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# Effectiveness of ESP Block as Post-Operative Analgesia in Comparison with Opioid Analgesia for Laparoscopic Cholecystectomy

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**Abstract** **Original Research Article**

***Background:*** In our country, the role of Erector Spinae Plane Block (ESP) for post-operative analgesia in laparoscopic cholecystectomy has not yet been investigated. As a result, the study was designed to compare the effectiveness of ESP block as post-operative analgesia to opioid analgesia for pain control following Laparoscopic Cholecystectomy. ***Objectives:*** The aim of the study was to evaluate the effectiveness of ESP block as post-operative analgesia in comparison with opioid analgesia. ***Methods:*** This cross-sectional comparative study was conducted at the department of surgery with collaboration of department of Anaesthesiology in CMH for 6 months of period. Before commencement of the study formal ethical clearance was taken from the Ethical Committee of DGMS Army. Total 60 patients, scheduled for laparoscopic cholecystectomy under general anesthesia were included in this study and randomly divided into two groups (30 patients in each group). total 30 Patients, received both GA and ultrasound guided ESP block were assigned as group E and 30 Patients, received GA and opioid analgesia were in group N. Informed written consent was taken from each subject and ethical measures were followed strictly in whole study. Following data collection, data were analyzed by the SPSS 24. ***Results:*** In terms of age, sex, BMI and ASA grading, the two groups had identical demographic features ($p>0.05$ in all cases). There was no significant difference in pre-operative, post-operative, or recovery room heart rate ($p>0.05$) or mean arterial pressure ($p>0.05$). In the recovery room, group E has significantly less pain than group N ($3.67\pm0.802$ vs $4.3\pm0.877$; $p<0.05$). A similar improvement was seen in group E at 6, 12 and 24 hours ($p<0.05$ in all follow ups). Post-operative analgesic consumption was similarly higher in group N at 1, 12, and 24 hours ($p<0.05$ in all follow up). Except for nausea, which was more common in group N ($p<0.05$), complications were similar in both groups. ***Conclusion:*** Erector spinae plane block is superior to opioid-based conventional therapy for post-operative analgesia in laparoscopic cholecystectomy.

**Keywords:** Erector Spinae Plane Block (ESP), Laparoscopic cholecystectomy, Analgesia.



## INTRODUCTION

One of the issues that an anaesthesiologist has is post-operative pain management [1]. As individuals became more aware of the procedures that are now available to control acute, chronic, and cancer pain, the expectation that surgery and recovery will be increases [2, 3]. Oral or parenteral analgesics, peripheral nerve blocks, neuraxial blocks with local anaesthetics, intraspinal opioids, and supplementary techniques such as transcutaneous electrical nerve stimulation (TENS) and physical therapy are examples of post-operative analgesic treatments [3].

Pain after laparoscopic cholecystectomy might range from mild to severe. Incisional pain (somatic pain from the trocar site), visceral pain, and shoulder discomfort (probably transferred visceral pain) are the three components of this pain [4]. In general, pain is at its height on the day of operation (during the first 4-8 hours following surgery) [5]. Laparoscopic cholecystectomy is performed under general anesthesia, with intra and post-operative opioid analgesia [6]. Excessive opioid use is linked to a number of perioperative side effects, including respiratory depression, sleepiness and sedation, post-operative nausea, vomiting, pruritus, urine retention, ileus, and constipation, all of which might cause hospitalization to be delayed. There has recently been concern that high doses of opioids may develop abrupt tolerance and hyperalgesia [7].

Erector spinae plane block is a relatively new anaesthesia/analgesia method [8]. Foreno first described the approach in 2016 when it was utilized to treat thoracic neuropathic paim [9]. The local anesthetic

solution (perhaps with adjuvant) is injected between the erector spinae muscle (iliocostalis, longissimus, spinalis) and the transverse process. [10]

With this knowledge, we may be able to do laparoscopic cholecystectomy without the use of postoperative opioids, lowering morbidity. We must determine whether an opioid-free erector spinae plane block-based GA is superior to the opioid-based GA that is commonly performed at our center.

