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Laparoscopic-Guided Transversus Abdominis Plane Block versus Ultrasound-Guided Transversus Abdominis Block in Laparoscopic (TAPP) Trans-Abdominal Pre Peritoneal for Inguinal Hernia Repair

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ABSTRACT

Background: Postoperative pain following laparoscopic surgery continues to be a significant issue. The transversus abdominis plane (TAP) block has been introduced as a safe and effective analgesic technique.

Objective: To compare laparoscopic-guided versus ultrasound-guided TAP block for early postoperative pain control in laparoscopic inguinal hernia repair (LIHR) TAPP.

Patients and Methods: This study was conducted on 48 patients with inguinal hernia admitted to Tanta University Hospital and Shebien-Elkom El-Helal Insurance Hospital, Egypt, in the duration from October 2023 till November 2024. **Results:** Visual analogue scale (VAS) scores, rescue analgesia, and analgesic consumption were comparable between groups.

Conclusion: Laparoscopic-guided TAP block provides analgesic efficacy equivalent to ultrasound-guided TAP block, with similar safety and low complication rates.

Keywords: LIHR**,** TAP‑block**,** VAS, Laparoscopic-guided.

INTRODUCTION

Around the world, Hernia repair (HR) is a common daycare treatment. Since deep breathing and early ambulation are known to lower the risk of problems, postoperative pain management is essential. For painless HR, many anesthetic methods have been described [(1)]. Numerous techniques have been developed to treat postoperative pain, such as local anesthetic (LA) infiltration, which is popular and may speed up patient recovery; it lowers postoperative pain within the first 24 hours without raising the risk of major side events [(2)]. A new localized anesthetic technique called TAP block anesthetizes the anterior abdominal wall's afferent neuronal system. Injecting a LA between the internal oblique muscle and the transversus abdominis muscle mediates this. TAP block has been demonstrated to be a successful pain management strategy during both open and laparoscopic procedures [(3)]. Anesthesiologists are increasingly using ultrasound, particularly when administering regional anesthesia. Because to ultrasonography guidance, doing regional nerve blocks is now considerably simpler. Without blocking visceral pain, traditional methods of the classical kind of TAP block can produce adequate somatic analgesia. Because it is simple to conduct under direct needle vision and LA spread, US-guided TAP-block has rapidly advanced and acquired favor in skilled hands because to its improved reliability, repeatability, and safety profile [(4)].This study aims to assess the safety and efficacy of laparoscopic-guided TAP-block versus US-guided transversus abdominis block regarding early post-operative pain control in laparoscopic inguinal hernia Trans-Abdominal Pre Peritoneal Repair (TAPP).

PATIENTS AND METHODS

This study was conducted on 48 patients with inguinal hernia admitted to Tanta University Hospital and Shebien-Elkom El-Helal Insurance Hospital, Egypt, in the duration from October 2023 till November 2024.

Inclusion criteria:

- Aged 18-60 years old.
- Both genders.
- ASA physical status I-II.

Exclusion criteria:

- The patient declined to take part in the research.
- A patient who has had an open abdominal procedure before.
- Any contraindication of laparoscopic surgeries or general anesthesia.

The include patients were allocated into 2 groups:

- Group 1 (n=24): Patients received TAP block after laparoscopic inguinal hernia (TAPP).
- Group 2 (n=24): Patients had ultrasound-guided transversus abdominis block after laparoscopic inguinal hernia (TAPP).

Perioperative assessment:

The medical and surgical history of the patients was obtained and physical examination of the patients was conducted. Normal laboratory investigations included CBC, liver function tests (albumin, total and direct bilirubin, prothrombin time, prothrombin concentration, international normalized ratio, alanine aminotransferase and aspartate aminotransferase), blood glucose level, kidney function testes (serum urea and creatinine), and ECG were done.

Every patient received instruction on using the VAS to measure postoperative pain. VAS (0 represents “no pain”, “mild pain” (1-3), “moderate pain” (4-6) and “severe pain” (7-10) [(5)].

Technique of TAP Block:

•Laparoscopic guided TAP block:

After almost penetrating the peritoneum under laparoscopic guidance, the needle was attempted to

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withdraw 3mm in order to reach the appropriate layer. Between the internal oblique and transversus abdominis, a little quantity of LA was injected. Before injecting the whole length of LA, the layer's appropriate dispersion was visually confirmed. A bilateral inguinal hernia was treated using the identical treatment on the contralateral side.

