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Original Research Paper

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A PROSPECTIVE STUDY TO ANALYSE THE EFFECTIVENESS OF TRANSVERSE ABDOMINIS PLANE BLOCK FOR POSTOPERATIVE ANALGESIA IN PATIENT UNDERGOING TOTAL LAPAROSCOPIC HYSTERECTOMY UNDER GENERAL ANAESTHESIA

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ABSTRACT

Background - Total Laparoscopic Hysterectomy causes significant postoperative pain. **Aim -** This study compares laparoscopic-guided TAP block versus IV paracetamol for post-TLH analgesia. **Methods:** Sixty female patients (ASA I/II) were alternately allocated to Group A (IV PCM 1g) or Group B (bilateral TAP block with 20 mL 0.25% bupivacaine). Primary outcomes: time to first rescue analgesia and total rescue analgesia consumption. **Results:** TAP block significantly prolonged time to first rescue analgesia (9.70±6.10 vs. 6.63±3.38 hours, $p=0.02$) and reduced total rescue analgesia doses (0.87±0.68 vs. 2.55±0.85, $p=0.0001$). VAS scores were significantly lower in the TAP group at 1, 3, 6, 20, and 24 hours ($p<0.05$). Hemodynamic stability was better with fewer complications. Mean block execution time was 11.72±1.35 minutes; 53.3% succeeded on first attempt. **Conclusion:** Laparoscopic-guided TAP block with 0.25% bupivacaine provides superior postoperative analgesia, prolongs analgesia duration, reduces analgesic consumption, and improves hemodynamic stability compared to IV paracetamol in TLH patients.

KEYWORDS : TAP Block, Laparoscopic Hysterectomy, Postoperative Analgesia, Bupivacaine

1. INTRODUCTION

Total Laparoscopic Hysterectomy (TLH) is preferred for benign uterine conditions due to reduced blood loss, shorter hospital stay, faster recovery, and lower infection rates [1,2]. However, TLH still causes significant postoperative pain that impedes early mobilization and recovery [3].

Postoperative pain following TLH is multifactorial, involving somatic pain from trocar insertion, visceral pain from organ handling and pneumoperitoneum, and referred pain from diaphragmatic irritation [4-6].

Traditional pain management relies on systemic analgesics including opioids and NSAIDs [7]. Opioids cause nausea, vomiting, respiratory depression, and dependence [8,9], while NSAIDs carry risks of gastrointestinal irritation and renal dysfunction [10]. This has led to a paradigm shift towards multimodal analgesia, which combines various techniques to target different pain pathways and minimize opioid requirements [11]. Regional anaesthesia techniques are now integral to multimodal pain management [12].

The Transversus Abdominis Plane (TAP) block has gained popularity for lower abdominal surgeries [13,14]. It involves depositing local anaesthetic in the fascial plane between the internal oblique and transversus abdominis muscles, targeting thoracolumbar nerves (T6-L1) that supply the anterior abdominal wall [15]. The TAP block attenuates somatic pain from abdominal wall incisions, reducing the need for systemic analgesics [16].

Despite evidence supporting TAP blocks in open abdominal surgeries, data on their effectiveness in laparoscopic gynaecologic procedures, particularly TLH, remain limited [17]. This study evaluates the efficacy of TAP block for postoperative analgesia in TLH patients, comparing it with intravenous paracetamol.

AIMS AND OBJECTIVES

Aim was to study the efficacy of transverse abdominis block for patient undergoing laproscopic hysterectomy:

Primary Objectives were time of first rescue analgesia, Duration of onset of analgesia (o hour after extubation), Total consumption of rescue analgesia required. Secondary Objective were hemodyanamic stability and any other complications. Other parameters we observed block execution time before laproscopic port closure and number of attempts

2. MATERIALS AND METHODS

This prospective, observational, analytical study was conducted in the Department of Anesthesiology at a tertiary care centre in Central India. Prior to commencement, ethical approval was obtained from the Institutional Ethics Committee. The study was conducted over a span of two year .2023 to 2025 .The study population comprised adult female patients admitted to the gynaecology ward and scheduled to undergo elective total laparoscopic hysterectomy (TLH) under general anesthesia.