## METHODOLOGY

This cross-sectional comparativestudy was carried out in the Department Anaesthesiology, Combined Military Hospital (CMH) Dhaka during June 2019 to November 2019(six months). A total of 60 patients were participated in the study. Among them 30 patients were Group-E and 30 patients were Group-N. Patients admitted for laparoscopic cholecystectomy operation in Combined Military Hospital (CMH), Dhaka within this study period.After taking consent and matching eligibility criteria, data were collected from patients on variables of interest using the predesigned structured questionnaire by interview, observation. Statistical analyses of the results were be obtained by using window-based Microsoft Excel and Statistical Packages for Social Sciences (SPSS-24).

## RESULTS

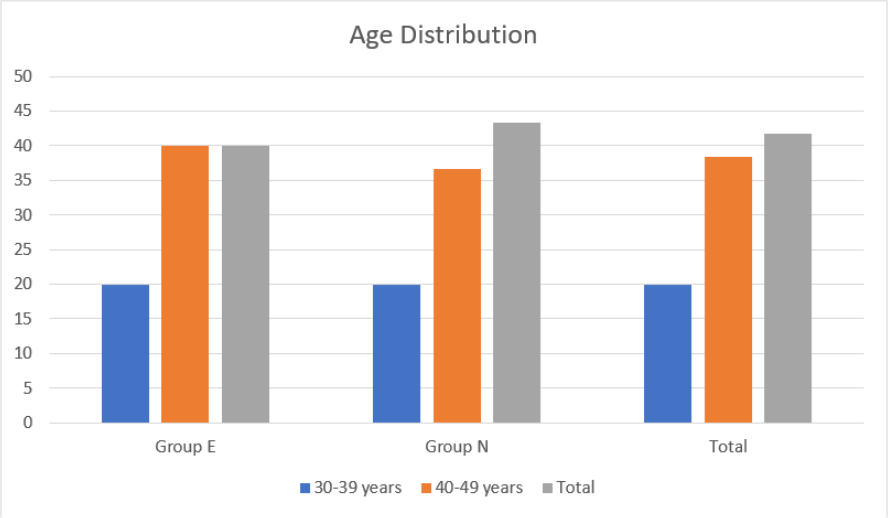


**Figure-I: Age group distribution of patients. (n=60)**

Mean age of all patients was 46.85±7.796 years. Maximum age was 61 years and minimum age 30 years. Majority of the patients belonged to age group 30-49 years (58.33%). Rest 41.67% were 50 years of age or above.

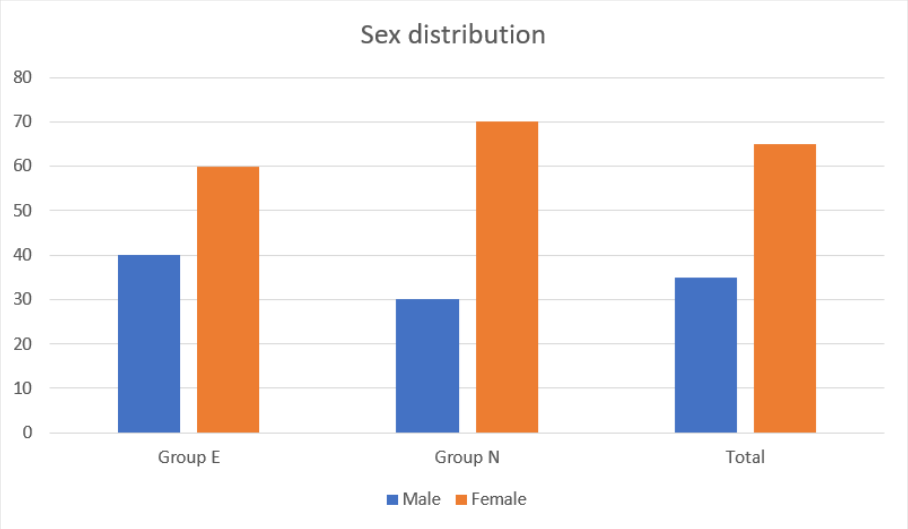


**Figure-II: Sex distribution of patients. (n=60)**

Greater part of the patients was female (65%) and other 35% were male.