•Ultrasound-guided TAP block:

TAP was acquired by tilting the US probe in either the cephalic or caudal direction as needed to provide a clear picture of the three lateral abdominal muscles, figure (1). Using an 8cm/22 G echogenic needle in a supine posture, blocks were established. The needle was subsequently positioned between the IO and TA muscles using the in-plane approach after being targeted in TAP [(6)]. Following a negative blood aspiration, 20mL of bupivacaine 0.5% was administered while guaranteeing a safe dose of the medication. This was done after 2mL of saline was given to verify proper needle insertion.

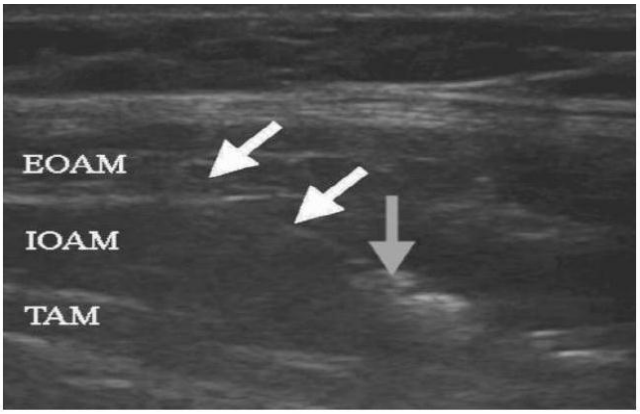

Figure (1): Transverse ultrasound view of the EOAM, IOAM, and TAM during injection of the local anesthetic between the inner two muscles. The white arrows indicate the shaft of the needle; the grey arrow indicates the tip of the needle[(6)].

Postoperative care:

During the postoperative phase, a standardized analgesic regimen was administered. As part of their usual analgesics, all patients were given 1 gram of paracetamol every six hours. Morphine rescue analgesia was administered as a 3mg bolus if the VAS was greater than 3, and repeated after 30 minutes if pain persisted until the VAS was less than 4. VAS was measured at 0, 3, 6, 12, 24, and 48hours postoperatively. The following side effects were also evaluated: ephedrine 5–10mg was used to treat hypotension (a 20% drop in basal MABP), atropine 0.02mg/kg was used to treat bradycardia (a 60% drop in basal HR), ondansetron 0.1mg/kg IV was used to treat respiratory depression (in which the SpO2 was less than 95% and oxygen was required), and ondansetron 0.1mg/kg IV was used to treat postoperative nausea and vomiting (PONV).

Study outcome:

Primary outcome was early post-operative pain evaluation using VAS, whereas the secondary outcomes were assessing the hemodynamic profile after block placement and comparing the occurrence of adverse events related with the two techniques in the two patient groups.

Ethical approval: The Ethics Committee of Tanta University's Faculty of Medicine in Egypt gave its approval to this study. Every patient provided written, informed consent. Throughout its implementation, the study complied with the Helsinki Declaration.

Statistical analysis:

We utilized SPSS version 27.0 for the statistical analysis. The Shapiro-Wilks test and histograms were used to assess the data distribution's normality. To evaluate quantitative parametric data, which were given as Mean ± SD, the unpaired student t-test was employed. Quantitative non-parametric data were examined using the Mann Whitney test and presented as median and IQR. The frequency and percentage (%) of the qualitative variables were given, and the X^2-test or Fisher's exact test, if appropriate, was used to assess them. It was deemed statistically significant when the two-tailed P value was less than 0.05.

RESULTS

Sixty-nine patients were evaluated for eligibility in this study; 13 patients did not fit the requirements, and 8 patients declined to take part. The remaining patients were divided into two equal groups of 24 at random.

There was no significant difference between the two groups in terms of age, sex, weight, BMI, height, ASA physical status, or duration of surgery (Table **1**).

