COMPARISON OF MODIFIED UNILATERAL ULTRASOUND GUIDED SUBCOSTAL TRANSVERSUS ABDOMINIS PLANE BLOCK WITH CONVENTIONAL PORT-SITE AND INTRAPERITONEAL INFILTRATION OF BUPIVACAINE FOR POSTOPERATIVE PAIN RELIEF IN LAPAROSCOPIC CHOLECYSTECTOMY

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ABSTRACT

Objective: To evaluate the analgesic efficacy of a modified ultra sound guided unilateral STAP block with 0.25% bupivacaine in laparoscopic cholecystectomy compared with conventional port site and intraperitoneal infiltration of the same drug in similar amount and concentration.

Study Design: Randomized clinical trial.

Place and Duration of Study: Pak Emirates Military Hospital Rawalpindi, from Oct 2017 to Feb 2018.

Material and Methods: 100 adult female as well as male patients were randomized by lottery method into 2 equal groups. In group A (n=50) unilateral STAP block was performed under ultrasound guidance (Xario 200 Toshiba). The 18 Hz linear probe was placed in the midline of the abdomen 2 cm below the xiphisternum and moved right laterally along the subcostal margin to the anterior axillary line and bupivacaine 0.25% 0.4 ml/kg) was injected after negative aspiration test. Group B (n=50) patients received intra peritoneal instillation of 1/3 of the total drug volume before closure and conventional port site infiltration of 0.25% bupivacaine by remaining 2/3 of the total drug vol (0.4 ml/kg)by the surgeon at the end of the procedure.

Results: One hundred patients were included and distributed in two equal groups. Out of 50 patients in each group six patients in group A and five patients in group B were excluded due to prolonged and difficult surgery. STAP block was associated with significantly lower postoperative mean pain scores, lesser requirement of tramadol 90.90 ± 39.28 mg vs 150.33 ± 99.3 mg and reduced recovery time 37.61 ± 6.01 vs 45.11 ± 8.75 min as compared to group B respectively. However, means of age, weight, female to male ratios, anaesthesia times, postoperative satisfaction scores and complications in both the groups did not differ significantly.

Conclusion: Preoperative STAP block as a component of multimodal analgesic regimen for laparoscopic cholecystectomy provides better analgesia and leads to significantly less postoperative pain scores, consumption of analgesics and recovery time as compared to port site local anaesthetic infiltration.

Keywords: Cholecystectomy, Port-site infiltration, Postoperative analgesia, Rectus sheath block, Subcostal transverses abdominis plane block.

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INTRODUCTION

Most patients who undergo surgical procedures experience acute postoperative pain but evidence suggests that less than half of them report adequate postoperative pain relief. The new clinical practice guidelines strongly recommend the use of multimodal analgesia, using a variety of medications and techniques to have a more synergistic and effective approach to pain relief than single-modality interventions[1]. Laparoscopic cholecystectomy is a minimally invasive procedure commonly performed in the day care units. Pain experienced following laparoscopic cholecystectomy derives significantly from the incisions made in the anterior abdominal wall which has segmental innervation provided by nociceptor afferents in the transversus abdominis fascial plane between the internal oblique and transversus abdominis muscle[2].

Despite the minimally invasive nature of laparoscopic cholecystectomy patients experience a considerable amount of pain in the first 24

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Received: 16 Apr 2018; revised received: 13 Sep 2018; accepted: 17 Sep 2018

hours postoperatively. There are various preoperative, Intraoperative and postoperative pain management strategies to inhibit or reduce postoperative pain. These include opioids[3], nonsteroidal anti-inflammatory drugs, local anesthetics infiltration, intraperitoneal instillation[4], thoracic paravertebral or epidural blocks[5] and having low-pressure pneumoperitoneum[6]. However every single modality has certain limitations.

The transversus abdominis plane (TAP) block was first described in 2001 by Rafi *et al*[7] using the 'Petit' triangle, with so-called "pop" or "double-pop" method (also called posterior approach). It is suitable for sub umbilical abdominal interventions[8]. In order to minimize potential local side effects, Hebbard *et al*[9] described the ultrasound-guided TAP block that enables direct visualization of all anatomical structures, the needle, and the spread of local anaesthetics by ultrasonographic guidance. The sububcostal transversus abdominis plane (STAP) block is a variation on the TAP block that produces reliable supra umbilical analgesia and has been found effective in laparoscopic bariatric procedures, gastrectomies[10], open hepato-biliary, renal or liver transplant surgeries[11,12].