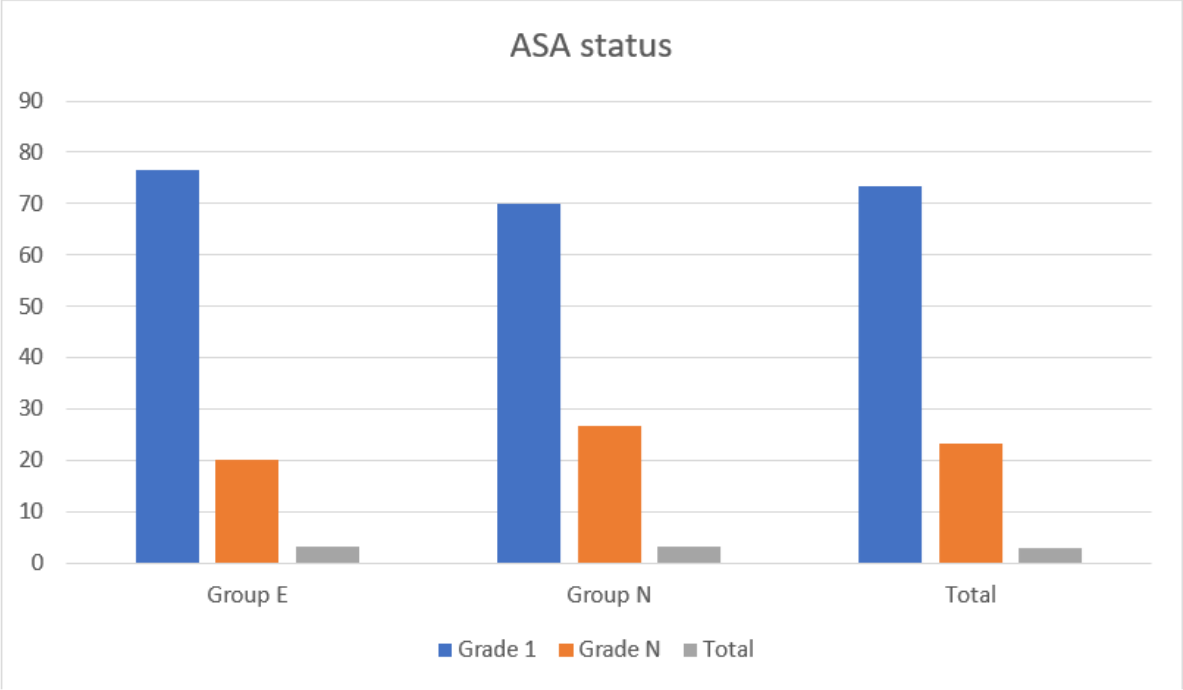


**Figure-III: ASA status of patients. (n=60)**

Majority of the patients were belonged to ASA grade I (73.33%).

**Table-I: Characteristics of the patients. (n=60)**

| Characteristics | Group E (n=30) | Group N (n=30) | Total (n=60) | P value |
|---|---|---|---|---|
| Duration of surgery (minute) | 47.20±7.15 | 47.50±7.16 | 47.35±7.10 | 0.872** |

Group E: received both GA and ultrasound guided ESP block
Group N: received GA and opioid analgesia

Values are expressed asMean±SD. ** Student t-test was performed to compare total opioid consumption between two groups. There had statistically no significant difference in duration of surgery as p>0.05.

**Table-II: Heart rate of the patients. (n=60)**

| Heart rate (beat/min) | Group E (n=30) | Group N (n=30) | Total (n=60) | P value |
|---|---|---|---|---|
| Preoperative | 73.87±7.74 | 76.37±7.91 | 75.12±7.86 | 0.221** |
| Per-operative | 65.64±4.17 | 67.10±5.02 | 66.35±4.64 | 0.213** |
| Recovery room | 63.97±4.12 | 64.30±4.98 | 64.13±4.53 | 0.779** |
| 30 minutes | 64.17±3.19 | 64.27±7.86 | 64.22±5.94 | 0.949** |
| 01 hour | 67.40±3.72 | 68.20±4.23 | 67.80±3.97 | 0.44** |
| 02 hour | 67.90±3.74 | 68.23±3.22 | 68.07±3.46 | 0.713** |
| 04 hours | 67.97±3.69 | 68.33±3.32 | 68.15±3.48 | 0.687** |
| 06 hours | 68.33±2.81 | 69.00±3.69 | 68.67±3.27 | 0.435** |
| 12 hours | 69.20±3.32 | 70.07±4.32 | 69.63±3.84 | 0.387** |
| 24 hours | 73.33±6.47 | 75.73±7.21 | 74.53±6.89 | 0.18** |

