Original Article

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Efficacy of The Subcostal Transversus Abdominis Plane Block In Laparoscopic Cholecystectomy: A Comparison With Conventional Port-Site Infiltration

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ABSTRACT

Introduction: Pain experienced following laparoscopic cholecystectomy derives significantly from incision made in anterior abdominal wall. Many patients experience moderate to severe pain following laparoscopic cholecystectomy. This study aimed to compare the efficacy of ultrasound guided bilateral subcostal transversus abdominal plane (TAP) block with port-site infiltration for post-operative analgesia after laparoscopic cholecystectomy.

Methods: Sixty patients undergoing laparoscopic cholecystectomy were randomly allocated to two groups to receive port-site infiltration of local anaesthesia or ultrasound guided subcostal TAP block at the end of surgery before extubation. All patients received 1 gm paracetamol intravenously 8 hourly. Post-operative pain was assessed using visual analogue score at 0,1,2,4,8,16 and 24 hours. Time to first analgesic requirement and total opioid consumption over 24 hours were recorded.

Results: Ultrasound guided bilateral subcostal transversus abdominis plane block significantly reduced post-operative pain score compared to port site infiltration. We observed statistically significant differences in visual analogue score between two groups at all other time frame. The 24 hours opioid consumption was less in Subcostal TAP (136±66.31µg VS 202±80.58µg, p=0.001). Time for rescue analgesia was prolonged in patient receiving subcostal TAP (3.63±2.09 hrs VS 1.73±1.60 hrs,p=0.0002).

Conclusion: Ultrasound guided bilateral subcostal transversus abdominal block provides superior post-operative analgesia and reduced opioid consumption after laparoscopic cholecystectomy compared to port-site infiltration.

Keywords: Laparoscopic Cholecystectomy, Subcostal TAP Block, Post - Operative Analgesia, Visual Analogue Scale (VAS).

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INTRODUCTION

Though laparoscopic surgery is minimal invasive surgery, pain can be moderate to severe in immediate post-operative period.[1-2] Substantial component of pain experienced by patients postoperatively is derived from anterior wall incision.[3] Different methods as intraperitoneal lavage or port-site infiltration of local anaesthesia were successfully used in past years to decrease pain score and opiod requirement.[4] Use of peripheral nerve block has become increasingly popular in past few decades. Subcostal TAP block is a newly developed block involving nerves of anterior abdominal wall from T7-T12 dermatomes.[5] The accuracy and quality of nerve blockade can be enhanced with guidance of ultrasound.

The aim of study was to investigate whether Ultra sound guided subcostal transversus abdominis block using bupivacaine was superior to traditional port-site infiltration in reducing post-operative pain.

METHODS

This is prospective interventional study studied at the tertiary care hospital of Nepal with the approval of ethical committee. Written informed consent was obtained from all patients. Patients aged from 20-60 years of either sex scheduled for elective laparoscopic cholecystectomy under general anaesthesia, belonging to American Society of Anaesthesiologist (ASA) I and II were included in this study. Emergency cases, patients with history of allergic reaction to local anaesthesia , patient belonging to ASA III and IV, pre-operative chronic opiod dependence and patient in whom surgical procedure was converted to open cholecystectomy were excluded from this study.

Detailed pre-anaesthestic evaluation was done a day prior to surgery. Pre-operatively all patients were instructed regarding the visual analogue scale (VAS) in which 0 means no pain and 10 indicates severe pain. Patient were kept nil per oral for 8 hours prior surgery. All patient received tablet Ranitidine 150 mg as oral premedication. On the day of surgery, in operation theatre intravenous access was obtained with 18G cannula. All patients received general anaesthesia with ASA standard monitoring. Anaesthesia was induced by Fentanyl 2mcg/kg, propofol 2mg/kg and endotracheal tube was facilitated with vecuronium 0.8mg/kg intravenously. Anaesthesia was maintained with total 1lt of gas in equal oxygen and air ratio, isoflurane (1-1.5%), intermittent dose of vecuronium with controlled ventilation. ETCO2 was maintained between 30-35mmHg. Intrabdominal pressure was maintained at 10-12 mmHg to minimize hemodynamic and respiratory complications. All the patients received paracetamol 1 gm intravenous infusion intraoperatively at the beginning of surgery. At the end of surgery before extubation, patient received either port-site local anaesthetic infiltration or ultrasound guided bilateral subcostal TAP block. All patient were randomly divided into two equal groups of 30 each using computer generated randomization. We used sealed envelope randomization.

