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Comparison Between Ultrasound Guided Transversus Abdominis Plane (TAP) Block Versus Local Wound Infiltration for Post Operative Pain Management in Patients Undergoing Appendectomy

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ABSTRACT

Objective: To compare the frequency of intra-operative and post-operative analgesia with pre-operative transverses abdominis plane (TAP) block with local wound infiltration of anesthetic agent.

Study Design: Quasi-experimental study.

Place and Duration of Study: Sheikh Khalifa Bin Zayed Al Nahyan Hospital-Combined Military Hospital (SKBZH-CMH) Muzaffarabad, Pakistan Nov 2023 to Apr 2024.

Methodology: After ethical permission this quasi-experimental study was performed with a sample of 145 patients randomized into two Groups named: T and W were subjected to laproscopic appendectomy. Group T comprised patients who received TAP block and Group W comprised patients who received local wound infiltration. The primary outcome was intra-operative analgesia and post-operative pain scores at zero hours, 4 hours and 8 hours. The secondary outcome was the presence or absence of post-operative nausea and vomiting. Visual analogue score (VAS) was used as tool for objective measurement of pain.

Results: The sample consisted of a total of 145 patients with 72 patients in Group T and 73 patients in Group W. One (1.4%) patient had mild pain in post-anesthesia care unit at zero hours in Group T versus 7(9.6%) patients in Group W. One (1.4%) patient in Group W had moderate pain at zero post-operative hours and 7(9.6%) had mild pain. Six (8.3%) patients in Group T had mild pain and 66(91.7) had no pain at 4th post-operative hour. The frequency of intra-operative pain was higher in Group T compared to Group W.

Conclusion: We concluded that pre-operative transversus abdominis plane (TAP) provides better peri-operative analgesia when compared to local wound infiltration.

Keywords: Anesthesia, Appendectomy, Bupivacaine, Local wound infiltration, Transversus abdominis plane.

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INTRODUCTION

Pain management is essential for a faster recovery and better physical condition following a laparoscopic procedure.[1] Numerous options for local and regional anesthesia have been used for reducing the need for opioids after laproscopic procedures. These techniques have added to the popularity of laproscopic interventions by enhancing recovery. Transversus abdominis plane (TAP) block is one such alternative that has undergone multiple variations since its inception and it provides analgesia to anterior abdominal wall.[2] Laproscopic appendectomy no doubt promotes early recovery and minimizes hospital stay.[3] Early postoperative pain following laparoscopic intervention is moderate to severe, necessitating the use of an effective multimodal analgesic approach,[4] which included pharmacological treatment along with use of local anesthetics at the port site and regional blocks.[5]

The intended anatomical site for TAP block is where four peripheral nerves-subcostal, ilioinguinal, iliohypogastric, and genitofemoral nerves - traverse the abdominal wall between the transversus abdominis and the internal oblique. It is a field block where a local anesthetic is injected into anatomical plane between the transversus abdominis and internal oblique muscles where it inhibits the neural pathways that transmit pain signals in the abdomen wall between the T6 and L1-L3 spinal levels and provides better analgesia compared to local infiltration6. In contrast, a few authors advocate that there is no discernible disparity in effectiveness of local infiltration and TAP block during a 12 hour period.[7] There are studies too which provide evidence regarding post-operative TAP block but there is no local study to provide evidence of analgesic efficacy of TAP block when given pre-operatively. Therefore, the

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rationale of our study is to compare the post-operative local wound infiltration with pre-operative transversus abdominis plane block in patients undergoing appendectomy with help of laparoscopy.

METHODOLOGY

After seeking permission from the hospital ethical committee (IERB NUMBER: 1139), this quasi-experimental study was carried out at the anesthesia department of SKBZH-CMH Muzaffarabad Pakistan from November 2023 to April 2024. The sample size was calculated with the help of WHO sample size calculator keeping level of significance 5%, power of test 80%, the anticipated mean pain score with Transversus abdominis plane block to be 1.84±1.078 and the anticipated mean pain score with wound infiltration to be 3.69±1.148. The sample size came out to be 72 so we included 75 patients in each Group to make up for any dropouts. The sample of 150 was collected with the help of non-probability consecutive sampling. The randomization was done with the help of sealed envelope.