Inclusion Criteria

1. Female patients aged 18 to 60 years
2. Patients scheduled for elective total laparoscopic hysterectomy under general anaesthesia
3. ASA physical status I or II
4. Willingness to participate and provision of written informed consent

Exclusion Criteria

1. Refusal to participate
2. ASA physical status III or IV
3. Coagulation disorders
4. Presence of significant systemic illnesses (cardiac, respiratory, neurologic/neuromuscular disorders)
5. Allergy or hypersensitivity to local anaesthetics
6. Local infection or skin abnormalities at the injection site.

A total of 60 patients were included based on predefined inclusion and exclusion criteria. Patients were selected using a method of alternate allocation to ensure even distribution and reduce selection bias. Group A (n=30): Patients received general anaesthesia followed by intravenous paracetamol (PCM) 1g as the analgesic intervention, administered prior to port closure.

Group B (n=30): Patients received general anaesthesia followed by administration of a bilateral Transversus Abdominis Plane (TAP) block as the analgesic technique, performed prior to port closure. All patients underwent a thorough preoperative evaluation including detailed medical history, physical examination, ASA physical status grading, airway assessment, and review of current medications and allergies. Standard preoperative investigations included hemogram, blood grouping, blood sugar levels, renal function tests, liver function tests, serum electrolytes, and electrocardiogram (ECG) All patients received standard balanced general anaesthesia:

Premedication:
- Injection Pantoprazole 40 mg IV, 30 minutes prior to surgery
- Injection Glycopyrrolate 0.004 mg/kg IV
- Injection Midazolam 0.02-0.03 mg/kg IV
- Injection Fentanyl 2 mcg/kg IV

Induction:
- Preoxygenation with 100% oxygen via face mask for 5 minutes
- Injection Propofol 2 mg/kg IV
- Injection Succinylcholine 2 mg/kg IV for intubation

Maintenance:
- Oxygen: Nitrous Oxide (50:50)
- Sevoflurane or Isoflurane as inhalational agent
- Injection Atracurium or Vecuronium IV as muscle relaxant

Reversal and Extubation:
- Injection Neostigmine 0.05 mg/kg IV
- Injection Glycopyrrolate 8 mcg/kg IV
- Proper oropharyngeal suctioning and extubation after return of protective reflexes

TAP Block Technique (Group B Only)

The TAP block was administered under laparoscopic vision prior to port closure using the landmark-based technique:

Equipment Used:
- 22½ gauge hypodermic block needle
- Two 20 mL syringes
- 0.25% Bupivacaine (maximum 1 mg/kg per side)
- 10 cm IV extension set

Procedure:

Step 1: Patient Positioning – The patient was positioned supine with arms placed comfortably by the sides. Lower limbs were slightly flexed at the knees to promote relaxation of abdominal wall muscles.

Step 2: Identification of Injection Site – The injection site was identified along the mid-axillary line between the costal margin and the iliac crest, at the midpoint between the anterior superior iliac spine (ASIS) and the inferior border of the costal margin.

Step 3: Needle Insertion – A sterile 22-gauge hypodermic needle was inserted perpendicular to the skin at the marked site, advanced through skin, subcutaneous tissue, and through the external and internal oblique muscles until loss of resistance suggested entry into the fascial plane between the internal oblique and transversus abdominis muscles.

Step 4: Local Anaesthetic Injection – Once correct needle placement was confirmed (aided by visualization of Doyle's bulge under laparoscopic view), 20 mL of 0.25% bupivacaine was injected slowly into the plane on each side of the abdomen.

Figure 1: Doyle's Bulge Under Laparoscopic Visualization

Postoperative Monitoring and Analgesia

All patients were monitored in the recovery ward for 24 hours. Pain was assessed using the Visual Analogue Scale (VAS; 0 = no pain, 10 = worst imaginable pain) at the following intervals: 0 hour (at extubation), 10 minutes, 20 minutes, 30 minutes, 60 minutes, 3 hours, 6 hours, 12 hours, 16 hours, 20 hours, and 24 hours postoperatively.

