ORIGINAL ARTICLE

ANALGESIC EFFECT OF BILATERAL SUBCOSTAL TAP BLOCK AFTER LAPAROSCOPIC CHOLECYSTECTOMY

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Background: Pain after laparoscopic cholecystectomy is mild to moderate in intensity. Several modalities are employed for achieving safe and effective postoperative analgesia, the benefits of which adds to the early recovery of the patients. As a part of multimodal analgesia, various approaches of Transversus abdominis plane (TAP) block has been used for management of parietal and incisional components of pain after laparoscopic cholecystectomy. This study was designed to compare the analgesic efficacy of two different approaches of ultrasound guided TAP block, i.e., Subcostal-TAP block technique with ultrasound guided Posterior-TAP block for post-operative pain management in patients undergoing laparoscopic cholecystectomy under general anaesthesia. **Methods:** In this double blinded randomized controlled study, consecutive nonprobability sampling was done and a total of 126 patients admitted for elective laparoscopic cholecystectomy fulfilling the inclusion criteria were selected. After induction of general anaesthesia, patients were randomized through draw method and received either ultrasound guided posterior TAP block with 0.375% bupivacaine (20ml volume) on each side of the abdomen or subcostal TAP block bilaterally with the same. Up to 24 hours postoperatively, static and dynamic numeric rating pain scores were assessed. **Results:** We found statistically significant difference in mean static pain scores over 24 hours postoperatively in subcostal TAP group, suggesting improved analgesia. However, mean dynamic postoperative pain scores were comparable between the two groups. Whereas, patients in both groups were satisfied with pain management. **Conclusions**: Ultrasound guided subcostal TAP block provides better postoperative analgesia as compared to the Posterior TAP block in laparoscopic cholecystectomy. Otherwise both of the approaches improve patient outcomes towards early recovery and discharge from hospital.

Keywords: Laparoscopic cholecystectomy; Postoperative pain; Subcostal TAP block; Ultrasound

Citation: Khan KK, Khan RI. Analgesic effect of bilateral subcostal tap block after laparoscopic cholecystectomy. J Ayub Med Coll Abbottabad 2018;30(1):12–5

INTRODUCTION

Laparoscopic cholecystectomy is a minimally invasive procedure that causes moderate intensity of parietal, visceral, incisional and referred postoperative pain.[1] A multimodal analgesic approach for management of such variety of pain is usually used for enhanced recovery of the patient. As a part of this approach, TAP block is a famous modality for postoperative analgesia in laparoscopic abdominal surgeries.[2] It is an abdominal field block that acts on the myocutaneous nerve supply of anterior abdominal compartment, targeting parietal and incisional components of pain. The benefits of utilizing TAP block for postoperative analgesia in abdominal surgeries are well known and include opioids sparing effects, reduction in pain scores and increased patient comfort and satisfaction.[3,4]

In the multiport laparoscopic cholecystectomy, the port site incisions, usually four in number are placed at supra-umbilical region. In literature the most common approach of performing TAP block with ultrasound for laparoscopic cholecystectomy is the classical or posterior one[5], which provides analgesia between T7 to the level of T10 dermatome[6]. The rationale for performing ultrasound guided bilateral subcostal TAP block was to achieve the extent of the block up to the T6 dermatome[7], where the epigastric port of laparoscope is inserted for which the block is required to be given at a more anterior level. Therefore, we compared the analgesic efficacy of subcostal TAP approach with posterior TAP block for post-operative analgesia after laparoscopic cholecystectomy.

MATERIAL AND METHODS

After approval from ethical review committee of Aga Khan University, we assessed eligibility of the patient between age of 18–60 years, admitted electively for laparoscopic cholecystectomy for recruitment. Patients with known allergies to local anaesthetics, who were morbidly obese, having hepato-splenomegaly or any known liver disease, and those whose laparoscopic procedure was converted to open cholecystectomy for any reason were excluded from the study. The procedure and its complications were explained in detail to the recruited patients in the preoperative area of the main Operation theatres, and written informed consent was then taken from them

after giving adequate time for reflecting back to the information. They were also explained about the numeric rating scale for assessment of pain and were informed about their follow up regarding their pain control, and related issues for 24 hours postoperatively by a designated team.