Inclusion Criteria: Patients with American society of anesthesiology class one male or female who were planned to have laproscopic appendectomy under general anesthesia.

Exclusion Criteria: The patients who had open appendectomy, patients with deranged coagulation profile or contraindication to local anesthetic or regional anesthesia, patients with psychiatric problems, patients with BMI greater than 30, pregnant patients and patients who refused to give consent were excluded.

The patients were either booked electively or through the emergency department for laproscopic surgery after thorough workup and lab investigations. Patients were subjected to detailed pre-anesthetic assessment, and they were randomized in operation theater into two Groups. A standardized general anesthetic regimen was given by consultant anesthetist including propofol (2.5 mg/kg) and Rocuronium (1.2 mg/kg) was used for rapid sequence induction. Isoflurane (2%–3%) was used for maintenance of anesthesia. There was 0.1 mg/kg of nalbuphine given to all patients for intra-operative analgesia. After induction of anesthesia Group T patients were given trasversus abdominis plane block. Abdomen was scrubbed with Hexi prep (Chlorhexidine Gluconate Solution 2% v/v) and ultrasound footprint was covered with sterilized probe cover. The ultrasound probe was placed laterally to midline. 3-4 cm below xiphisternum. The block needle was navigated through in-plane technique at the anterior axillary line, in the neurovascular fascial plane, so that the tip of needle could be identified between the transversus abdominis and internal oblique muscle. Five ml of normal saline was injected to confirm correct needle placement. After that 16-milliliter volume of (0.25%) bupivacaine was injected in the fascial plane with help of 10 cm long insulated needle. Same procedure was performed bilaterally and total 32 milliliter volume was given. Every patient was subjected to standard laparoscopic appendectomy carried out by a laparoscopic surgeon who had 5 years experience of laparoscopic procedures. In all patients standard port position was used.

All Group W patients were given general anesthesia with exact same drugs as used in Group T. All patients were subjected to standard laproscopic appendectomy. After surgery, local wound infiltration of 0.25 bupivacaine was done. Eight milliliters of bupivacaine were injected in each port site to make a volume of 32 ml in total. The patients were extubated in operation theater. The demographic details of patients were recorded including age, weight, height, BMI, gender. The primary outcome was intra-operative analgesia and post-operative pain scores at zero hours, 4 hours and 8 hours. The intra-operative analgesia was defined as no incidence of tachycardia (greater than 20% increase in heart rate from baseline) and hypertension (greater than 20% increase in blood pressure from baseline). The secondary outcome was the presence or absence of Post-operative nausea and vomiting. Visual analogue score (VAS) was defined as objective scoring by patients from no pain (VAS=0), mild pain (VAS 1-3), moderate pain (VAS=4-6) to severe pain (VAS=7-10). Patients were asked to rate their pain on a scale of 11 points 1cm apart. The consort flow diagram of study protocol is mentioned in Figure.

Data was analyzed by using Statistical Package for Social Sciences (SPSS) 22.00. Quantitative data was represented using mean ± standard deviation and qualitative data was represented by using percentage and frequency. Quantitative variables in both groups were compared by applying the independent samples t test while qualitative variables were compared using the chi square test/ fisher exact test taking p value of less than 0.05 as statistically significant.

