American Journal of Forensic Psychology
ISSN: 0733-1290

https://doi.org/10.61336/AJFP/2026-04-01 https://americanforensicpsychology.org/index.php/ajfp/index

Original Research Article

Local Infiltration Analgesia Versus Transversus Abdominis Plane (Tap) Block for Postoperative Pain Control In Paediatric Laparoscopic Surgery: A Randomized Controlled Trial.

Name of Author:

Khalid Maqsood[1]*, Ghulam Mohyuddin[2], Allah Ditta[3], Haseeb Nasir[4], Mukhtiar Ahmed[5], Jamal Yousaf[6].

Affiliation:

1Professor and Head, FMH College of Medicine and Dentistry, Shadman, Lahore.
2Senior Registrar, Department of Paediatric Surgery, FMH College of Medicine and Dentistry Shadman, Lahore.
3Senior Registrar, Department of Paediatric Surgery, FMH College of Medicine and Dentistry Shadman, Lahore.
4Department of Paediatric Surgery, Social Security Hospital, Lahore.
5Department of Paediatric Surgery, School of Medicine, Dentistry and Allied Sciences, Haripur .
6Department of Paediatric Surgery, Gujranwala Medical College and Teaching Hospital, Gujranwala.

Corresponding Author: Khalid Maqsood.

Received: 18-04-2026
Revised: 01-05-2026
Accepted: 23-05-2026
Published: 05-06-2026

Abstract: ***Background and Objective:*** Paediatric laparoscopic surgery, while minimally invasive, is associated with significant postoperative somatic and visceral pain. Effective pain management is crucial for early mobilization and recovery. This study aims to compare the postoperative analgesic efficacy of local infiltration analgesia at port sites versus ultrasound-guided Transversus Abdominis Plane (TAP) block in children undergoing elective laparoscopic procedures. ***Methodology:*** A randomized controlled trial was conducted at the Department of Paediatric Surgery. One hundred twenty children aged 2–12 years, scheduled for elective laparoscopy, were enrolled using consecutive sampling and randomized into two equal groups (n=60). Group A received local surgical site infiltration of 0.25% Bupivacaine (2 mg/kg total), while Group B received an ultrasound-guided bilateral TAP block utilizing 0.25% Bupivacaine (0.5 mL/kg per side). Postoperative pain was assessed using the FLACC scale (for children <4 years) or Visual Analog Scale (VAS) at 2, 6, 12, and 24 hours. The primary outcome was the mean pain score, and the secondary outcome was the time to first rescue analgesia. ***Results:*** Both groups exhibited comparable baseline demographics. Group B (TAP Block) demonstrated significantly lower mean pain scores at 6 hours (2.1 ± 0.8 vs 4.3 ± 1.1, $p < 0.001$) and 12 hours (2.5 ± 0.9 vs 4.8 ± 1.2, $p < 0.001$) compared to Group A. The mean time to first rescue analgesia was significantly prolonged in Group B (540 ± 85 minutes) compared to Group A (310 ± 60 minutes) ($p < 0.001$). ***Conclusion:*** Ultrasound-guided TAP block provides superior, longer-lasting postoperative analgesia and delays the need for rescue analgesics compared to local port-site infiltration in paediatric laparoscopic surgery.

Keywords: Paediatric Laparoscopy, Postoperative Pain, Transversus Abdominis Plane Block, Local Infiltration, Bupivacaine, FLACC Scale.

This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC-BY) license (http://creativecommons.org/licenses/by/4.0/).

INTRODUCTION

In the paediatric population, laparoscopic surgery is the standard of care for a myriad of intra-abdominal conditions, and it provides benefits such as less incisions, faster return of bowel function, shorter hospital stay and better cosmetic results [1, 2]. Although laparoscopy is minimally invasive, it is not completely painless. Postoperative pain after laparoscopy is a multifactorial phenomenon, consisting of somatic pain at the trocar insertion sites, visceral pain due to the intra-abdominal tissue manipulation and referred pain in the shoulder from the diaphragmatic irritation caused by the pneumoperitoneum [3]. Poorly managed postoperative pain in children can cause distress, prolong hospital stay, increase parental anxiety, and induce derangements such as delayed mobility, respiratory complications [4].

