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ORIGINAL RESEARCH **REGIONAL ANESTHESIA**

Comparison of ultrasound guided subcostal transversus abdominis plane block with intraperitoneal instillation of levobupivacaine for post-operative pain relief in laparoscopic cholecystectomy

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ABSTRACT

Background & Objective: Postoperative pain is the main source of perioperative stress, morbidity, prolonged hospital stays and overall financial burden to society. Regional anesthesia techniques have been widely used for pain control in day care surgeries, as a part of early recovery after surgery (ERAS). We compared the efficacy of ultrasound guided subcostal Transversus Abdominis Plane Block (sTAP) using levobupivacaine with intra-peritoneal instillation of levobupivacaine for quality and duration of postoperative pain in patients undergoing laparoscopic cholecystectomy under general anesthesia (GA).

Methodology: This randomized double-blind trial included one hundred patients posted for laparoscopic cholecystectomy under GA. Patients were randomly divided into two equal groups: Group sTAP received sTAP block, and Group IP received intraperitoneal instillation of levobupivacaine, at the end of surgery before extubation. Quality of postoperative analgesia was compared in terms of Visual Analog Scale (VAS) scores. Duration of analgesia as well as the frequency of side effects in both groups were also compared.

Results: Mean duration of surgery was 51.15 ± 9.33 min and 52.42 ± 9.06 min in Group IP and Group sTAP respectively. Demographic parameters were comparable among groups. VAS scores recorded postoperatively in first 24 hours were significantly lower in Group sTAP in comparison to Group IP ($P < 0.05$), at all intervals. Time to first dose of rescue analgesic required was 2.23 hours vs. 4.91 hours in Group sTAP and Group IP respectively ($P < 0.05$). Total amount of analgesia required in first 24 hours was significantly lower in Group sTAP ($P < 0.05$). Nausea and vomiting were reported as common adverse effects among both the study groups with similar prevalence.

Conclusions: Based upon the results of our study, we conclude that the post-operative analgesic profile of the ultrasound-guided subcostal transversus abdominis plane block is better than intraperitoneal instillation of levobupivacaine in patients undergoing laparoscopic cholecystectomy under general anesthesia.

Keywords: Analgesia; Cholecystectomy; Intraperitoneal instillation; subcostal transversus abdominis plane block; Ultrasound.

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1. INTRODUCTION

Laparoscopic cholecystectomy is regarded as a day care minimally invasive procedure, but then still many patients have to over stay in the hospital due to poorly managed postoperative pain. Postoperative pain often leads to increase in perioperative stress, morbidity and overall financial burden. Moreover, if not treated promptly, it could lead to development of chronic pain.[1] Therefore appropriate management of postoperative pain have been greatly emphasized as one of the major elements of early recovery after surgery (ERAS).

There are several methods employed for the prevention and treatment of postoperative pain after laparoscopic cholecystectomy. Conventional use of perioperative analgesics including paracetamol, non-steroidal anti-inflammatory drugs and opioids have their own limitations and systemic side effect profiles. Presently intra-peritoneal instillation of local anesthetic agents as well as ultrasound guided regional blocks are gaining popularity in clinical practice as a part of multimodal approach for the management of perioperative pain post laparoscopic cholecystectomy.[2]

Intraperitoneal instillation of levobupivacaine at the end of procedure is very easy to perform, needs no expertise however its influence on somatic pain relief after laparoscopic cholecystectomy remains controversial.[3,4] Ultrasonography guided oblique subcostal approach for TAP blockade has been recently described. Preliminary data have shown that this approach provides wider sensory blockade both superior and inferior to the umbilicus. Despite the encouraging initial results, there have yet to be studies demonstrating the efficacy of oblique subcostal TAP block when used as a means of perioperative analgesia. Studies comparing TAP block with standard systemic opioids or intraoperative epidural anesthesia are also lacking.[3]

Thus, this study was intended to compare the efficacy of ultrasound guided subcostal transversus abdominis plane (sTAP) block with intraperitoneal instillation of Levobupivacaine in terms of quality and duration of postoperative analgesia in elective laparoscopic cholecystectomy.