The postoperative pain at 24 hours was considered to estimate the required sample size. It was calculated that sample size of 63 patients in each group to have 90% power to detect a difference of 0.7 in the mean pain score between groups at the 5% alpha level. Mean pain score of TAP block and sub costal groups as 1.7 (SD; 1.7)[4] and 1 (SD; 1 SD computed by range /4: Range 0–4)[8] respectively.

After standardized induction of general anaesthesia, patients were selected randomly using draw method assigning them to each of the intervention group. Blocks in all the patients were performed by either of the primary investigator using ultrasound. After all aseptic measures, one of the group received ultrasound guided bilateral posterior TAP block, approached in the mid axillary line between costal margin and iliac crest. Upon optimal identification of neuro-fascial plane, i.e., between the fascia of transverses abdominis muscle and internal oblique fascia, 20 ml volume of 0.375% bupivacaine was injected on each side of abdomen.

The other group received ultrasound guided bilateral subcostal TAP block, however, local anaesthetic, i.e., 20 ml of 0.375% bupivacaine was administered into each side of abdominal wall just inferior to the costal margin in the plane between rectus sheath and fascia of transverses abdominis muscle in the mid clavicular line. No complications were noticed in any of the group. Both groups also received standard of care postoperative analgesia, which includes, intravenous ketorolac (NSAID) 30 mg eight hourly, intravenous tramadol 50 mg eight hourly and 50 mg as per need basis and intravenous infusion of paracetamol 1gram 6 hourly for 24 hours. Patients, nurses providing postoperative care in the recovery room and in wards and designated pain team were all blinded to group allocation.

At conclusion of surgery, after emergence from anaesthesia, patient was shifted to recovery room, and time of arrival in recovery room was taken as 0-hour and then at 1 hr, 2 hr, 6hr, 12hr, and at 24 hours, postoperatively, pain scores were assessed by designated team including a doctor and a nurse on a structured proforma for each patient.

As primary outcome measure, we used numeric rating score (NRS) for assessment of static and dynamic postoperative pain at each point of time (0= no pain, score of 1–3=mild pain, 4–6=moderate pain, 7–10=severe pain). Final outcome was measured at 24 hours postoperatively. Patients received an increment of 50 mg of IV tramadol when complained of pain with NRS score of more than 3. Data collection was started immediately in recovery room and completed by 24-hour post operatively, i.e., before the patient was discharged home.

The collected data was analysed using SPSS Inc., Chicago, IL. Frequency and percentage was computed for gender, whereas mean and standard deviation were estimated for age, duration of the surgery and pain score between groups. For normal data t-test was applied to compare mean pain scores between groups at different points of time. For non-normal data Mann-Whitney U test was applied to compare mean pain score. The *p*-value of ≤ 0.05 was considered as significant.

RESULTS

A total of 126 patients electively admitted for laparoscopic cholecystectomy were randomized between March to September 2013 and all completed the trial. All patients underwent multiport laparoscopic cholecystectomy. Patients were allocated in to two groups comprising of 63 patients in each, receiving TAP block with either posterior or subcostal approach. A standard postoperative and intraoperative analgesic regimen was administered to all the enrolled patients.

Baseline demographic and clinical characteristics were similar between the groups. Of the 126 enrolled patients, 88 (69.8%) were female and 38 (30.2%) were male patients. The two groups were comparable in terms of gender. Mean age of the patients was 38.04±7.65 years whereas; mean duration of the surgical procedure was 1.84±0.38 hours in both the group. (Table-1)

NRS was used for scoring static and dynamic pain at zero, 1, 2, 4, 6, 12 and 24 hours postoperatively for both the groups. None of the patient complaint of severe pain either during rest or at movement. According to the data, results showed statistically significant difference only in the mean NRS for static pain over 24hours in the subcostal TAP group (Table-2). The most significant lower pain scores were at 6 hours with p-value of 0.001 and at 12 hours with *p*-value of 0.005. However, it did not show any significant difference in mean dynamic pain scores between the two approaches (Table-2). Rescue analgesia was requested by 19 out of 63 patients in posterior TAP group and therefore symptoms of nausea were higher in that group, as they received tramadol. All patients were satisfied with their mode of analgesia (Table-3) and were discharged home within 24 hours postoperatively, except the two patients in posterior TAP group and the reason behind that was not related to objectives of our study. No complications were observed during the procedure in both the groups.