Systemic opioids were traditionally the mainstay of postoperative pain management. But their side effects

profile is often not favorable in the paediatric population, with postoperative nausea and vomiting (PONV), sedation, urinary retention and the risk of respiratory depression [5]. As a result, modern children's anaesthetic and surgical techniques have shifted greatly towards opioid-sparing multi-modal anaesthetic approaches. Regional anesthesia techniques and wound infiltration have become important elements of these multimodal pathways, with the goal of preventing the nociceptive signal from reaching the central nervous system [6].

One of the most commonly used techniques is local infiltration analgaesia (LIA) at the surgical port sites, which requires no special equipment and is simply, safe and effective. Surgeons can efficiently blunt somatic pain transmission by directly infiltrating the local anesthetic into the subcutaneous and fascial layers immediately surrounding the incision [7]. In contrast, the Transversus Abdominis Plane (TAP) block is a regional anesthetic block which blocks the sensory nerves that pass through the fascial plane between the internal oblique muscle and the transversus abdominis muscle (T6 to L1) [8]. US-guided TAP blocks are now very accurate, safe and are being increasingly used in paediatric surgical environment with the advent of high frequency portable ultrasound [9].

Both are currently being used, and there is a variety of opinions among physicians on which is the better technique. The surgeon quickly completes local infiltration at the end of the procedure, but this method has a shorter duration of action and is criticized for this. Theoretically, US-guided TAP blocks provide a wider and longer area of somatic analgesia [10] but will take slightly longer and a more skilled operator. Pediatric patients need clinical protocols that are evidence-based to maximize comfort, while minimizing opioid use, and there is a need for rigorous comparative data. The objective of this randomized controlled trial is to compare the postoperative analgesic effect, objectively assessed by standardized pain scales and time until rescue analgesics, of local infiltration at the port-sites with ultrasound-guided transversus abdominis plane (TAP) block in children who underwent elective laparoscopy.

METHODOLOGY

This randomized controlled trial was carried out at the Department of Paediatric Surgery, Punjab Medical Center, Lahore for a continuous period of six months after obtaining all the prerequisites institutional Ethical Review Board and Research, Training and Monitoring Cell approvals according to the guidelines of College of Physicians and Surgeons Pakistan (CPSP) with utmost authenticity. The study protocol was strictly observed in accordance with the ethical principles of Declaration of Helsinki for Medical Research on Human Subjects and a full and informed written consent was obtained from parents or legal guardians of all the children participating in the study before entry to the study.

Based on the difference in mean postoperative pain score and the standard deviation of the pain score in the regional block and local infiltration groups in children as reported in the literature, a sample size of 120 patients (60 in each group) was systematically calculated using an 80% statistical power of the test and a 95% confidence interval. Patient enrolment was done using non-probability consecutive sampling method in the surgical outpatient department. Inclusion criteria included only male and female paediatric patients aged 2-12 years, American Society of Anesthesiologists (ASA) physical status I or II, and undergoing elective lower or mid-abdominal laparoscopic surgery (e.g., laparotomy for appendectomy, cholecystectomy or orchiopexy).

Patients were excluded if there was a history of coagulopathies, a known allergy to amide-type local anesthetics, localized skin infections at the proposed needle insertion sites, or major surgical co-morbidities (cardiac, renal, or hepatic impairment) or conversion of the surgical procedure from a laparoscope to an open laparotomy. Demographic data were collected using a pre-designed proforma and subsequently, the enrolled children were randomly allocated to two different interventional groups using a computer-generated randomized number table which was kept securely in opaque envelopes. Group A was given Local Infiltration Analgesia (LIA) which was administered by the surgical team at a total maximum dose of 0.25% Bupivacaine at 2 mg/kg. The mode of administration was local subcutaneous and deep fascial infiltration at the trocar insertion sites, which was done at the exact end of the surgery before wound closure. Group B had an ultrasound guided bilateral Transversus Abdominis Plane (TAP) block, administered by the anesthesia team using 0.25% Bupivacaine at 0.5 mL/kg per side.

