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Comparative Study of Erector Spinae Plane Block Versus Transversus Abdominis Plane Block for Post Operative Analgesia in Patient Undergoing Laparoscopic Surgeries

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Abstract
Effective pain management is a primary responsibility of anaesthesiologists. Despite advancements in surgical methods and anaesthesia practices, postoperative pain continues to be a significant concern. The International Association for the Study of Pain (IASP) defines pain as “an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage. In comparison to the TAP block, the ESP block provides broader dermatomal coverage, offers potential visceral pain relief, and leads to reduced opioid consumption, making it a potentially more reliable option for postoperative analgesia. Patients scheduled for elective laparoscopic surgeries at PES institute of medical sciences and research (PESIMSR), Kuppam from (November2023-April2025) were included in this study. Sample size: based on a study by kamel et al., july 2020, sample size was calculated by using the mean difference and standard deviation of the VAS SCORE. Inclusion criteria are patients aged between 20 and 40 years, patients with American Society of Anaesthesiologist (ASA) physical status I and II of either gender, and patients scheduled for elective laparoscopic abdominal surgeries under general anesthesia.Exclusion criteria are defined as patient refusal; patients who have infection at the injection site; clotting abnormalities; liver and renal abnormalities. In the present study, the patients in group T demanded diclofenac significantly more times than those in group E, and the first analgesic demand was significantly delayed in group E ($p < 0.001$). These results are similar to the above three studies. Shahid et al. conducted a study comparing the effects of paracetamol and tramadol on postoperative pain and found that the use of tramadol significantly increases the incidence of PONV. Similar to this, in the present study, nine patients (13.0%) from group 'O' whose tramadol requirement was higher developed PONV. The significant lower VAS scores were observed earlier in group E compared to groupT. The duration of analgesia was prolonged in group E compared to group T. The rescue analgesic requirement was lowering in groupE compared to group T for 24 hours in postoperative period.The hemodynamic variations were within physiological limits in both the groups. There were no post procedural complications in both the groups.

INTRODUCTION

Effective pain management is a primary responsibility of anaesthesiologists. Despite advancements in surgical methods and anaesthesia practices, postoperative pain continues to be a significant concern. The International Association for the Study of Pain (IASP) defines pain as "an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage."

Postoperative pain results from multiple factors, and its intensity is influenced by the extent of surgical trauma, anaesthesia techniques, and various physiological, psychological, emotional, and sociocultural aspects of the patient[1]. Non-opioid analgesics, such as NSAIDs, antidepressants, and alpha-2 agonists, are frequently employed either as alternatives to opioids or within a multimodal analgesia strategy, particularly when combined with opioids[2,3]. Moreover, intravenous lidocaine (bolus or infusion) and preoperative gabapentin or pregabalin have proven effective in preventive analgesia[4,5].

The use of ultrasound (USG) has revolutionised regional analgesia techniques, facilitating various truncal blocks that help control pain effectively and reduce opioid consumption, particularly in laparoscopic abdominal surgeries. The TAP block is a widely used technique for postoperative pain management in laparoscopic abdominal surgeries. Local anaesthetic is administered under ultrasound. Guidance between the transversus abdominis and internal oblique muscles. Alternatively, the procedure can be performed using landmarks, specifically targeting the Petit triangleThis fascial plane includes nerves like the intercostal, subcostal, iliohypogastric, and ilioinguinal, which innervate the anterior and lateral abdominal wall and parietal peritoneum. However, the TAP block primarily provides somatic analgesia and does not offer adequate visceral pain relief.

TAP blocks are effective in both open and laparoscopic abdominal procedures and can be applied in both inpatient and outpatient settings[5]. Unilateral TAP blocks are typically used for surgeries on one side of the abdomen (e.g., cholecystectomy, appendectomy, nephrectomy). Bilateral TAP blocks are indicated for surgeries involving midline or transverse incisions (e.g., hernia repairs, caesarean sections, hysterectomies, prostatectomies). Administered either before the incision or post-surgery before the patient awakens, TAP blocks help reduce opioid consumption and enhance patient comfort. The effectiveness of the block depends largely on the proper spread of the anaesthetic within the targeted fascial plane.The ESP block is a more recent technique offering both somatic and visceral analgesia. It involves injecting local anaesthetic between the erector spinae muscles and the transverse processes of the vertebrae, allowing for multi-segmental pain relief. The ESP block has shown promise in thoracic, abdominal, and spinal surgeries[6].

In comparison to the TAP block, the ESP block provides broader dermatomal coverage, offers potential visceral pain relief, and leads to reduced opioid consumption6, making it a potentially more reliable option for postoperative analgesia.Considering the increasing interest in ultrasound-guided truncal blocks and the potential advantages of the ESP block over the conventional TAP block, this study aims to compare the postoperative analgesic efficacy of the ESP and TAP blocks following laparoscopic surgeries in our clinical practice.