MATERIAL & METHODS:

Study was conducted in the department of Anesthesiology of a tertiary care centre after due clearance from college research committee and institutional ethical committee. Hundred patients undergoing elective laparoscopic cholecystectomy under general anesthesia were randomized into two equal groups of fifty each using chit and box technique. Written informed consent was taken after explaining the procedure, possible complications like hematoma, pain, bruising and tenderness at injection site as well as use of VAS score (visual analog scale).

Patients aged between 20- 60 years, ASA status I and II with body mass index 18.5-24.9 kg/m^2 were included in the study. Patients with known hypersensitivity to local anesthestics, bleeding diathesis, psychiatric illness taking antipsychotic or antidepressant medications were not included in the study.

All patients were operated under general anesthesia as per the institutional protocol for day care surgery with ASA monitoring throughout the perioperative period. Patients of Group sTAP received ultrasound guided subcostal TAP (transverse abdominis plane) block bilaterally each using 20 mL fixed dose 0.25% levobupivacaine while intra-peritoneal instillation was done with 40 mL fixed dose 0.25% levobupivacaine in patients of Group IP. Either of the procedures; TAP block or intraperitoneal instillation were performed at the end of surgery prior to reversal and extubation of the patient.

All patients were kept in the post anesthesia care unit (PACU) for maximum of six hours after extubation. During stay in PACU patients were monitored; complications associated with the procedure including exacerbation of pain, bleeding, hematoma, infection, nausea and vomiting etc. were also noted. All patients were assessed for discharge readiness as per modified Post Anesthesia Discharge Scoring System (PADSS) in PACU at 4th, 5th and 6th postoperative hour which considers six criteria: vital signs, ambulation, nausea/vomiting, pain, bleeding and voiding (Figure I). Each criterion was given a score ranging from 0 to 2. Patients who achieved a score greater than or equal to 9 as per modified PADSS were considered as ready to discharge. All patients discharged were required to have a responsible adult available to accompany them home and stay with them for 48 hours. Further follow

up was done for the next 24 hours either through telephonic conversation/video calls or Clinic visits to record VAS scores and requirement of rescue analgesics i.e., number of paracetamol 650mg oral tablets consumed by the patient as an rescue analgesic. Patients who could not be discharged within 6th postoperative hour were noted and kept admitted in hospital as per the institutional protocols. Quality of postoperative analgesia were compared in patients of both the groups in terms of VAS scores recorded every hour for the first 6hrs then after 12hrs, 18hrs, and 24hrs postoperatively telephonically. Duration of analgesia (DOA) was assessed from extubation to 1st demand 'for rescue analgesia' given when VAS score recorded exceeded four. Side effects and complications were also assessed.

STATISTICS

Data so collected was tabulated in an excel sheet, under the guidance of statistician. The means and standard deviations of the measurements per group were used for statistical analysis (SPSS 22.00 for windows; SPSS inc, Chicago, USA). Difference between two groups was determined using t test as well as chi square test and the level of significance was set at $p < 0.05$.

The sample size for the present study was calculated using following formula; $\eta = 2\sigma^2 [Z_{\alpha 12}+Z_{\beta}]^2/(\text{mean difference})^2$; where σ = standard deviation of outcome variable, $Z_{\alpha 12}$= standard normal variate, Z_{β} = desired Power of the study, Mean difference= difference between means of the outcome variable for two groups. In this study σ was 1.17, $Z_{\alpha 12}$ was 2.58 at 99% confidence interval, Z_{β} was 0.84 at 80% power. Mean difference was 0.88. Sample size came out to be 47 in each group. Total 100 patients were enrolled considering drop outs and loss of follow ups.

RESULTS

Total hundred patients included in the study were analysed. There were no differences between the groups for demographic data as well as mean duration of surgery (Table I). The VAS scores recorded for pain were significantly lower in Group sTAP than Group IP ($p < 0.05$) (Table II). Dose of rescue analgesic needed in first 24 hours of postoperative period was significantly lower in patients of Group sTAP (52.1 grams) as compared with that of Groups I (215.8 grams) ($p<0.05$) (Figure II). Nausea and vomiting were reported as common adverse effects among both the study groups with similar prevalence (Figure III).