Table-1: Comparison of characteristics and rescue analgesia between groups

Variables	P-TAP (n=63)	S-TAP (n=63)	*p*-value
Age (Years) †	37.43±8.26	38.66±7.06	0.50
Male	20 (31.7%)	18 (28.6%)	0.79
Female	43 (68.3%)	45 (71.4%)	
Duration of surgery (hours) ǂ	1.84±0.38	1.78±0.41	0.79

† Independent sample t test after checking assumption of normality. € chi-square = 0.068, $p = 0.79$. ǂ Independent sample Mann-Whitney U Test use due to violation of normality

Table-2: Comparison of mean static and dynamic pain scores between groups with respect to time

Time scale	Static pain P-TAP (n=63)	Static pain S-TAP (n=63)	*p*-Value	Dynamic pain P-TAP (n=63)	Dynamic pain S-TAP (n=63)	*p*-Value
At Zero hour	1.03±0.92	0.97±0.82	0.78	1.86±1.16	2.23±0.69	0.11
At 1st hour	1.34±1.02	1.03±0.62	0.12	2.03±0.89	1.86±0.49	0.32
At 2nd hour	1.11±0.83	0.69±0.58	0.015*	1.80±0.75	1.29±0.66	0.004
At 6th hour	0.86±0.87	0.29±0.45	0.001*	1.20±1.05	0.83±0.71	0.08
At 12th hour	0.51±0.74	0.11±0.32	0.005*	0.86±1.00	0.34±0.59	0.01
At 24th hour	0.40±0.69	0.11±0.32	0.031*	0.46±0.70	0.29±0.57	0.26

Repeated measure ANOVA and independent sample t test. *significant

Table-3: Comparison of patient satisfaction between the two groups

Patient satisfaction and recommendation	P-TAP (n=63)	S-TAP (n=63)	*p*-Value
Are u satisfied with the method of pain relief	100%	100%	1.00
Would you recommend the same method to your family or friends	100%	100%	1.00

DISCUSSION

Laparoscopic cholecystectomy is currently the gold standard treatment for symptomatic cholelithiasis.[9] It is associated with moderate degree of postoperative pain.[10] In the current study, among patients undergoing multiport supra-umbilical laparoscopic cholecystectomy bilateral subcostal TAP block compared to bilateral posterior TAP block showed reduction only in the mean static postoperative numeric rating score. Whereas, both of the approaches had shown improved patient satisfaction. Both of the approaches has been compared in the past for laparoscopic gynaecological surgeries and results were comparable among the two approaches[11] but the ports were at umbilical region.

The superior analgesia provided by subcostal TAP block over posterior TAP block is attributed by fact that extend of spread of analgesia achieved by subcostal approach is up to dermatome T6, where epigastric port is placed. Whereas, previous studies have shown that spread of local anaesthetic does not exceed T7 dermatome level in posterior approach of TAP block and hence poor analgesia over the epigastric port site.[6] Subcostal TAP block has been compared with port site infiltration,[12,13] with epidural analgesia[14] and with conventional postoperative analgesia for abdominal surgeries and it turned out to be superior in all aspect.

There are some limitations to our study. First, although the interventions were performed with real time ultrasound, we did not check the spread of sensory blockade in both the groups. Second, our study population was too low to explore the adequate effectiveness of the intervention used. Larger sample size may have revealed more significant results.

CONCLUSION

We conclude that by using subcostal approach of transverses abdominis plane block in conjunction with the multimodal analgesia in patient undergoing laparoscopic cholecystectomy, satisfactory postoperative analgesia can be achieved which improves patient and surgical outcomes.

AUTHORS' CONTRIBUTION

Both the authors contributed equally in this manuscript.

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Received: 15 April, 2017	*Revised: 20 December, 2017*	*Accepted: 5 January, 2018*

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