Group E: received both GA and ultrasound guided ESP block
Group N: received GA and opioid analgesia

Values are expressed asMean±SD. ** Student t-test was performed to compare the mean heart rate of both groups at pre-operative, per-operative, recovery room,30 minutes, 1 hour, 2 hours, 4 hours, 6 hours, 12 hours and 24hours interval. There had no statistically significant difference between two groups as p>0.05.

**Table-III: Mean arterial pressure of the patients. (n=60)**

| Heart rate (beat/min) | Group E (n=30) | Group N (n=30) | Total (n=60) | P value |
|---|---|---|---|---|
| Preoperative | 79.53±5.14 | 77.57±5.99 | 78.55±5.622 | 0.178** |
| Per-operative | 78.47±4.42 | 76.77±4.49 | 77.62±4.49 | 0.144** |
| Recovery room | 78.77±4.73 | 76.83±4.43 | 77.8±4.64 | 0.107** |
| 30 minutes | 79.67±3.59 | 78.43±4.02 | 79.05±3.83 | 0.215** |
| 01 hour | 77.97±3.25 | 77.53±3.04 | 77.75±3.13 | 0.596** |
| 02 hour | 78.97±3.94 | 76.93±4.64 | 77.95±4.39 | 0.072** |
| 04 hours | 80.87±4.07 | 79.8±4.04 | 80.33±4.05 | 0.312** |
| 06 hours | 79.70±3.77 | 79.6±2.98 | 79.65±3.37 | 0.91** |
| 12 hours | 80±3.83 | 78.2±4.01 | 79.1±3.99 | 0.081** |
| 24 hours | 79.67±4.16 | 78.4±4.32 | 79.03±4.25 | 0.252** |

Group E: received both GA and ultrasound guided ESP block
Group N: received GA and opioid analgesia

Values are expressed asMean±SD. ** Student t-test was performed to compare the mean arterial pressure of both groups at pre-operative, per-operative, recovery room,30 minutes, 1 hour, 2 hours, 4 hours, 6 hours, 12 hours and 24hours interval. There had no statistically significant difference between two groups as p>0.05.

**Table-IV: Visual analogue scale (VAS) score of the patients. (n=60)**

| VAS score | Group E (n=30) | Group N (n=30) | Total (n=60) | P value |
|---|---|---|---|---|
| Preoperative | 3.33±1.348 | 3.53±1.432 | 3.43±1.382 | 0.580** |
| Recovery room | 3.67±0.802 | 4.3±0.877 | 3.98±0.892 | 0.005** |
| 02 hours | 3.67±0.802 | 3.73±0.74 | 3.7±0.766 | 0.739** |
| 04 hours | 4.1±0.96 | 4.0±0.91 | 4.05±0.928 | 0.680** |
| 06 hours | 3.3±0.877 | 3.83±0.986 | 3.57±0.963 | 0.031** |
| 12 hours | 3.13±0.819 | 3.77±0.935 | 3.45±0.928 | 0.007** |
| 24 hours | 2.6±0.675 | 3.23±0.817 | 2.92±0.809 | 0.002** |

Group E: received both GA and ultrasound guided ESP block
Group N: received GA and opioid analgesia

Values are expressed asMean±SD. ** Student t-test was performed to compare the mean VAS score of both groups at pre-operative, recovery room, 2 hours, 4 hours, 6 hours, 12 hours and 24hours interval. There had statistically significant difference at recovery room, 6 hours and 24 hours interval as p value <0.05 but no significant difference at other intervals as p>0.05.

