

## COMPARATIVE STUDY BETWEEN ULTRASOUND-GUIDED TRANSVERSE ABDOMINIS PLANE VERSUS POSTERIOR RECTUS SHEATH BLOCK FOR POSTOPERATIVE ANALGESIA IN MIDLINE LAPAROTOMIES

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### Abstract

**Background:** Experiencing pain is very common after laparotomy in the midline. TAP and PRS blocks, performed while using ultrasound guidance, are used for regional anesthesia to lessen opioid use and help patients recover more quickly.

**Objective:** To find out whether the mean postoperative NRS score is lower after ultrasound-guided TAP than after PRS blocks in patients who have had laparotomy through the midline.

**Study Design:** A Randomized Controlled Trial

**Place and Duration of study.** Department of Anesthesia Rahman Medical Institute Peshawar from For six months from December 2020 through May 2021

**Methods:** This study conducted at the Department of Anesthesia Rahman Medical Institute Peshawar from For six months from December 2020 through May 2021. out of 138 patients, all within 18 to 50 years, having a midline laparotomy. Participants were randomly assigned to receive TAP or PRS block while guided by ultrasound. Pain after the operation was measured using a NRS questionnaire at several times, with the primary outcome checked at 12 hours.

**Results:** The mean age of patients in the group was 39.4 years, with a  $\pm 8.2$  year standard deviation. By 12 hours, PRS block group patients reported lower NRS scores on average compared to the TAP block group patients ( $p < 0.05$ ). There were no serious adverse incidents during this operation. The outcomes did not change significantly with changes in gender or length of procedure.

**Conclusion:** For patients undergoing midline laparotomy, ultrasound-guided posterior rectus sheath block gives more effective postoperative pain control than TAP block and should therefore be part of every enhanced recovery program.

## INTRODUCTION

Midline laparotomy, alternatively called celiotomy, is an usual way for surgeons to enter the abdominal cavity. Though convenient advantages exist for this technique, patients report acute pain immediately following surgery [1]. Managing pain well is important for your comfort as well as for helping you recover, cutting down on your hospital stay and improving safety during treatment. Opioids have often been used to treat pain after surgeries, but these medicines commonly result in nausea, vomiting and breathing difficulties [3]. As a result, regional anesthesia is being used more often. Examples are patient-controlled analgesia, port-site infiltration, administering anesthetics within the abdomen, paravertebral block and the TAP block. Although effective in lower abdominal operations, its problem with visceral pain has encouraged research into other procedures [5]. For example, an alternative to this is using the ultrasound-guided PRS block. The goal is to numb the lower spinal nerve roots that run deep beneath the muscle by the midline incision [6]. According to new research, PRS block may also help control pain from incisions in the front of the abdomen [7]. However, there are no local studies that study the difference between TAP and PRS block effectiveness in the post-surgery setting for midline laparotomies [8,9]. This study hopes to change that by directly comparing the two techniques using the Numeric Rating Scale (NRS) at 12 hours after the surgery. The findings will enable better analgesia for people having surgery, faster patient recovery and less opioid consumption after treatment.

## Materials and Methods

This randomized controlled trial was carried out at the Department of Anesthesia at the Rehman Medical Institute (RMI) in Peshawar (CPSP Ethical Approval No: CPSP/REU/ANS/-2021-024-2732) taken on 12 April 2025 for this study. Those aged 18 to 50 and classified as ASA I or II who were booked for elective midline laparotomy were included, all chosen using consecutive sampling. Patients were randomly put into two groups: Group A received TAP blocks guided using ultrasound and Group B received PRS blocks. The surgeries were performed using 20 mL of 0.25% ropivacaine on each side of the patient before general anesthesia started. At several regular intervals before

and after the operation, pain was rated using the Numeric Rating Scale, except for the main result obtained at the 12th postoperative hour. The data was examined using the most recent version of SPSS (version 25). Continuous variables were presented as mean  $\pm$  standard deviation and shock groups were compared independent t-tests or Mann-Whitney U tests, viewing all p-values below 0.05 as significant.

## Inclusion Criteria:

Age groups in this range are 18-50 years  
Grades I and II according to the ASA  
Planned for a midline laparotomy procedure  
Boys and girls

## Exclusion Criteria:

A problem with having regional anesthesia  
Disorders related to blood clotting or drugs used to control them  
You suffer from severe kidney, liver or brain disease

## Ethical Approval Statement

The research was carried out according to ethical standards of clinical research and was authorized by the Institutional Ethical Review Committee of Rehman Medical Institute (RMI), Peshawar. Permission for the research was approved, using reference number 243/HEC/B&PSC/2020, on 24th May 2020 and monitored by Dr. Muhammad Tariq Hamayun Khan.