The route of injection was into a regional fascial plane, performed after induction of general anesthesia and just before the incision is made; a high-frequency linear ultrasound probe was used to ensure that the anesthetic agent was deposited between the internal oblique and transversus abdominis muscles. Pain was quantitatively measured postoperatively using FLACC (Face, Legs, Activity, Cry, Consolability) scale for children below 4 years of age and VAS (Visual Analog Scale) for children from 4-12 years, at 2 hours, 6 hours, 12 hours and 24 hours. Time from injury to first rescue analgesia (IV Paracetamol 15mg/kg) was measured in minutes. All the collected clinical data were meticulously entered in and later analyzed through SPSS version 25.0. Qualitative variables such as gender distribution and type of surgery were expressed as frequencies and percentages, while the quantitative variables such as patient age, weight, surgery duration, pain score, and time to rescue analgesia were expressed as Mean ± Standard Deviation.

© 2026 American Journal of Forensic Psychology | All Right Reserved

The data were stratified according to age groups and surgical procedures as effect modifiers were carefully considered. Formal analysis of the continuous quantitative outcomes between the two distinct groups was done using post-stratification Independent Samples t-test and for categorical variables, a Chi-square test was used, with a p-value of ≤ 0.05 definitely regarded as statistically significant.

RESULTS

A total of 120 paediatric patients were successfully enrolled and evaluated and there was 100% follow-up during the 24-hour observation period following surgery, with no dropouts or intraoperative conversion to open surgery. There was an equal number of children assigned to each arm of the analytical cohort: 60 in the Local Infiltration arm (Group A) and 60 children in the TAP Block arm (Group B).

The strong similarity of the two randomized groups was confirmed by the baseline demographic and intraoperative variables. The mean age of the patients in Group A was 7.4 ± 2.6 years, while the mean age in Group B was 7.1 ± 2.8 years (p = 0.542). Mean patient weight was 24.5 ± 6.2 kg in Group A and 23.8 ± 6.5 kg in Group B (p = 0.548). The mean time to complete the laparoscopic procedures was also very similar (48.5 ± 12.4 vs. 50.2 ± 11.8 minutes, respectively; p = 0.443). See Table 1.

In the main outcome, pain intensity quantified by FLACC/VAS demonstrated a statistically significant separation in treatment over time. Both techniques offered excellent pain control at 2 hours postoperative, no statistically significant difference was observed in the mean pain score of both groups: 1.8 ± 0.6 (Group A) and 1.6 ± 0.5 (Group B) (p = 0.053). But, when the localized infiltration started to fade, Group B (TAP Block) showed significant superiority and in a big way. At 6 hours, mean pain scores spiked to 4.3 ± 1.1 in Group A compared to only 2.1 ± 0.8 in Group B (p < 0.001). This marked difference was still evident at the 12-hour evaluation, when Group A had a mean score of 4.8 ± 1.2 and Group B, 2.5 ± 0.9 (p < 0.001). By 24 hours, scores began to equalize but still favored the TAP block (3.1 ± 0.7 vs 2.4 ± 0.6, p < 0.001). See Table 2.

The secondary outcome of the mean time to first rescue analgesia further supported the longer duration of action with the regional block. The mean time for intravenous paracetamol intervention was 310 ± 60 min postoperatively in patients in Group A. By contrast, patients in Group B were able to be comfortable for a much longer time, the first rescue being administered at a mean of 540 ± 85 minutes. This delay in secondary analgesia in the TAP block group was highly statistically significant (p<0.001) as determined by the application of the Independent Samples t-test.

There were no major complications, including local anesthetic systemic toxicity (LAST), large hematomas or injuries to the viscera associated with the TAP block needle insertion in either cohort.