**Table-V: Frequency of analgesics demand of the patients. (n=60)**

| | Group E (n=30) | Group N (n=30) | Total (n=60) | P value |
|---|---|---|---|---|
| 1 hour | 1(3.33%) | 14(46.67%) | 15(25%) | <0.001 |
| 02 hours | 7(23.33%) | 7(23.33%) | 14(23.33%) | 1.00 |
| 04 hours | 14(46.67%) | 11(36.67%) | 25(41.67%) | 0.432 |
| 06 hours | 7(23.33%) | 11(36.67%) | 18(30%) | 0.26 |
| 12 hours | 2(6.67%) | 11(36.67%) | 13(21.67%) | 0.005 |
| 24hours | - | 4(13.33%) | 4(6.67%) | 0.038 |

Group E: received both GA and ultrasound guided ESP block
Group N: received GA and opioid analgesia

Values are expressed within parenthesis percentage (%) over column in total. *Pearson chi-squared Test ($c^2$) was performed to compare analgesic demand between two groups at 1 hour, 2 hours, 4 hours, 6 hours, 12 hours and 24 hours interval. There had statistically significant difference at 1 hour, 12 hours and 24 hours interval as p value <0.05 but no significant difference at other intervals as p>0.05.

**Table-VI: Total opioid consumption of the patients. (n=60)**

| | Group E (n=30) | Group N (n=30) | Total (n=60) | P value |
|---|---|---|---|---|
| Total opioid consumption (mcg) | 37±15.12 | 67±26.92 | 52±26.41 | <0.001** |

Group E: received both GA and ultrasound guided ESP block
Group N: received GA and opioid analgesia

Values are expressed as Mean±SD. ** Student t-test was performed to compare total opioid consumption between two groups. There had statistically significant difference in total opioid consumption as p<0.001.

**Table-VII: Complication of the patients. (n=60)**

| | Group E (n=30) | Group N (n=30) | Total (n=60) | P value |
|---|---|---|---|---|
| Complication developed | 4(13.33%) | 15(50%) | 19(31.67%) | 0.005 |
| Nausea | - | 6(20%) | 6(10%) | 0.024 |
| Vomiting | - | 1(3.37%) | 1(1.67%) | 1.00 |
| Tachycardia | - | 1(3.37%) | 1(1.67%) | 0.601 |
| Sweating | 1(3.33%) | 4(13.33%) | 5(8.33%) | 0.353 |
| Hypoxia | 1(3.37%) | 5(16.67%) | 6(10%) | 0.195 |
| Failure of block | - | - | - | - |

Group E: received both GA and ultrasound guided ESP block
Group N: received GA and opioid analgesia

Values are expressed within parenthesis percentage (%) over column in total. *Pearson chi-squared Test ($\chi^2$) was performed to compare complications. There had statistically significant difference in developing complication as p=0.005.

## DISCUSSION

The absence of higher abdominal incisions results in less post-operative pain and faster recovery with laparoscopic cholecystectomy. However, even laparoscopic cholecystectomy is not without suffering and pain [11]. Following a laparoscopic cholecystectomy, patients typically have stomach pain and shoulder tip pain. Peritoneal stretching and diaphragmatic irritation induced by elevated intra-abdominal pressure generated by pneumoperitoneum or CO2 absorption from the peritoneal cavity are two reasons of this pain [12]. Several research studies are being conducted to determine the best approaches to lessen the frequency and intensity of post-operative pain following laparoscopic cholecystectomy. The numerous approaches evaluated include intra-peritoneal local anesthetic instillation, elimination of residual CO2 before closure, peritoneal washing with saline, and ultrasound guided transverse abdominis plane block with local anesthetic [13].

Many post-operative analgesics, such as diclofenac sodium, Fentanyl, Morphine, Ketoprofen, and Ibuprofen, have been explored, but none have shown enough satisfactory outcomes to provide full analgesia. For comprehensive pain reduction after laparoscopic cholecystectomy, multimodal analgesia is required. Epidural and paravertebral blocks are widely used to relieve acute or chronic pain associated with cervical, thoracic, or abdominal surgery [14]. Many myofascial blocks and regional techniques, such as transversal abdominis plane block, rectus sheath block, and quadratus lumborum block for abdominal surgeries, pectoral nerve block for breast surgeries, and intercostals and interpleural blocks for thoracic surgeries, have recently been introduced [15].