This objective of the study to evaluate the analgesic efficacy of a modified ultra sound guided unilateral STAP block with 0.25% bupivacaine in laparoscopic cholecystectomy compared with conventional port site and intraperitoneal infiltration of the same drug in similar amount and concentration. The purpose was to compare the recovery time, pain scores in the first 24 hours postoperatively, total tramadol consumption, the rate of complications and patient satisfaction scores at the time of discharge from the hospital.

MATERIAL AND METHODS

This Randomized clinical trial study was performed in Pak Emirates Military Hospital Rawalpindi from 15th October 2017 to 28th February 2018. After obtaining the approval from the Institutional Ethics Committee and the patients' written informed consent, sample size was calculated by WHO calculator. Total 100 patients were selected by non-Probability consecutive sampling. Hundred adult female as well as male patients were randomized by lottery method into 2 equal groups. Inclusion criteria were ages from 18 to 60 years, ASA I/II (American Society of Anesthesiologists physical status classification) and scheduled for elective laparoscopic cholecystectomy. Exclusion criteria consisted of a patient's refusal to participate in the study, allergy to local anaesthetics, infection at the injection site, acute cholecystitis, documented severe cardiovascular, renal, hepatic, neurological or psychiatric diseases, chronic pain syndrome, BMI more than 30, anaesthesia time more than 90 min and conversion to open cholecystectomy. Patients were blinded to the treatment group, as was the anaesthetist involved in postoperative data collection. A standardized general anaesthetic regime was employed, consisting of dexamethasone 0.1 mg/kg, metoclopramide 0.15mg/kg, nalbuphine 0.15mg/kg, propofol 2.5 mg/kg, atracurium 0.5 mg/kg and endotracheal intubation. Maintenance of anaesthesia was achieved with isoflurane 1-2 MAC in Oxygen and air (FiO_2 0.4). Mechanical ventilation was provided in a control mode maintaining end tidal CO_2 between 30-40 mmHg and SpO_2 between 96–100%. Intraoperative non-opioid analgesia by ketorolac 0.45mg/kg was administered. Standard monitoring included 3 lead electrocardiography (ECG), noninvasive blood pressure (NIBP), pulse oximetry (SpO_2), capnography, temperature and level of muscle paralysis by train-of-four (TOF). At the end of the surgery, the neuromuscular block was reversed with neostigmine 0.04 mg/kg and atropine 0.01 mg/kg. Extubation was performed once the patient was awake with TOF above 90%.

In group A (n=50) unilateral STAP block was performed under ultrasound guidance (Xario 200 Toshiba). The 18 Hz linear probe was placed in the midline of the abdomen 2 cm below the xiphisternum and moved right laterally along the subcostal margin to the anterior axillary line. The transversus abdominis muscle was identified lying beneath and extending lateral to the rectus

abdominis muscle. A 22-G Stimuplex (B. Brauns) block needle was then guided in plane at the lateral border of rectus sheath between the transversusabdominis and rectus abdominis muscle within the neurovascular fascial plane and 1/3 of the total drug vol (bupivacaine 0.25% 0.4 ml/kg) was injected after negative aspiration test and confirmation of needle tip position by injecting one ml of the drug. Then the needle was repositioned and guided to a point just inferior to the right costal margin at the anterior axillary line between the transversus abdominis and internal oblique muscle within the neurovascular fascial plane. Following aspiration and confirming the positionof the tip of the needle by injecting 01 ml of local anaesthetic solution the remaining 2/3 of the total dosewas injected within the plane. The standard four port laprascopic surgical technique was modified and a supra umbilical port was made instead of an infraumbilical port by the surgeon.

Group B (n=50) patients received intra peritoneal instillation of 1/3 of the total drug volume before closure and conventional port site infiltration of 0.25% bupivacaine by remaining 2/3 of the total drug vol (0.4 ml/kg) by the surgeon at the end of the procedure.