Aims and Objectives: This is to compare the post-operative analgesic efficacy of Erector Spinae Plane block (ESP) versus Transversus Abdominis Plane block(TAP) after Laparoscopic surgeries.

- To compare visual analogue scale (VAS) scores between two groups
- To assess the duration of the analgesia
- To assess the Haemodynamic variations betwee n the groups
- To assess the adverse effects in each group

MATERIALS AND METHODS

Patients scheduled for elective laparoscopic surgeries at PES institute of medical sciences and research (PESIMSR), Kuppam from (November2023-April2025) were included in this study.After obtaining clearance from the institutional scientific and ethical committee [M22010303124] and written informed consent from the patient,60 patients aged 20-15 mg/kg, ensuring that the anaesthesia was both effective and safe. Continuous monitoring of vital signs was implemented throughout the procedure to promptly address any fluctuations in the patients' conditions.

Study Design: Quasi-experimental study. Sample size: based on a study by kamel *et al*., july 2020, sample size was calculated by using the mean difference and standard deviation of the VAS SCORE. Inclusion criteria are patients aged between 20 and 40 years, patients with American Society of Anaesthesiologist (ASA) physical status I and II of either gender, and patients scheduled for elective laparoscopic abdominal surgeries under general anesthesia.Exclusion criteria are defined as patient refusal; patients who have infection at the injection site; clotting abnormalities; liver and renal abnormalities; cardiovascular and respiratory abnormalities; psychiatric and neurological disorders; and patients who are allergic to local anaesthetics.

All patients were visited pre-operatively and the patients were subjected for detailed pre- anesthetic

evaluation which includes detailed history, which includes general , physical and systemic examination and detailed laboratory workup including complete hemogram, serum electrolytes, blood urea, serum creatinine, ECG, RBS and other tests when necessary.After the written informed consent was obtained, the patients were explained about the procedure and educated about the VAS score in their own understandable language.

Patient was kept nil per oral 8 hours before the surgical procedure.Tablet pantaprazole 40mg and Alprazolam 0.5mg was given to all patients night before surgery. Patients were monitored continuously. Intraoperatively, IV fluid continued as per requirement. At the end of the surgery, before extubation, patients were divided into two groups by coded envelope by the random selection of the envelope method as follows: GROUP E (n=30) Patients received a bilateral erector spinae block with 0.125% bupivacaine, volume 15 ml. GROUP T (n=30) Patients received a bilateral transverse abdominal plane block with 0.125% bupivacaine, volume 15 ml, and the blocks were given.The data will be entered into MS Excel 2019 version and further analysed using SPSS (version 26.0; SPSS Inc., Chicago, IL, USA). For descriptive analysis, the categorical variables will be analysed by using frequency and percentages, and the continuous variables will be analysed by calculating mean ± standard deviation. For inferential analysis, the numerical data were analysed using the -t‖-test. The categorical data were analysed using the chi-square test. Will be applied, and -p‖ < 0.05 will be considered as statistically significant.

RESULTS AND DISCUSSIONS

Data Analysis and Interpretation: 60 patients of either gender ofage 20-40 years was selected and randomly allocated in to two groups i.e.; group E (n=30) and group T (n=30). Group E received Erector Spinae Plane block with 0.125% bupivacaine of 15 ml on either sides and Group T received TAP Block with 0.125% bupivacaine of 15 ml on either sides respectively. The observation and results were obtained and inference discussed regarding demographic variables (age, height, weight and gender), ASA physical status, haemodynamic parameters, VAS scores, Analgesic duration and side effects.

Observation: In Group E, among the 30 patients 13 patients were male (43%) and 17 patients (56%) were female. In Group Tamong 30 patients 8 patients were male (27%) and 22 patients (73%) were female, P value is 0.176 which is greater than 0.05.it is statistically insignificant. Both the groups are comparable.

Observation: In Group E among the 30 patients 14 patients (46.67%) were belong to ASA I and 16 patients (53.33%) were belong to ASA II. In Group T among 30 patients 13 patients (43.33%) were belong to ASA I and17 patients (56.67%) were belong to ASA II, P value is 0.795 which is greater than 0.05. It is statistically insignificant. Both the groups are comparable.