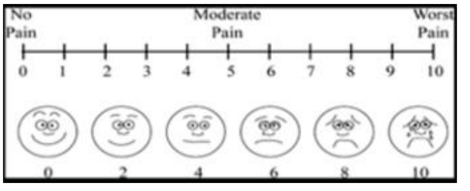

Figure 2: Visual Analoge Scale (VAS) Score

Analgesia Protocol:
- Group A (IV PCM): Inj. Paracetamol 1g IV. Rescue analgesia (Inj. Paracetamol 1g IV) given when VAS > 3.
- Group B (TAP Block): No routine analgesia. Rescue analgesia (Inj. Paracetamol 1g IV) given when VAS > 3.

Parameters Observed

Primary Outcomes:
1. Time to first rescue analgesia (time in hours postoperatively when VAS > 3)
2. Total consumption of rescue analgesia (number of doses in 24 hours)

Secondary Outcomes:
1. Block execution time (duration from needle insertion to completion of drug administration in Group B)
2. Number of attempts taken for successful TAP block execution
3. VAS pain scores at all time intervals
4. Hemodynamic stability (pulse rate, blood pressure, respiratory rate, SpO2)
5. Any complications (inadvertent peritoneal puncture, abdominal wall hematoma, nerve injury, intravascular injection, nausea/vomiting)

Statistical Analysis

All collected data were compiled, tabulated, and analysed using SPSS software version 6.0 and Microsoft Excel. Descriptive statistics were used to summarize baseline characteristics. Continuous variables were expressed as mean ± standard deviation (SD). Normality was tested using the Kolmogorov-Smirnov test. Categorical variables were presented as frequencies and percentages.

Inferential Statistics:
- Independent samples t-test for comparing means of normally distributed continuous variables
- Mann-Whitney U test for non-normally distributed or ordinal data (e.g., VAS scores)
- Chi-square test/Fisher's exact test for comparing categorical variables

A p-value < 0.05 was considered statistically significant. All tests were two-tailed.

4. RESULTS

4.1 Demographic Characteristics:

Table 1 represents the sociodemographic characteristics of study participants in group A and group B. Both groups were comparable in mean age. Group A (IV PCM) had a mean age of 46.70 ± 7.09 years, while Group B (TAP Block) had a mean age of 47.07 ± 8.13 years ($p = 0.79$). The most common age group in both was 55-59 years (30.0% in each group). Group A had a significantly higher mean weight (66.43 ± 8.92 kg) compared to Group B (60.30 ± 9.21 kg, $p < 0.05$). Group A had more patients in higher weight categories (70-79 kg and ≥80 kg), while Group B had more patients in lower weight ranges (40-59 kg).

ASA Status: Group A had a higher proportion of ASA I patients (70%) compared to Group B (40%), while Group B had a higher proportion of ASA II patients (60% vs. 30% in Group A).

Comorbidities: Group A had a majority of patients with no comorbidity (72.4%), while Group B had a higher proportion of patients with comorbid conditions, notably diabetes (30.4%) and hypertension (26.1%). Heavy menstrual bleeding (HMB) was the most frequent diagnosis in both groups. Subserosal fibroids and ovarian cysts were also commonly reported.

Duration of Surgery: Surgeries in Group B (TAP block) tended to last longer (110.00 ± 11.03 minutes) compared to Group A (99.83 ± 12.53 minutes, $p < 0.05$).

Table 1: Baseline Characteristics Comparison

Parameter	Group A (IV PCM) (n=30)	Group B (TAP Block) (n=30)	P-value
Mean Age (years)	46.70 ± 7.09	47.07 ± 8.13	0.79
Mean Weight (kg)	66.43 ± 8.92	60.30 ± 9.21	<0.05
ASA I (%)	70%	40%	-
ASA II (%)	30%	60%	-
Surgery Duration (min)	99.83 ± 12.53	110.00 ± 11.03	<0.05

4.2 TAP Block Execution Characteristics (Group B)

Table 2 shows the TAP Block execution characteristics in which the meantime taken to perform the TAP block at the end of surgery was 11.72 ± 1.35 minutes.