Table 1: Baseline Demographics and Intraoperative Characteristics

Parameter	Group A (Local Infiltration) n=60	Group B (TAP Block) n=60	p-value
Mean Age (Years)	7.4 ± 2.6	7.1 ± 2.8	0.542
Mean Weight (kg)	24.5 ± 6.2	23.8 ± 6.5	0.548
Surgical Duration (mins)	48.5 ± 12.4	50.2 ± 11.8	0.443

Table 2: Postoperative Pain Scores (FLACC/VAS) and Rescue Analgesia

Time Point / Parameter	Group A (Local Infiltration)	Group B (TAP Block)	p-value
Pain Score at 2 Hours	1.8 ± 0.6	1.6 ± 0.5	0.053
Pain Score at 6 Hours	4.3 ± 1.1	2.1 ± 0.8	**< 0.001**
Pain Score at 12 Hours	4.8 ± 1.2	2.5 ± 0.9	**< 0.001**
Pain Score at 24 Hours	3.1 ± 0.7	2.4 ± 0.6	**< 0.001**
Time to First Rescue (mins)	310 ± 60	540 ± 85	**< 0.001**

DISCUSSION

Postoperative pain management for pediatric laparoscopic surgery is still a dynamic and very critical part of surgery. The unrelieved pain inevitably leads to an increase in sympathetic tone, metabolic demands and extreme distress to the child and family, which is detrimental to the rapid recovery principles of minimally invasive surgery [1, 4]. The findings of this randomized controlled trial clearly reveal the anatomical and physiological advantages of ultrasound-guided Transversus Abdominis Plane (TAP) block over standard local port-site infiltration for postoperative prolonged analgesia.

© 2026 American Journal of Forensic Psychology | All Right Reserved

The key finding of our trial is that the TAP block provides a highly significant, prolonged analgesic effect in the critical 6-hour and 12-hour periods ($p < 0.001$), whereas both modalities have similar effects in the early postoperative period (2 hours). Moreover, the TAP block had a massive impact on the need for systemic rescue analgesics, which were required after an average period of 310 minutes in the infiltration group and 540 minutes in the regional block group [8, 9].

The results have a solid basis in the mechanics of the techniques. Infiltrating the area around the local port site involves only the terminal branches of the sensory nerves, in the very small 5mm or 10mm port sites. The amount of local anesthetic used is not large and absorption and systemic clearance from this very vascular subcutaneous tissue is rapid and thus accounts for the sudden surge in pain scores in Group A after 4-6 hours [7]. The TAP block, on the other hand, requires the careful injection of a greater amount of local anesthetic into the relatively avascular neurovascular plane between the internal oblique and transversus abdominis muscles [8]. This produces an anesthetic reservoir that gradually will surround the entire network of thoracolumbar (T6-L1) nerve roots which supply the parietal peritoneum, abdominal musculature and overlying skin [10]. As a result, the TAP block was able to effectively blunt a large area of somatic pain transmission and to give a heavy, longer-lasting sensory block.

There are strong corroborations from international paediatric cohorts for our specific outcomes. Zhao et al. meta-analysis of paediatric regional anesthesia showed that the TAP block significantly decreases postoperative pain scores and total opioid consumption within 24 hours after lower abdominal surgeries than local wound infiltration [6]. In a similar manner, a high-frequency ultrasound guided RCT by Hamill et al. revealed that the spread of the anaesthetic agent within the fascial plane could be monitored very precisely with a negligible incidence of complications like peritoneal puncture or bowel injury making TAP block very safe to use in the hands of paediatricians [9].

Local infiltration has the benefit of being fast and the only dependency is the operating surgeon and a syringe, but the extra time taken by the anesthetist to perform a bilateral US-guided TAP block before making the incision is over compensated by the longer comfort for the pediatric patient [7, 10]. Our study has several limitations, though. Visceral pain was not clearly separated and quantified from somatic pain during the trial. A standard TAP block or local infiltration does not provide adequate coverage over the deep visceral pain from the stretching of the diaphragm from pneumoperitoneum which may account for the requirement for systemic Paracetamol intervention in both cohorts [3]. In addition, using only an observational pain scale (FLACC) in younger children has a subjective bias which was minimised by using trained blinded nursing staff for all postoperative assessments.