The purpose of this cross-sectional comparative study was to compare the efficacy of ESP block as post-operative analgesia to that of opioid analgesia. This study included 60 patients scheduled for laparoscopic cholecystectomy under general anesthesia at the Combined Military Hospital (CMH), Dhaka, with ASA grades I, II, and III who were randomly divided into two groups of 30 patients each, E and N. Group E consisted of 30 patients who underwent both GA and ultrasound guided ESP block, while group N included of 30 patients who received both GA and opioid analgesia.

There was a female predominance (65%), with the majority having an ASA grade I (73.33%). All patients had a mean age, weight, and height of 46.85±7.796 years, 67.48±7.99 kg, and 159.07±12.83 cm, respectively. There was no statistically significant difference in any patient characteristics between the two groups, as p>0.05. This discovery is congruent with the discovery of [16].

The duration of operation also did not differ considerably between the two groups. This suggests that the surgery could be completed in the same amount of time while maintaining the surgical procedure's safety and efficacy. However, this may be dependent on the

surgeon's level of experience. Many patient characteristics, such as obesity, past surgery, and the existence of adhesions, might all play a role [17]. As a result, more research is needed to compare different surgical teams and obese patients.

There was no statistically significant difference in the mean heart rate and mean arterial pressure of both groups at 30 minutes, 1 hour, 2 hours, 4 hours, 6 hours, 12 hours, and 24 hours intervals ($p>0.05$). Yeung et al discovered that ESP block eliminates the risk of hypotension associated with epidural analgesia, epidural spread, and vascular puncture associated with paravertebral block, as well as pneumothorax associated with intercostal nerve block and interpleural block [18]. These findings were consistent with previous research [16].

The mean VAS score of both groups in the recovery chamber was statistically significant (p value <0.05). Furthermore, the mean VAS score in Group E was lower than in Group N for the entire time span, which was statistically significant ($p <0.05$). Tulgar et al found almost identical post-operative VAS values up to 24 hours follow up in their trial on ESP block in laparoscopic cholecystectomy, according to our findings [19].

Analgesic demand differences between two groups were statistically significant ($p <0.05$) at 1 hour, 12 hours, and 24 hours intervals. Furthermore, the difference in overall opioid use was statistically significant ($p<0.001$). This adds to the evidence that GA with ESP block has a considerably superior post-operative analgesic impact than GA with opioid.

Patients who got GA and opioid analgesia developed nausea substantially more than patients who received both GA and ESP block ($p<0.05$). ESP blocks are also superior to pectoral nerve blocks (single shot), TAP blocks (four quadrant blocks required for the entire abdomen), rectus sheath, and quadratus lumborum blocks due to their continuous nature, extensive craniocaudal spread, no hindrance to the surgical field, and only sensory blockade. When compared to ESP block, the risk-benefit ratio of recently deployed conventional regional approaches is inadequate [20].

Based on my findings, erector spinae plane block is equivalent to opioid-based analgesia for pain control following laparoscopic cholecystectomy. To reduce analgesic requirement, further research can be planned by combining erector spine plane block with other procedures such as low-pressure pneumoperitoneum, local anesthetic infiltration of wounds, and intraperitoneal instillation of Ropivacaine or Bupivacaine. As a result, more study into ways to improve the quality of post-operative care for these patients is required.

**Limitations of the study**

The present study was conducted in a very short period due to time constraints and funding limitations. The small sample size was also a limitation of the present study.

## CONCLUSION

In this study, it was discovered that using Erector spinae plane block for post-operative analgesia management in laparoscopic cholecystectomy provides significant superior benefits over conventional treatment, as evidenced by a longer analgesia period and a lower requirement for post-operative analgesia. In terms of safety, both groups are comparable. Only nausea is more common in the opioid group. Based on our findings, we may infer that Erector spinae plane block is preferable to standard post-operative analgesic treatment in laparoscopic cholecystectomy.

## RECOMMENDATION

This study can serve as a pilot to much larger research involving multiple centers that can provide a nationwide picture, validate regression models proposed in this study for future use and emphasize points to ensure better management and adherence.

## ACKNOWLEDGEMENTS

The wide range of disciplines involved in effectiveness of esp block as post-operative analgesia in comparison with opioid analgesiaresearch means that editors need much assistance from referees in the evaluation of papers submitted for publication. I would also like to be grateful to my colleagues and family who supported me and offered deep insight into the study.

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