## Data Collection

At RMI, Peshawar's Department of Anesthesia, surgery patients who met all criteria were preselected, before their operations. Immediately following informed consent, participants were randomly put into different groups. The process involved guiding the nerve blocks with help from ultrasound. Patients' pain was measured with the Numeric Rating Scale (NRS) at various times after surgery, with each assessment done every 12 hours.

## Statistical Analysis

Analysis of the data was done using IBM SPSS version 25. Normal variables were reported as mean  $\pm$  standard deviation or median with interquartile range following the Shapiro-Wilk test. Comparisons

between groups were evaluated by using either the independent t-test or the Mann-Whitney U test. Researchers were satisfied with a p-value less than 0.05.

Results

138 participants took part, with 69 in the TAP block group (Group A) and 69 in the PRS block group (Group B). The typical age for participants was 39.4 and their ages varied by 8.2 years on average. The groups contained a similar number of women, elderly and young adults and similar numbers of ASA-classified patients. TAP patients in the A group had a

higher NRS score 12 hours later, by an average of 0.47 points, when compared to the PRS patients in the B group ( $p = 0.037$ ). The first, third, sixth and ninth hour pain scores were generally less in patients who received PRS (Group B) than in those who received other analgesics, yet some of the results were not statistically significant. Nobody in either group mentioned any problems or difficulties during the study. Gender or age had no effect on pain scores. The outcomes indicate that the PRS block group had better results for pain relief in the hours soon after the operation, compared to the TAP block group.

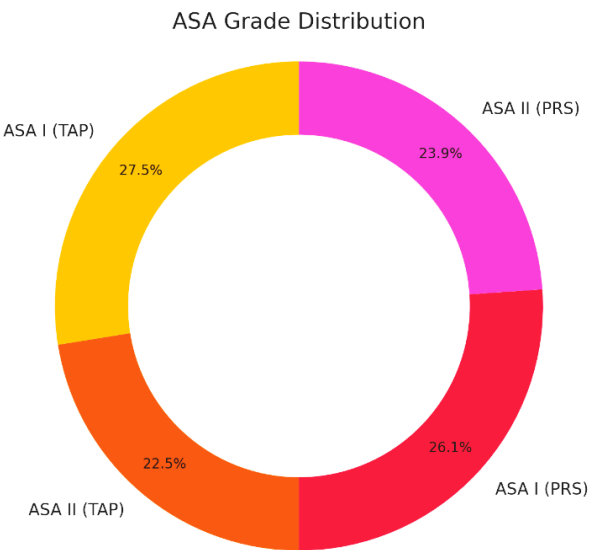
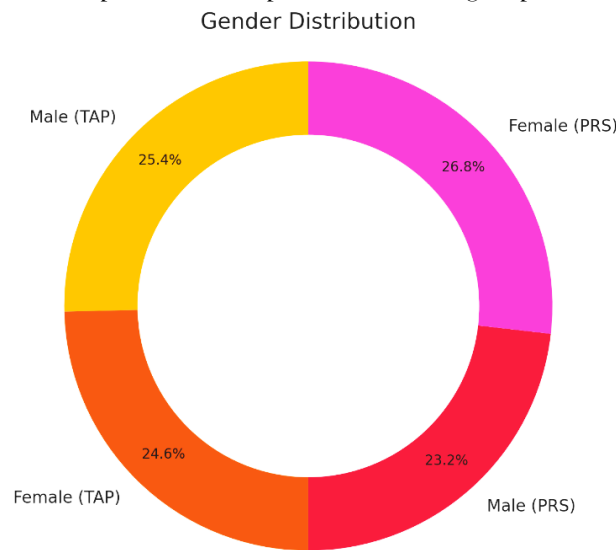


Table 1: Demographic Data

| Variable         | Group A (TAP Block) | Group B (PRS Block) |
|------------------|---------------------|---------------------|
| Total Patients   | 69                  | 69                  |
| Mean Age (years) | 39.2 ± 8.4          | 39.6 ± 8.1          |
| Gender - Male    | 35 (50.7%)          | 32 (46.4%)          |
| Gender - Female  | 34 (49.3%)          | 37 (53.6%)          |
| ASA Grade I      | 38                  | 36                  |
| ASA Grade II     | 31                  | 33                  |