RESULTS

A total of 150 patients were recruited for the study after application of inclusion and exclusion criteria. However, three patients were dropped from Group T and two patients were dropped from Group W. Two patients in Group T were converted to open appendectomy and one was prolonged due to incidental ovarian cyst which was also removed therefore that patient was excluded from results. Two patients in Group W were opened due to technical difficulties therefore these patients were excluded from results. The demographic variables were similar in both Groups. The mean age of Group T patients was 43.07±8.37 years and mean age in Group W patients was 42.70±8.733 years. The mean weight of Group T patients was 68.56±4.98 kg and 42.70±8.73 kg in Group W. The mean height of Group T patients was 160.03±13.47 cm and mean height of Group W patients was 162.52±5.72 cm. The mean BMI of Group T patients was 26.26±2.33 kg/m^2 and mean BMI of Group W patients was 26.21±2.39 kg/m^2. The mean surgical time of Group T patients was 52.44±6.67 minutes and Group W patients were 52.06±6.67 minutes. There were 33(45.8%) males and 39(54.2%) females in Group T. There were 31(42.5%) males and 42(57.5%) females in Group W. The demographics of patients are shown in Table-I.

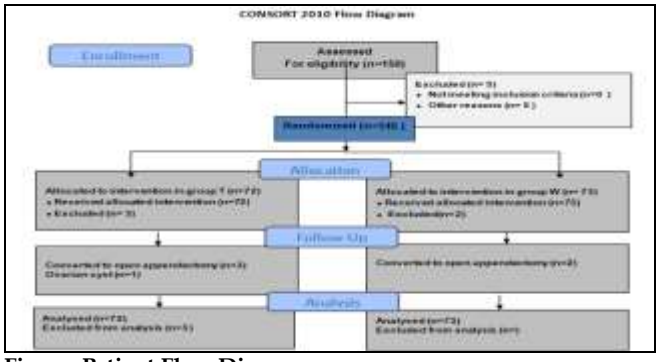

Figure: Patient Flow Diagram

Table-I: The Demographics Characteristics of Study Groups (n=145)

		Group T n=72	Group W n=73	*p*-value
Mean Age (age)		43.07± 8.37	42.70±8.73	0.941
Mean Weight (Kg)		68.56±4.98	69.68±5.19	0.944
Mean Height (cm)		160.03±13.47	162.52±5.72	0.901
Mean BMI (kg/m2)		26.26±2.33	26.21±2.39	0.235
Mean Surgical Time (minutes)		52.44±6.67	52.06±6.67	0.988
		Frequency (%)	Frequency (%)	
Gender	Males	33(45.8%)	31(42.5%)	0.405
	females	39(54.2%)	42(57.5%)	

One (1.4%) patient had mild pain in post-anesthesia care unit at zero hours in Group T versus 7(9.6%) patients in Group W. one (1.4%) patients in Group W had moderate pain at zero post-operative hours and 7(9.6%) had mild pain. Six (8.3%) patients in Group T had mild pain and 66(91.7) had no pain at 4th post-operative hour. Nine (12.3%) patients had mild pain, and 9(12.3%) patients had moderate pain in Group W at 4rth post-operative hour and 55(75.3%) experienced no pain with *p*-value<0.001. One (1.4%) patient experienced moderate pain in Group T and 13(17.8%) patients experienced moderate pain in Group W at eighth post-operative hour. Three (4.2%) in Group T patients developed post-operative nausea and vomiting and 17(23.3%) patients developed nausea and vomiting in Group W with *p*-value <0.001.

Table-II: The Primary Outcome (Peri-Operative Pain Scores) and Secondary Outcomes (Post-Operative Nausea and Vomiting) of both Groups (n=145)

		Group T n=72 Frequency (%)	Group W n=73 Frequency (%)	*p*-value
Intra-Operative Pain	Yes	0(0%)	38(52.1%)	<0.001
	No	72(100%)	35(47.9%)	
Pain at Zero Hours	No pain	71(98.6%)	65(89.0%)	0.035
	Mild pain	1(1.4%)	7(9.6%)	
	Moderate pain	0(0%)	1(1.4%)	
	Severe pain	0(0%)	0(0%)	
Pain at Four Hours	No pain	66(91.7%)	55(75.3%)	<0.001
	Mild pain	6(8.3 %)	9(12.3%)	
	Moderate pain	0(0%)	9(12.3%)	
	Severe pain	0(0%)	0(0%)	
Pain at Eight Hours	No pain	64(88.9%)	52(71.2%)	<0.001
	Mild pain	7(9.7%)	8(11.0%)	
	Moderate pain	1(1.4%)	13(17.8%)	
	Severe pain	0(0%)	0(0)	
Post-operative nausea and vomiting (PONV)	Yes	3(4.2%)	17(23.3%)	<0.001
	No	69(95.8 %)	56(76.7%)	