Table (1): Demographic data and duration of surgery of the studied groups

Variables		Group 1 (n=24)	Group 2 (n=24)	P value
Age (years)	**Mean±SD**	43.46 ± 8.83	44.75 ± 9.07	0.619
	Range	22 - 59	19 - 60	
Sex	**Male**	20 (83.33%)	19 (79.17%)	1
	Female	4 (16.67%)	5 (20.83%)	
Weight (kg)	**Mean±SD**	81.67 ± 10.69	78.83 ± 11.97	0.392
	Range	56 - 99	59 - 102	
Height (cm)	**Mean±SD**	166.79 ± 6.69	168.58 ± 6.44	0.350
	Range	156 - 181	159 - 182	
BMI (kg/m^2)	**Mean±SD**	29.38 ± 3.71	27.81 ± 4.37	0.187
	Range	21.9 - 34.4	17.8 - 34.9	
ASA physical status	**I**	11 (45.83%)	9 (37.5%)	0.558
	II	13 (54.17%)	15 (62.5%)	
Duration of surgery (min)	**Mean±SD**	59.38 ± 20.87	55.21 ± 16.58	0.448
	Range	30 - 110	35 - 95	

BMI: Body mass index, ASA: American Society of Anesthesiologists.

VAS was insignificant difference at 0h, at 3 h, 6 h, 12 h, 24 h and 48 h between both groups (Table **2**).

Table (2): VAS of the studied groups

Time course	Group 1 (n=24)	Group 2 (n=24)	P value
0 h	1(0 - 1)	0(0 - 1)	0.391
3 h	1(0 - 2)	1(0 - 2)	0.852
6 h	2(1 - 2)	1.5(1 - 3)	0.921
12 h	3(2 - 3.25)	3(2 - 5)	0.094
24 h	3.5(2 - 4)	3(2 - 4.25)	0.618
48 h	3(2 - 4)	3(2 - 3.25)	0.915

*: Significant as P value<0.05.

Postoperative heart rate (HR) was insignificant difference at 0h, 3 h, 6 h, 12 h, 24 h, and 48 h between both groups. Postoperative mean arterial blood pressure (MABP) was insignificant difference at 0h, at 3 h, 6h, 12 h, 24 h, and 48 h between both groups (Table **3**).

Table (3): Postoperative HR of the studied groups

Time course	Group 1 (n=24)	Group 2 (n=24)	P value
0 h	81.83±6.68	79.04±7.44	0.178
3 h	83.29±9.53	83.75±7.09	0.851
6 h	86.17±10.15	81.25±12.44	0.140
12 h	93.96±14.83	85.92±16.84	0.086
24 h	96.67±13.82	94.67±10.94	0.581
48 h	102.83±9.3	100.88±8.32	0.446

Postoperative MABP was insignificant difference at 0h, at 3 h, 6 h, 12 h, 24 h, and 48 h between both groups (Table **4**).

Table (4): Postoperative MABP of the studied groups

Time course	Group 1 (n=24)	Group 2 (n=24)	P value
0 h	90.29±11.74	91.96±10.46	0.606
3 h	96.58±11.22	95.96±10.09	0.840
6 h	98.96±16.28	96.13±15.02	0.534
12 h	98.13±14.97	95.92±11.96	0.575
24 h	101.71±14.39	97.75±15.9	0.371
48 h	101.96±12.89	99.5±12.66	0.508

*:Significant as P value<0.05; PACU: Post anesthesia care unit.

Time to first request of rescue analgesia, total amount of paracetamol consumed during the first postoperative 24 hours, and postoperative NSAIDs requirements were insignificant difference between both groups (Table **5**).

Table (5): Time to first request of rescue analgesia and total amount of paracetamol consumed during the first postoperative 24 hours and postoperative NSAIDs requirements of the studied groups

Variables		Group 1 (n=24)	Group 2 (n=24)	P value
Time to first request of rescue analgesia (h)	**Mean ± SD**	9.38 ± 1.81	10.08 ± 1.74	0.174
	Range	6 – 12	8 - 12	
Total amount of paracetamol consumed during the first postoperative 24 hours (mg)	**Mean ± SD**	791.67 ± 291.8	687.5 ± 355.47	0.273
	Range	500 - 1500	500 - 1500	
Postoperative NSAIDs requirements	**Yes**	7 (29.17%)	3 (12.5%)	0.286
	No	17 (70.83%)	21 (87.5%)	

There was no significant difference in complications between the two groups (Table **6**).