DISCUSSION

Cholecystectomy is currently one of the most commonly performed operation of the biliary tract. Benefits of Laparoscopic Cholecystectomy includes reduced pain, a faster recovery period, and shorter hospital stay. Three types of pain are distinguished from the multifactorial pain that follows Laparoscopic Cholecystectomy: visceral pain, abdominal wall pain, and shoulder-referred pain.[5] Abdominal cavity's stretching, peritoneal inflammation, and stimulation of the phrenic nerve due to leftover carbon dioxide in the peritoneal cavity causes visceral pain. Abdominal wall pain is due to the skin incision made for port entry while shoulder pain is referred pain due to irritation of diaphragm by carbon dioxide.

In this prospective randomised control trial hundred patients undergoing elective laparoscopic cholecystectomy under general anesthesia were recruited as per the eligibility criteria. Patients were segregated into two equal groups of 50 each, Group sTAP and Group IP. Group sTAP received ultrasound guided subcostal TAP (Transversus Abdominis Plane) block while intra-peritoneal instillation was done in patients of Group IP for postoperative pain.

The variations in age, sex, and weight and operative time were statistically non-significant between the groups.

Postoperative pain reflected in terms of VAS score recorded every hour for the first 6hrs then after 12hrs, 18hrs, and 24hrs postoperatively was found to be significantly lower in Group sTAP when compared to Group IP at all intervals. The time for the first call for rescue analgesic postoperatively was longer in Group sTAP than Group IP. Moreover, the total amount of analgesia needed in initial first 24-hour postoperative period was reduced upto four times in patients of Group sTAP when compared to Group IP. These findings suggests that patients who received sTAP block postoperatively had significantly better analgesic profile when compared to patients of Group IP.

Findings of our study are in line with the results of study conducted by Khandelwal,[3] where authors reported significantly lower pain scores in patients of sTAP block Group sTAP has intraperitoneal instillation in the first 6 hours. However, they reported that there was no significant difference noted in pain scores after 6 hours up to 24 hours in postoperative area among the two groups.

Findings of our study corroborated with the study conducted by Hamoda et al.[6] which also stated that TAP block provides superior analgesia, longer duration, less postoperative analgesic consumption and more satisfaction in patients undergoing Laparoscopic cholecystectomy than Intra- peritoneal instillation block.

Ahmed A. Metwally et al.[7] in their research, have compared intraperitoneal instillation with rectus sheath block. They also reported a statistically significant higher fentanyl intake as rescue analgesic among patients in the intraperitoneal instillation group

compared to the rectus sheath group. The VAS was found to be significantly lower in the rectus sheath block group.

In this study sTAP block was given bilaterally. However, studies have reported unilateral TAP block on right side also provides postoperative analgesia as effective as bilateral TAP block in laparoscopic cholecystectomy.[8]

In contrast to findings of our study, some researches pointed out ineffectiveness of TAP block for postoperative pain after laparoscopic surgeries. They reasoned that TAP block can relieve only somatic component of pain and not the visceral pain that occurs post laparoscopy.[9,10]

This can be explained by the fact that visceral pain in laparoscopic cholecystectomy occurs due to peritoneal stretch, residual gas under diaphragm and viscera dissection. Anatomical variations, tissue adhesions and tissue inflammation among the patients as well as surgical expertise in tissue handling may affect the grade and severity of visceral pain and thereby effectiveness of TAP block

In conclusion, this study adds to the body of evidence supporting the use of ultrasound guidance for STAP block to effectively relieve pain during ELP. Additionally, it successfully lowers the need for opioid analgesics during elective laparoscopic cholecystectomy, which lessens the patients' load on recovery services. Notably, these results were obtained with single injection STA blocks and simple ultrasonography equipment. The current results could be further enhanced by the use of implanted catheters or multiple injection locations. It would also be interesting to see future research assessing the analgesic effectiveness and recovery advantages of axial blocks for all abdominal laparoscopic procedures.

CONCLUSION

The current study's results indicate that, in comparison to the intraperitoneal group, the USG Guided STAP Block group experienced reduced pain scores and required fewer analgesics. Therefore, subjects who underwent LA, the USG-guided STAP Block group is a better technique for analgesia than intraperitoneal instillation.

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Conflicting Interest

(If present, give more details): Nil

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