Observation: VAS scores at rest were compared between group E and group T and calculated at 0, 0.5hr,2hr,4hr,8hr,12hr,24hr after ESP BLOCK in Group E and TAP BLOCK in Group T respectively. In group E the mean VAS score at 0 hr and 30 min were 0, patient had no pain, at 2hr and 4hr the mean VAS score were 0.33±0.47 and 1.27±0.45 respectively, patient had minimal pain. at 8 hr the mean VAS score were 2.06±0.63 the pain was gradually increasing. At 12th hr the mean VAS score was 2.83±0.64 patient had moderate pain and first rescue analgesia was given. At 24 hr. the mean VAS score was 3.93±0.73. In group T the mean VAS score at 0 hr and 30 min were 0, patient had no pain, at 2hr and 4hr the mean VAS scorer were 0.70±0.60 and 1.67±0.48 pain steadily increasing from 4th hr. At 8hr the mean VAS score was 2.40±0.49 patient had moderate pain and first rescue analgesia was given. At 12th hr. the mean VAS score was 3.23±0.62.At 24 hr. the mean VAS score was 4.37±0.61.

Till 4 hrs.' there was no statistical difference of mean VAS Scores. The group T had higher VAS score at 8hrs which is statistically significant subsequently group T had higher VAS score at 12 and 24 hrs. which is statistically significant. The group T had higher VAS scores earlier compared with group E.

Observation: In group E the mean duration of analgesia was 12.23±1.94 hrs. and in group T was 8.77±0.82 hrs., the p value was <0.0001* which are statistically highly significant. The duration of analgesia in Group E is more compared to group T

Observation: The above table and graph depicts that in group E (n=30) 24 patients (80%) received single dose of rescue analgesic and 6 (20%) patients received two dose of rescue analgesia, In group T(n=30) 7 patients(23.3%) received single dose of rescue analgesia and 18 patients (60%) received two doses of rescue analgesia and 5 patients (16.67%) received third dose of rescue analgesia. The p vale is <0.0001* which is highly significant. Majority of the patients in group E took single dose of rescue analgesia compared with group T Majority of the patient in group T took second dose of rescue analgesic compared with group E .The require amount of rescue analgesia was less in group E compared to group T.

Postoperative pain is associated with a variety of negative outcomes, such as fear, anxiety, patient discomfort, cardiovascular events, pulmonary atelectasis, poor wound healing, and ventilation issues, each of which can lead to postoperative complications,

Table 1: Association between the Genders with group of the subjects

Gender	Group		X2-value	„p" Value	Sig
	E	T			
Male	13(43.33%)	8(26.67%)	1.8315	0.176	NS
Female	17(56.67%)	22(73.33%)			
Total	30(100.0%)	30(100.0%)			

*P<0.05statisticallysignificant

Table 2: Comparison between the ASA and group of the subjects

ASA	Group		X2-value	„p"Value
	E	T		
I	14(46.67%)	13(43.33%)	0.067	0.795
II	16(53.33%)	17(56.67%)		
Total	30(100.0%)	30(100.0%)		

*P<0.05statisticallysignificant

Table 3: Comparison betweenTypes of surgery and Group of the subjects

Type of Surgery	Group E	Group T	Total	χ^2 value	P value
LAVH	8 (26.67%)	4 (13.33%)	12 (20.00%)	2.0833	0.555
Lap appendicectomy	3 (10.0%)	5 (16.67%)	8 (13.33%)		
Lap cholecystectomy	12 (40.0%)	12 (40.0%)	24 (40.0%)		
Lap mesh hernioplasty	7 (23.33%)	9 (30.0%)	16 (26.67%)		
Total	30 (100.00%)	30 (100.00%)	60 (100.00%)		

*P<0.05statisticallysignifican

Table 4: Comparison between the VAS with group of the subjects

Time Point	Group E (Mean ± SD)	Group T (Mean ± SD)	t-value	p-value
Baseline	0.00 ± 0.00	0.00 ± 0.00	NA	NA
30 min	0.00 ± 0.00	0.00 ± 0.00	NA	NA
2 hr	0.33 ± 0.47	0.70 ± 0.60	2.6256	0.0110
4 hr	1.27 ± 0.45	1.67 ± 0.48	3.3326	0.0015
8 hr	2.06 ± 0.63	2.40 ± 0.49	2.2517	0.0281
12 hr	2.83 ± 0.64	3.23 ± 0.62	2.4321	0.0181
24 hr	3.93 ± 0.73	4.37 ± 0.61	2.4674	0.0166

*P<0.05statisticallysignificant

Table 5: Comparison between the Duration of Analgesia hr and Group of the subjects

Variable	Group E (Mean ± SD)	Group T (Mean ± SD)	t-value	p-value
Duration of Analgesia (hr)	12.23 ± 1.94	8.77 ± 0.82	9.01	<0.001

*P<0.05statisticallysignificant

Table 6: Comparison between the No of Rescue Analgesia and Group of the subjects

Variable	Group E (Mean ± SD)	Group T (Mean ± SD)	t-value	p-value
Number of Rescue Analgesia	1.20 ± 0.41	1.93 ± 0.64	5.30	<0.001

delayed rehabilitation, and reduced function and quality of life[10].