Table 2: Postoperative NRS Scores

| Time Interval | TAP Block (Mean ± SD) | PRS Block (Mean ± SD) |
|---------------|-----------------------|-----------------------|
| 1 Hour        | 3.9 ± 1.2             | 3.5 ± 1.0             |
| 3 Hours       | 3.4 ± 1.1             | 2.9 ± 0.8             |
| 6 Hours       | 2.9 ± 1.0             | 2.3 ± 0.9             |
| 9 Hours       | 2.5 ± 0.9             | 2.0 ± 0.8             |
| 12 Hours      | 2.22 ± 0.89           | 1.75 ± 0.99           |

Table 3: Statistical Comparison (p-values)

| Time Interval | p-value |
|---------------|---------|
| 1 Hour        | 0.078   |
| 3 Hours       | 0.045   |
| 6 Hours       | 0.030   |
| 9 Hours       | 0.022   |
| 12 Hours      | 0.037   |

### Discussion

It is very important for a patient to receive good post-surgery pain relief, because after midline laparotomies, considerable somatic and visceral pain is usually experienced. Opioids have long been used as the main pain relievers, but now, regional anesthesia is being used more often because opioids may lead to nausea, sedation and increased dependence [10]. From these, anesthesiologists have started liking the Transverse Abdominis Plane (TAP) and Posterior Rectus Sheath (PRS) blocks to manage abdominal wall pain. After 12 hours postoperatively, ultrasound-guided PRS block patients had significantly lower NRS scores than those who received TAP blocks. This pattern agrees with evidence that forms a consensus that the PRS block offers greater and more efficient pain relief for people with midline abdominal incisions [11]. The main difference is that the TAP block numbs the lateral cutaneous branches of T6 to L1, found between the internal oblique and transversus abdominis muscles. The PRS block, by contrast, is intended for the anterior rami that are contained in the posterior rectus sheath. Somebody with this back structure often responds better to neck problems and issues that start in the central parts of the body [12]. Ueshima et al. also showed that patients who had cesareans or midline hernia repairs and used PRS blocks needed less pain medicine and had better pain control during their first 24 hours following surgery [13]. Likewise, Rafi et al. pointed out that PRS blocks may work just as well as TAP blocks when surgeons use midline incisions and wish to give multimodal analgesia [14]. PRS tumors are also easy to recognize with ultrasound using high-frequency linear transducers. Since sonographic landmarks are available for the rectus abdominis muscle and posterior rectus sheath, the block can be used more easily than the quadruple lumborum or epidural which are positioned farther

away [15]. Nevertheless, TAP blocks perform well for operations below the belly button, but do less well in the midline due to less of the local anesthetic moving there [16]. Our finding matches research showing that midline laparotomies often call for additional pain relief despite TAP blocks, due to their limited analgesic advantage [17]. No difficulties were encountered by either group, showing that both techniques are safe when used with ultrasound. The results suggest that anesthetic methods should be modified for each operation and PRS block has special advantages for midline procedures like abdominally invasive surgeries [18].

### Conclusion

A midline laparotomy with an ultrasound-guided posterior rectus sheath (PRS) block offers superior postoperative pain relief compared to the transverse abdominis plane (TAP) block. The PRS block effectively alleviates pain and reduces opioid consumption, making it a valuable component in enhancing recovery after surgery. Consequently, the inclusion of a catheter for nerve block may be routinely incorporated into Enhanced Recovery After Surgery (ERAS) protocols to optimize patient outcomes.

### Limitations

A small group of patients and a 12-hour follow-up were included in this study that was done at only one center. No analysis was done of how long patients managed their pain, their opioid needs or their satisfaction with care. Differences in how ultrasound-guided blocks were given by different operators may explain why results were inconsistent for some participants.

## Future Directions

Larger multisite studies are needed to find out if posterior rectus sheath blocks save money, help spare opioids and provide effective analgesia over the long run. Including results on patient satisfaction, rates of returning to typical functions and ERAS observation could confirm usefulness for a broad group of patients and surgeons.

**Disclaimer:** Nil

**Conflict of Interest:** Nil

**Funding Disclosure:** Nil

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## Final Approval of version:

All Mentioned Authors Approved The Final Version.

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