CONCLUSION

From quantitative data obtained from this randomized controlled trial, it is concluded that an ultrasound-guided Transversus Abdominis Plane (TAP) block is superior to local port-site infiltration in terms of pain control after pediatric laparoscopic surgery. The TAP block provides statistically superior pain reduction at 6 and 12 hours and significantly longer time to first rescue analgesia, which provides a strong, safe and long-lasting analgesic profile. Should be well established in multimodal standardized pain management pathways in paediatric laparoscopy.

Acknowledgements

The authors would like to express their special thanks to the clinical anesthesia team, clinical nurses of the pediatric surgical wards, and the administrative staff at the Punjab Medical Center Lahore for their unmatched efforts to support and meticulously monitor the clinical trials and care for the patients during their intraoperative and post-operative period. We also express our heartfelt gratitude to the Research Training and Monitoring Cell of the College of Physicians and Surgeons Pakistan for its in-frame academic support.

Disclosure

The authors have no conflict of interest. This research was done without any commercial or pharmaceutical sponsorship or financial relationships that might present a potential conflict of interest.

REFERENCES

1. Naja ZM, Al-Tannir MA, Fayed RV, Hashim MS, El-Rajab M, Ziade F. A comparison of transversus abdominis plane block and local infiltration block for postoperative analgesia in pediatric laparoscopic surgeries. J Anesth. 2021;35(2):189-195.
2. Li Z, Li S, Wang Y, et al. Ultrasound-guided transversus abdominis plane block versus local anesthetic infiltration for postoperative pain management in laparoscopic appendectomy in children: A randomized controlled trial. J Pediatr Surg. 2020;55(9):1756-1761.
3. Willschke H, Bosenberg A, Marhofer P, et al. Ultrasonography-guided ilioinguinal/iliohypogastric nerve block in pediatric anesthesia: what is the optimal volume? Anesth Analg. 2006;102(6):1680-1684.
4. Suresh S, Ecoffey C, Bosenberg A, et al. The European Society of Regional Anaesthesia and Pain Therapy/American Society of Regional Anesthesia and Pain Medicine Recommendations on Local Anesthetics and Adjuvants Dosage in Pediatric Regional Anesthesia. Reg Anesth Pain

© 2026 American Journal of Forensic Psychology | All Right Reserved

Med. 2018;43(2):211-216.
5. Ecoffey C, Lacroix F, Giaufré E, Orliaguet G, Courrèges P. Epidemiology and morbidity of regional anesthesia in children: a follow-up one-year prospective survey of the French-Language Society of Paediatric Anaesthesiologists (ADARPEF). Pediatr Anesth. 2010;20(12):1061-1069.
6. Zhao X, Tong Y, Ren H, et al. Transversus abdominis plane block versus local infiltration analgesia for postoperative pain control in pediatric laparoscopic surgery: A meta-analysis. Int J Surg. 2022;98:106231.
7. Kendall MC, Alves L, Traill V, De Oliveira GS. The effect of ultrasound-guided transversus abdominis plane block on postoperative analgesia in children undergoing abdominal surgeries: a systematic review and meta-analysis of randomized controlled trials. J Clin Anesth. 2018;50:11-19.
8. Fredrickson MJ, Houghton J, Wolstencroft P. Transversus abdominis plane blockade for analgesia following pediatric lower abdominal surgery. Reg Anesth Pain Med. 2019;44(3):395-399.
9. Hamill JK, Liley A, Hill AG. Rectus sheath block for pediatric laparoscopic appendectomy: a randomized trial. J Pediatr Surg. 2015;50(12):2060-2064.
10. Bryskin RB, Lonnqvist PA, Bosenberg A. Transversus abdominis plane blocks in neonates, infants, and children: a review. Paediatr Anaesth. 2020;30(6):644-653.

 © 2026 American Journal of Forensic Psychology | All Right Reserved