The main objective of postoperative pain management is to keep drug doses as low as possible to reduce adverse effects. The transversus abdominis plane (TAP) and erector spinae plane block (ESP) blocks are two relatively new regional anaesthesia techniques that provide analgesia to the parietal peritoneum and visceral peritoneum and muscles of the lower abdominal wall in a variety of laparoscopic abdominal surgeries. It can be utilised as part of a multimodal analgesic approach, leading to rapid recovery[7].

Ultrasonography has grown to be popular among anaesthesiologists, especially when providing regional anaesthesia. Regional nerve blocks are now much simpler to perform, due to ultrasonographic assistance[13]. Conventional approaches to the classic form of TAP block can provide enough somatic analgesia while preventing visceral pain[9]. The ESP block is a novel abdominal wall block procedure that provides effective postoperative analgesia. ESP is a newer member of the interfascial plane block family, which Ferraro first described[8].

Our study involved 60 participants in total, divided into two groups of 30 instances each. (Erector spinae plane block) group E and (transverse abdominis plane block) group T.In the present study, patients from group E had better pain control during the first 24 hours following surgery. The first analgesic demand of this group of patients was significantly delayed compared to that of group T[11,12].

The VAS and the total diclofenac requirement in patients from group E were significantly less. The patients in this group also demanded analgesics less frequently than the patients in group T.The incidence of post-operative nausea and vomiting (PONV) was significantly lower in group E patients. The patient satisfaction score for postoperative pain control was higher in patients in group E than in group T[14,15].

In a case report by Petsas *et al*., who performed a bilateral ultrasound-guided ESP block at the T6 level scheduled for laparoscopic cholecystectomy, it was reported that there was no analgesic requirement up to 10 hours postoperatively. This finding is similar to the findings of the present study. Similar results are reported by Altiparmak *et al*. Daghmour et al.

conducted a meta-analysis study on bilateral erector spinae plane block for postoperative analgesia in laparoscopic cholecystectomy, which showed a significant reduction in postoperative intravenous opioid consumption reported up to 24 hours after surgery. The study concluded that the block was effective in terms of reducing postoperative opioid consumption and the time required for the first rescue analgesic[16-18].

In another study conducted by Routray *et al*., it was concluded that rescue analgesic paracetamol consumption was lower in the ESPB group and the time to the first rescue analgesia request was longer in the ESPB group. This difference was found to be statistically significant, the results of which are persistent with the findings of the present study.

In a study conducted by Ozdemir *et al*., it was concluded that intraoperative and postoperative fentanyl requirements were lower in ESPB, and the time to first rescue analgesic need was longer in ESPB. The numerical rating scale (NRS) scores were also lower in ESPB in comparison to TAPB.Sahu et al., in their RCT, compared the efficacy of ESPB and TAPB at T7 but did not find any significant difference in intraoperative opioid requirement between the groups, whereas there was a statistically significant difference in the mean VAS between the groups, which remained significantly lower in the ESP group during the first 24 hours as compared to TAPB.They concluded that ESPB was a superior block for laparoscopic cholecystectomy in comparison to TAPB[19,20].

In the present study, the patients in group T demanded diclofenac significantly more times than those in group E, and the first analgesic demand was significantly delayed in group E ($p < 0.001$). These results are similar to the above three studies. Shahid et al. conducted a study comparing the effects of paracetamol and tramadol on postoperative pain and found that the use of tramadol significantly increases the incidence of PONV.

Similar to this, in the present study, nine patients (13.0%) from group 'O' whose tramadol requirement was higher developed PONV. None from group 'E' had PONV.In the present study, feedback regarding postoperative pain relief was collected 24 hrs after surgery. Similar to Sahu *et al*., significantly more patients from the ESPB group were satisfied in comparison to the TAP group.

The present study had some limitations, as the blocks were performed at two different sites and the needle prick site was covered with sterile dressing pads; hence, the blinding could not be performed during the procedure.

CONCLUSION

The significant lower VAS scores were observed earlier in group E compared to groupT. The duration of analgesia was prolonged in group E compared to group T. The rescue analgesic requirement was lowering in groupE compared to groupT for 24hours in postoperative period.The hemodynamic variations were within physiological limits in both the groups. There were no post procedural complications in both the groups. However, in Ultrasound guided Erector spinae plane block with 0.125% bupivacaine provides superior analgesia compared to TAP block with 0.125% bupivacaine in elective laparoscopic abdominal surgeries.

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