Number of Attempts: At the end of surgery, 53.3% of participants (n=16) required only 1 attempt, 33.3% (n=10) required 2 attempts, and 13.3% (n=4) required 3 attempts. The mean number of attempts was 1.60 ± 0.72. No participants required 4 attempts.

Table 2: TAP Block Execution Characteristics

Parameter	Value
Mean Block Execution Time (min)	11.72 ± 1.35
Mean Number of Attempts	1.60 ± 0.72
Success on 1st Attempt	53.3%

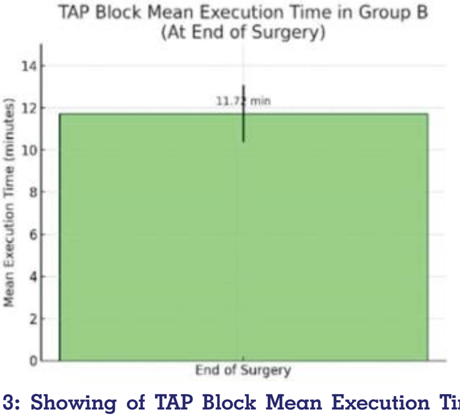

Figure 3: Showing of TAP Block Mean Execution Time in Group B at the End of Surgery.

4.3 Primary Outcomes

In table 3, Group B (TAP Block) had a significantly longer mean time to first rescue analgesia (9.70 ± 6.10 hours) compared to Group A (6.63 ± 3.38 hours, $p = 0.02$).

Total Rescue Analgesia Consumption: Group A required significantly more rescue analgesia doses (2.55 ± 0.85) compared to Group B (0.87 ± 0.68, $p = 0.0001$).

Table 3: Primary Outcomes Comparison

Outcome	Group A (IV PCM)	Group B (TAP Block)	P-value
Time to First Rescue Analgesia (hours)	6.63 ± 3.38	9.70 ± 6.10	0.02
Total Rescue Analgesia Doses (24h)	2.55 ± 0.85	0.87 ± 0.68	0.0001

4.4 Secondary Outcomes:

Table 4 represents VAS score comparison between group A and group B. Group B (TAP Block) demonstrated significantly lower VAS scores at multiple time points compared to Group A, particularly at 60 minutes, 3rd hour, 6th hour, 20th hour, and 24th hour postoperatively.

Figure 4: VAS Score Comparison at Key Time Points

Hemodynamic Parameters:

Pulse Rate: Group B maintained consistently lower mean postoperative pulse rates across most time points, suggesting better hemodynamic stability and less sympathetic stimulation.

Blood Pressure: Both systolic and diastolic blood pressure showed a gradual decline over time in both groups, with Group B (TAP block) generally maintaining lower mean blood pressure levels.

Respiratory Rate: Group B demonstrated consistently lower mean respiratory rates at all measured intervals, indicating more effective pain control and reduced respiratory effort.

SpO2 Levels: Group B consistently maintained higher oxygen saturation readings compared to Group A, suggesting superior respiratory outcomes.

4.5 Complications

Table 5 illustrates comparison of complications in group A and group B. A higher overall incidence of complications was observed in Group A compared to Group B. The most frequent complication was nausea, reported in 53.57% of patients in Group A and 43.33% in Group B ($p = 0.599$). No complications were observed in 53.33% of Group B patients compared to 42.86% in Group A. One case of inadvertent intravascular injection (3.57%) was observed in Group A, with none in Group B. One case of abdominal wall hematoma (3.33%) was reported in Group B, with none in Group A. None of these differences reached statistical significance.

Table 5: Complication Comparison

Complication	Group A (IV PCM)	Group B (TAP Block)	P-value
No complication	42.86%	53.33%	0.306
Nausea	53.57%	43.33%	0.599
Intravascular injection	3.57%	0.00%	0.483
Abdominal wall hematoma	0.00%	3.33%	1.000

5. DISCUSSION

This prospective study demonstrates that a laparoscopic-guided TAP block with 0.25% bupivacaine provides superior postoperative analgesia compared to intravenous paracetamol in patients undergoing total laparoscopic hysterectomy.

