 (16%) required 3 doses and 2 (4%) in first 24 hours postoperatively. P-value = <0.001 which is statically significant.(Table 3, Figure 1)

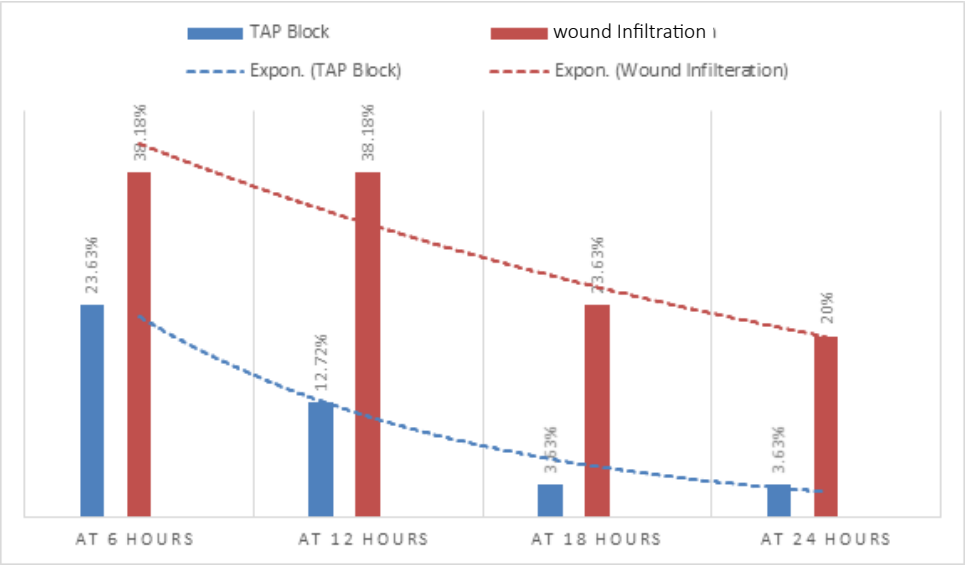

Figure 1: Comparison of rescue analgesic doses at different time intervals between both groups.

hernia repair. Postoperative pain management plays a vital role in the early mobilization and recovery of the patient. Achieving this without the side effects of oral/injecTable analgesics is also a challenge to be faced by surgeons. Wound infiltration with LA is a predominant technique used to manage postsurgical pain. In previous years, there was increasing corroboration in the favor of effectuality of TAP block in a number of abdominal operations.[13,14]

In our study, it is evident that the numeric rating score in the TAP Block group remained significantly less as compared to that of wound infiltration with the local anesthetic group with less need for rescue analgesic doses.(Table 2) Compared to another study the pain-relieving ability of TAP block after cesarean delivery performed under spinal anesthesia varies depending upon whether or not intrathecal morphine is utilized as a postsurgical pain reliever.[15] When intrathecal morphine isn't utilized, TAP block, contrasted with placebo, is related to lesser post-operational morphine utilization and pain count, increased duration to 1st pain killer shot, decreased rate of after effects, and increased patient contentment. Likewise, local anesthesia injection in the incision, contrasted with placebo, is linked with decreased morphine utilization and decreased rate of nausea after cesarean delivery.[16] In line with these findings, this study has confirmed that post-operative pain management using a TAP block is more effective than using local wound infiltration with Lignocaine and Bupivacaine. (Table 3) (Figure 1) The demographic characteristics in both studies suggested a comparable age, gender distribution, BMI, as well as ASA physical status which precludes the baseline patient factors as the reason for the differences in the pain outcomes reported by the study.[17] (Table 1)

The TAP block proved to have better pain relief outcomes at all the postoperative time intervals as evidenced by the enhanced percentage of patients who complained of no pain or mild pain as compared to the Local Wound Infiltration Group. Decreased by 72% in the Local Wound Infiltration Group, ($p = 0.004$). It was also evidenced at 12, 18, and 24 hours of the procedure where TAP Block Group had better scores in their pain relief than the Local Wound Infiltration (Table 3) Group with p-values less than 0.05.[18] These findings agree with previous studies that have also noted that the TAP block provided a longer duration of Analgesia with reference to abdominal surgeries. The TAP block involves the nerves that are involved in the anterior abdominal wall thus avoiding pain from the surgical site. Nonetheless, similar to patient-controlled thigh infiltration, local wound infiltration gives the first release of pain and lasts for a shorter period resulting in reinjection or rescue analgesia.[19]

The requirement for rescue analgesia once again proves the emergence of more effectiveness from the TAP block.[20] At 6 hours the total rescue analgesic consumption also did not show much variation between the two groups but the TAP Block Group used a smaller number of doses on a rescue basis. That is why over time the difference became distinctive. When compared to the Local Wound Infiltration Group the TAP Block Group used significantly fewer rescue analgesic doses at 12, 18 and 24 hours with p values of 0. 002, 0. 002, and 0. 008, respectively.[21]

Limitations

The following are weaknesses that should be taken into consideration when analysing and interpreting the results of this research study. The number of patients was relatively small, and the study was conducted at a single centre, which modifies the transferability of the results. The blinding was not conducted properly and this might have resulted in biases; the short duration of follow-up did not enable the identification of other results like chronic pain and overall recovery. Other shortcomings of the study include inconsistency in the methods of conducting surgeries as well as dependence on self-report of pain. The study also did not compare the TAP block with other analgesic techniques like epidural or spinal anesthesia, nor did it assess the cost-effectiveness or broader aspects of postoperative care and rehabilitation.

Conclusion

In managing postoperative pain of Inguinal Hernia Repair, TAP Block is superior to Wound Infiltration of local anesthetic agent. After TAP Block NRS remains fewer and a smaller number of rescue doses are needed as compared to Wound infiltration.

Conflict of Interest: The authors declare no conflict of interest.

Authors' Contributions: MSA contributed to the initial conception and design of the study, wrote the initial draft and supervised the project; MK was primarily involved in the acquisition of data, including overseeing the patient selection criteria and ensuring proper randomization protocols; SM conducted the statistical analysis; AA focused on literature review; QF was responsible for organizing patient follow-up assessments, monitoring post-operative pain levels, and documenting patient-reported pain outcomes; MR contributed to the ethical and administrative aspects of the study, ensuring compliance with institutional review requirements and obtaining informed consent from participants.

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