Postoperatively, patients were transferred to the recovery unit. The criteria for discharge from the post anesthesia care unit (PACU) to the ward were adequate pain control (absent or mild pain), hemodynamic stability, alert and appropriate responsiveness to voice. On discharge from the PACU all patients had achieved a modified Aldrete score of ≥9 and were transferred to the ward. In the ward the patients were given two doses of inj ketorolac 0.45 mg/kg at 08 hours interval. Severity of pain was assessed using VAS on a 10 point scale at 1, 4, 8 and 24 hours post operatively at rest and at movements (the patient was asked to cough and to flex the knees). Further analgesic requirement was checked intermittently and moderate to severe pain was treated with intravenous tramadol analgesia in 1 mg/kg boluses. Pain scores, total tramadol consumption, complications and patient satisfaction scores after 24 hours were recorded by an anaesthesiologist who was blinded regarding the two groups. The pain was considered mild for VAS = 1–3, moderate for VAS = 4–6, or severe for VAS = 7–10). Patient satisfaction was graded on a four point scale i.e as highly satisfied, satisfied, poorly satisfied and unsatisfied (4,3,2,1) respectively.

Table-I: Mean Age, Weight, Anesthesia Time, Recovery Time and Male/Female ratio.

Variables	STAP (Group A) n=50	LAI (Group B) n=50	*p*-value
Mean Age (years)	48.70 ± 12.25	48.35 ± 13.89	0.99
Mean Weight (kg)	73.79 ± 9.98	71.22 ± 9.63	0.181
Male/Female (ratio)	1.8:2.6	1.7:2.8	-
Anaesthesia Time (minutes)	59.61 ± 9.14	55.73 ± 10.75	0.075
Recovery Time (minutes)	37.61 ± 6.01	45.11 ± 8.75	<0.001

Table-II: Mean Post-Operative pain and satisfaction scores in Group A and B.

Mean Pain Scores (VAS)	STAP (Group A) n=50	LAI (Group B) n=50	*p*-value
Pain 1st hour	2.65 ± 1.60	4.42 ± 1.11	<0.001
Pain 2nd hour	3.20 ± 1.26	4.64 ± 1.63	<0.001
Pain 8th hour	3.47 ± 1.62	5.08 ± 1.45	<0.001
Pain 24th hour	1.36 ± 0.74	1.52 ± 0.59	<0.001
Total Pain score of 24 hours	2.67 ± 1.47	3.92 ± 1.88	<0.001
Mean Satisfaction Score	3.31 ± 0.7	2.42 ± 0.62	0.260

Statistical analysis was done using SPSS 21. Normally distributed data were analyzed independent sample t-test, whereas non-normally distributed data were analyzed by Mann–Whitney U-test and the chi-squared t-test. A *p*-value ≤0.05 was considered as significant.

RESULTS

In our study 100 patients were included according to inclusion and exclusion criteria and were randomly distributed into two equal groups A and B by lottery method. Four patients in group A and three patients in group B were excluded due to prolonged and difficult surgery leading to anaesthesia time more than ninety minutes whereas two patients in group A and one patient in group B had to be converted to open cholecystectomy.

Mean age, weight, female to male ratios and anaesthesia times in minutes in both the groups did not differ significantly table-I. Mean recovery time was significantly lower in group A as compared to group B i.e, 37.61 ± 6.01 vs 45.11 ± 8.75 minutes respectively (*p*-value less than 0.05) table-I. Mean pain scores on VAS were significantly less in group A as compared to group B at 1st, 4th and 8th post op hours however there was no significant difference in pain and postoperative satisfaction scores after 24 hours in both of the groups table-II. Mean tramadol consumption in twenty four hours was significantly less in group A as compared to group B i.e, 99.98 ± 39.28mg vs 153.33 ± 99.31 mg both in females as well as males (*p*-value is 0.007) however males required more tramadol as compared to females in both of the groups fig-1. Incidence of complications was very low in both the groups and did not differ significantly fig-2. Three patients in group A and one patient in group B had PONV which was managed with inj ondansetron 08 mg iv. One patient in group B had severe left shoulder pain and respiratory rate of 06 per minute for a short duration after getting inj tramadol 100mg with ketorolac 30 mg. However she recovered without any intervention except Oxygen therapy at 4 lit per minute with a face mask and psychological reassurance. Patients in both the groups were satisfied at