DISCUSSION

Our study demonstrated that pre-operative TAP block provided better peri-operative analgesia. It produced better pain scores post-operatively and provided optimal analgesia during anesthesia upon objective measurement of pain during surgery. Acute postoperative pain has a predetermined trajectory, and it decreases as the tissue heals,[9] but sometimes it converts into chronic pain if not treated properly in peri-operative period. Therefore, prevention of onset of pain is very important as acute pain can transform into chronic pain.[10] Therefore, we chose to study regional block before surgical incision which provided pre-emptive analgesia.[10]

In TAP block local anesthetic is directly infiltrated into the fascial plane between two anterior abdominal wall muscles and it provides analgesia for interventions involving anterior abdominal wall incisions.[14] It has been used for procedures such as lower segment cesarean sections, cholecystectomies and appendicectomies.[13] According to research conducted by Kadam *et al*.,[14] found that the mean analgesic requirement (fentanyl) in the local infiltration Group after LC was 86.90mcg (SD±73.97) and 33.16mcg (SD±54.17) in the ultrasound guided TAP blockade Group with *p*-value of 0.03, which signifies the superiority of TAP block. They applied TAP block at end of surgery for post-operative analgesia, but we provided TAP block before the port insertion. The mean pain score was 2.5 in their study upon coughing at zero hours, but we studied frequency of pain unlike them. There was no pain in our patients at zero hours. The possible explanation to this is that some patients develop pain in recovery soon after TAP block is given despite adequate block as they are immediately extubated after TAP block. Therefore, timing of block is also very important. Poupak Rahimzadeh *et al*., studied the effects of pre-emptive and post-operative TAP block in 85 patients. They found that pain scores at rest were lower in pre-emptive Group compared to post-operative Group with *p*-value 0.004. In our study, one patient had mild pain at zero hours, but 7 patients had mild pain at zero hours.[15]

Although some authors in the past advocate that post-operative TAP block provides analgesia up to twenty-four hours and it's more effective than pre-operative TAP block, we found that pain scores were low till 12 hours.[16] Zhi YU Geng *et al*., presented the findings of their study which is like ours. They demonstrated that pre-operative TAP block provided better post-operative analgesia and patient satisfaction with p value 0.041.[15] The measured pain scores for 24 hours and we measured for eight hours.[17]

According to Muhammad Rashid *et al*.,[18] unilateral TAP block provided a superior analgesia to local infiltration in subcutaneous tissue and peritoneum. Our study agrees with their findings, and we advocate pre-operative application for better results. The pre-operative application was more convenient as there was no surgical incision or stitches to hinder the maneuvering of probe and there was no chance of contamination of surgical wound.

According to a local study conducted by Usman Khalid *et al*.,[19] it is established that TAP block has resulted in substantial improvement of pain scores when given post-operatively in cesarean section. The time for first analgesic request in TAP block Group was 11.45± hours and in our study 88% patients had no pain eight hours post-operatively. However, in their study spinal anesthesia provided intra-operative analgesia. The presence of spinal anesthesia can make comparisons difficult. The surgery was also lower segment cesarean and local anesthetic requirements of gravid ladies are also different.[20] The findings of their studies cannot be generalized to the rest of the population.

We recommend TAP block as a good alternative to local anesthetic infiltration and we advocate the pre-operative delivery of block to provide pre-emptive analgesia.

CONCLUSION

We concluded that pre-operative transversus abdominis plane (TAP) provides better peri-operative analgesia when compared to local wound infiltration of port-site.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

AN & RA: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

IS & SI: Data acquisition, data analysis, approval of the final version to be published.

AAK & AK: Critical review, concept, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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