Table (6): Complications between our two groups

Variables	Group 1 (n=24)	Group 2 (n=24)	P value
Hypotension	5 (16.67%)	7 (23.33%)	0.740
Bradycardia	4 (13.33%)	5 (16.67%)	1
PONV	5 (16.67%)	3 (10%)	0.70
Urinary retention	2 (6.67%)	1 (3.33%)	1

DISCUSSION

After LIHR, early postoperative pain is common. It affects physical recovery, early ambulation, and the prevalence of chronic pain, which is a proven risk factor. In order to reduce postoperative pain, LA techniques have been studied [(5)]. Techniques include intravenous (IV) analgesics, LA infusion to the wound site, and regional blocks like the TAP block can all help manage pain [(6)]. The purpose of US TAP and LTAP blocks was to restrict peritoneal invasion and assist in identifying the appropriate plane. The object of this trial was the assessment of safety and efficacy of LTAP versus US TAP regarding early post-operative pain control in laparoscopic inguinal hernia (TAPP). In this study, VAS was statistically insignificant difference at 0h, at 3 h ,6h ,12h, 24h and 48h between both groups.

Hubbard *et al.* [(6)] reviewed 18 articles on TAP blocks in LIHR. According to their findings, post-operative pain is reduced when TAP blocks are used in conjunction with LIHR. **Aguirre-Ospina *et al.*** [(7)] **and Arora *et al.*** [(8)] conducted a randomized controlled trial with 45patients receiving IHR. They were randomly assigned to either placebo or TAP block. They found that the TAP group experienced less pain discomfort 24 hours after surgery than the control group.

Our findings are supported by a trail was carried out on 120 obese individuals who were slated for LAP bariatric procedures by **Algyar and Abdelsamee** [(9)]. Two equal groups of patients were assigned to LTAP and UTAP, and each group received 20mL of 0.25% bupivacaine. They observed that, throughout all measurement periods, there was no statistically significant difference in postoperative pain between the two groups.

On contrary, in a prospective, randomized study, **Venkatraman *et al.*** [(10)] randomly assigned 80patients having laparoscopic cholecystectomy into two groups. At the conclusion of the procedure, the patients received either laparoscopy-guided (group L) or ultrasound-guided (group U) subcostal TAP block. For the first four hours following surgery, they discovered that group U's VAS score was noticeably lower than group L's. After four hours, the VAS score showed no signs of statistical significance. This discrepancy from our findings might be explained by the different anesthetic medication (propofol) and sample size employed in their investigation.

In this study, postoperative HR and MABP were statistically insignificant different at 0h, 3h, 6h, 12h, 24h, and 48h between both groups.

This came in line with **Algyar and Abdelsamee** [(9)] who illustrated that LTAP and UTAP groups had comparable post-operative HR and MABP. This is confirmed by **Sahap *et al.*** [(11)] found that hemodynamic measurements were statistically insignificant difference between LTAP and UTAP groups.

In the current study, time to first request of rescue analgesia, total amount of paracetamol consumed during the first postoperative 24hours, and postoperative NSAIDs requirements were insignificant difference between both groups. **Arora *et al.* [8]** noted that TAP block had lesser patient-controlled analgesia fentanyl requirement than control. **Aguirre-Ospina *et al.* [7]** reported that The TAP group consumed fewer opiates than the control group.

This agreed with **Algyar and Abdelsamee [9]** who found that the difference between the UTAP and LTAP groups in terms of total morphine use and time to the first rescue analgesia was negligible.

In contrast, **Venkatraman *et al.* [10]** showed that duration of postoperative analgesia was significantly higher in ultrasound group than laparoscopy group and total morphine consumption was significantly higher in laparoscopy group than ultrasound group.

Also, **Zaghiyan *et al.* [12]** showed that LTAP block used substantially less total morphine than ultrasound guided. The study found that problems were no statistically significant difference between the two groups.

This is supported by **Algyar and Abdelsamee (2024) [9], and Zaghiyan *et al.* (2019) [12]** who reported that postoperative complications were statistically insignificant difference between UTAP and LTAP groups. This is agreed with **Wong *et al.* [13]** who showed that PONV was statistically insignificant different between LTAP and UTAP blocks.

CONCLUSIONS

Comparable pain scores, time to first rescue analgesia, total paracetamol consumption, and NSAID requirements demonstrate that the analgesic effect of laparoscopic TAP in laparoscopic inguinal hernia surgery is not inferior to ultrasound-TAP. Additionally, the low incidence of post-operative complications indicates that the two procedures are nearly equally safe.

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