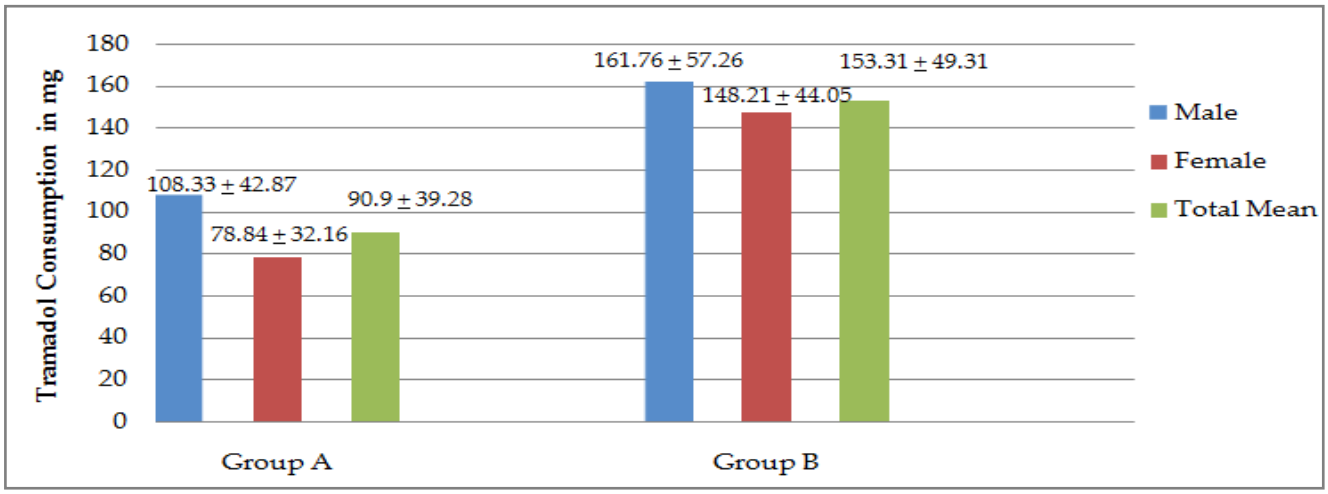

Figure-1: Mean tramadol consumption in 24 hours in males and females in group A vs. B

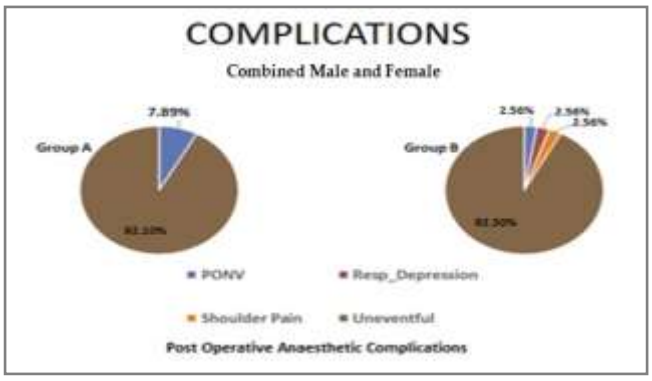

Figure-2: Incidence of complications group Avs B.

discharge with mean satisfaction scores 3.31 ± 0.7 vs 2.42 ± 0.62 without any statistically significant difference.

DISCUSSION

There are various studies which recommend TAP block as an effective component of multimodal analgesia after laparoscopic cholecystectomy[13-17]. However, Ortiz *et al* have concluded that even bilateral transversus abdominis plane block does not decrease postoperative pain after laparoscopic cholecystectomy when compared with local anesthetic infiltration of trocar insertion sites[18]. These contradictory results might be explained by differences in the methodology used in these studies regarding the type of block (posterior approach, blind technique or ultrasound guided TAP), the timing of the block (before or after surgery), the medication and the doses of local anesthetics used, and the placebo group.