The significant prolongation of time to first rescue analgesia (9.70 ± 6.10 hours vs. 6.63 ± 3.38 hours, p = 0.02) and the marked reduction in total rescue analgesic requirements (0.87 ± 0.68 vs. 2.55 ± 0.85 doses, p = 0.0001) strongly support the superior analgesic efficacy of the TAP block.

Our findings are consistent with several previous studies. Carney et al. [18] reported that TAP block significantly reduced pain scores and opioid consumption after total abdominal hysterectomy, with a longer time to first analgesic request (45 minutes vs. 12.5 minutes). Abdallah et al. [13] in their systematic review demonstrated that TAP block reduced 24-hour morphine consumption by 43-83% in caesarean delivery and 47% in hysterectomy. Mishra et al. [19] found that ultrasound-guided TAP block was superior to intravenous tramadol in laparoscopic hysterectomy, with lower pain scores and reduced rescue analgesia requirements.

The significantly lower VAS scores observed in our TAP block group, particularly during the first 6 hours postoperatively (0.6 ± 0.55 vs. 5.2 ± 1.64 at 6 hours, p < 0.001), suggest effective somatic pain relief from abdominal wall incisions. This early pain control likely contributed to the improved hemodynamic stability observed, with lower pulse rates and blood pressure readings reflecting reduced sympathetic activation secondary to pain.

The technical success of the TAP block in our study (mean execution time 11.72 ± 1.35 minutes, 53.3% success on first attempt) indicates that the laparoscopic-guided landmark technique is feasible and efficient when performed by trained anaesthesiologists. The learning curve appears favourable, as fewer attempts were needed at the end of surgery compared to earlier attempts.

The TAP block's ability to reduce reliance on systemic analgesics aligns perfectly with Enhanced Recovery After Surgery (ERAS) protocols. Lauretta et al. [20] demonstrated that integrating TAP block into ERAS pathways for gynaecologic surgery resulted in reduced opioid consumption, earlier ambulation, shorter hospital stays, and enhanced patient satisfaction. The lower incidence of nausea in our TAP block group (43.33% vs. 53.57%) further supports the opioid-sparing benefit, as postoperative nausea and vomiting is a well-known opioid-related side effect.

Our study has several limitations. The sample size is relatively small (n=60), which may limit the generalizability of findings. The alternate allocation method, while systematic, is not true randomization and may introduce selection bias. The weight difference between groups (significantly higher in Group A) could potentially influence analgesic requirements and pain perception. Additionally, the TAP block was performed using a landmark-based laparoscopic-guided technique rather than ultrasound guidance, which is now considered the standard for accuracy and safety. However, in resource-limited settings where ultrasound may be unavailable, this technique remains a viable option.

Despite these limitations, our findings contribute valuable evidence supporting the use of TAP blocks in laparoscopic gynaecologic surgery. The consistent benefits observed across multiple outcomes, longer analgesia duration, reduced rescue analgesic requirements, lower pain scores, improved hemodynamic stability, and a trend toward fewer complications make a strong case for incorporating TAP blocks into routine multimodal analgesia protocols for TLH.

6. CONCLUSION

The Transversus Abdominis Plane (TAP) block provides superior postoperative analgesia when compared to intravenous paracetamol in patients undergoing total laparoscopic hysterectomy under general anaesthesia. With respect to prolonging the time to first rescue analgesia and reducing overall analgesic consumption, the TAP block demonstrates a strong and sustained analgesic effect with better hemodynamic stability and without significant complications.

7. Recommendations

1. We recommend the routine use of bilateral TAP block with 0.25% bupivacaine as part of multimodal analgesia for patients undergoing TLH.
2. TAP block should be incorporated into Enhanced Recovery After Surgery (ERAS) pathways for gynaecologic laparoscopic surgery.
3. Larger multicentre randomized controlled trials are needed to confirm these findings and evaluate:
   - o Different local anaesthetics and concentrations
   - o Ultrasound-guided vs. landmark techniques
   - o Long-term outcomes including chronic pain and quality of recovery
   - o Cost-effectiveness analysis
4. Anesthesiology training programs should include TAP block technique (both landmark and ultrasound-guided) as part of regional anaesthesia curriculum.

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