Results of only a few studies are available about the effectiveness of STAP block approach in laparoscopic cholecystectomy however even these are heterogeneous regarding the procedure as well as the postoperative analgesic regimen[19-22]. Most of them performed a bilateral block with standard four port sites for laparoscopic cholecystectomies.

We compared the effectiveness of a modified unilateral ultrasound guided subcostal TAP block (STAP) versus port site infiltration and peritoneal instillation of 0.25% bupivacaine for postoperative pain control in laparoscopic cholecystectomies. For a modified STAP block the surgical technique was altered too and a supra umbilical port was made instead of an infraumbilical port. Our results of postoperative pain scores, total tramadol consumption and recovery times are consistent with the study of Tolchard S, Davies R and Martindale S19 who havecompared the subcostal transversus abdominis plane block with conventional port-site infiltration in laparoscopic cholecystectomy using bupivacaine 0.25% in 43 patients. They concluded that pre-incisional STAP block was significantly more effective in reducing the intra operative as well as 24 h opioid consumption and postoperative care unit (PACU) stay in STAP group. In their study STAP block significantly reduced the serial visual pain score values, reduced fentanyl requirement in recovery by >35% and post op Morphine by 50% (N21 vs 22).

In our study the pain scores were significantly less in STAP group at 1, 4, and 8 hours but there was no significant difference at 24 hours in both the groups. They have shown that STAP block reduced median recovery time from 110 to 65 min where as in our study less reduction in Mean recovery times (45.11 ± 8.75 vs 37.61 ± 6.01 min) may be attributed to the intra op use of relatively higher doses of nalbuphine and ketorolac requiring less inhalational anaesthesia (isoflurane) resulting in quick recovery and reduced anesthesia times. Postoperative satisfaction score at 24 hours also did not differ significantly in both the groups in our study. This effectiveness of analgesia in both of the groups might be due to the use of multimodal analgesia in our patients.

In another study Saxena, Joshi and Srivastava *et al*[20] have compared ultrasound-guided posterior rectus sheath plus STAP block with port infiltration in laparoscopic cholecystectomies for post-operative pain relief. The average fentanyl consumption remained higher for port site infiltration (group A) (223.60 ± 101.96 µg) and was approximately twice of group B (120.22 ± 74.93 µg) with a statistically significant difference between the two group. However they did not use peritoneal instillation of local anaesthetics with port site infiltration.

Similarly Shin *et al*[21] have compared STAP with TAP block in laparoscopic cholecystectomy. They have also concluded that STAP block provided more effective analgesia than the TAP block and reduced significantly the postoperative opioid requirements for 24 hours.

Although in our study Mean tramadol consumption in 24 hours was reduced from 153.33 ± 49.31 to 90.90 ± 39.28 mg in group A as compared to group B however there was significantly more

tramadol consumption in males as compared to females which is in contrast to the study of Aziza *et al*[22].

LIMITATION OF STUDY

Our study has certain limitations as unilateral STAP block was performed after induction of general anaesthesia, so we were unable to check block onset time or its extension. Secondly our study necessitated adjustment of the port-site positions to facilitate the anatomical distribution of the block and postoperative analgesia was limited to ketorolac and tramadol only. The use of bilateral blocks, multiple injection sites, or implanted catheters along with more potent opioids may further improve on the present findings. It is important to mention that in group B (LAI) the post-incisional port-site infiltration was employed in this study. Pre-incisional infiltration[23] is also a recognized analgesic technique for laparoscopic cholecystectomy and its efficacy compared with pre incisional STAP block may be better. To establish the definite superiority of one technique over the other and to establish the appropriate guidelines regarding timings, dose of local anaesthetics, different multimodal regimens and the gender based dose adjustments of different drugs, larger multicentre randomized controlled trials are required.

CONCLUSION

After laparoscopic cholecystectomy STAP block with bupivacaine 0.25% provided significantly superior postoperative analgesia, shorter recovery times and less postoperative analgesic requirement up to 24 hours when compared with a conventional port site infiltration along with intraperitoneal instillation of local anaesthetic. However there was no significant difference in both the groups regarding postoperative patient satisfaction scores and the complications in both the groups were insignificant.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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