Port- site infiltration was done with 20ml of 0.5% bupivacaine, 5ml at each of four port-site- epigastric, umbilical, midclavicular at the level of umbilicus and anterior axillary ports on right side by operating surgeon. An ultrasound guided bilateral TAP block performed by anaesthesiologist at end of surgery. A linear array ultrasound probe with 6-13HZ frequency (Mindray M5 diagnostic ultrasound system) was placed in midline of abdomen 2cm below the xiphisternum and moved laterally along the subcostal margin to the anterior axillary line. The transverse abdominis muscle was identified lying beneath and extending laterally to rectus abdomins muscle. After visualization of neurofascial plane between internal oblique and transverse abdominis muscle at level of anterior axillary line a 100mm,22GZ stimuplex block needle was advanced in plane under direct visualization. The tip of needle was visualized in the plane. Aspiration was done to exclude any vascular puncture then a test dose of 2 ml Normal saline was injected to confirm needle tip placement. After aspiration and test dose,0.25% 20 ml plain bupivacaine was deposited bilaterally within the plane. When patient's spontaneous respiratory effort appeared, muscle relaxation was reversed with neostigmine 50mcg/kg and glycopyrolate 0.004mg/kg. Following adequate and complete recovery patient was transferred to the recovery unit and after that transferred to ward. Pain was assessed using Visual analogue score on arrival in recovery room when patient is oriented at 0hr,thereafter 1hr,2hr,4hr,8hr,16hr and 24 hourly. Pain score were recorded by recovery and ward nurse who usually do them without any knowledge of patient group. Opiod requirement and adverse effect like nausea, vomiting and other vital parameters

HR, NIBP,SPO2, RR were recorded. At any time if pain score was more than 4, fentanyl 20mcg as rescue analgesia was given. Paracetamol 1gm was intravenously 8 hourly.

Statistical analysis:

The data were entered in Microsoft excel and analyzed using statistical package for social science (SPSS™) software version 20. Descriptive results were presented in frequencies, percentage, mean and standard deviation (SD). Differences between the groups were analyzed by students t-test for narmal distribution data and mann-whitney u test for data without normal distribution. For non parametric data the chi square test was used. P <0.05 was statistically significant.

RESULTS

All sixty patients were enrolled for the study and all patients had completed the study. There were 23 (77%) female and 7 (23%) male in Subcostal TAP whereas 21(70%) female and 9 (30%) male in port-site infiltration (Table 1). On analyzing the demographic data, we found no statistically significant variation in age,sex, ASA classification and weight between the two groups (Table 1)

Table1. Comparison of demographic variables between the two groups.

Variables		Subcostal TAP	Port-site- infiltration	Stats
Sex	Male	7 (23%)	9 (30%)	X^2=0.341, df=1,N=60,
	Female	23 (77%)	21 (70%)	p=0.559
ASA	I	19 (63%)	24 (80%)	X^2 =2.052, df=1,N=60,
	II	11 (37%)	6 (20%)	p=0.152
Mean age $\pm$ SD (years)		40.27$\pm$12.57	38.77$\pm$9.95	Mann Whitney U=417.000, N=60, p=0.625
Mean weight $\pm$ SD (kg)		56.37$\pm$10.54	54.93$\pm$9.01	Mann Whitney U=426.500, N=60, p=0.728
Mean duration of surgery $\pm$ SD (mins)		77.17$\pm$24.23	78.97$\pm$10.74	p=0.711

In our study, the mean VAS score was lower in the subcostal TAP group in comparison to the Port-site infiltration group at all the postoperative time periods. These differences in mean VAS scores were found to be statistically significant (Table 2).

Table 2. Comparison of mean VAS scores between the two groups.

Time interval	Sub-costalTAP (Mean VAS±SD)	Portsite- infiltration (Mean VAS±SD)	Stats
0 hrs	3.10±0.48	3.37±0.49	Mann Whitney U=341.000, p=0.044
1 hrs	2.87±0.81	3.87±1.07	Mann Whitney U =222.500, p<0.001
2 hrs	3.23±1.06	4.30±0.988	Mann Whitney U=213.000, p<0.001
4 hrs	3.33±1.18	4.37±1.12	Mann Whitney U=246.500, p<0.001
8 hrs	3.73±0.90	4.87±1.00	Mann Whitney U=189.000, p<0.001
16 hrs	3.10±0.75	4.27±0.94	Mann Whitney U=155.000, p<0.001
24 hrs	2.67±0.95	3.83±0.83	Mann Whitney U=167.000, p<0.001

The time for rescue analgesia was significantly prolonged in patients receiving subcostal TAP block (p<0.001). The overall 24 hours opiods consumptions was significantly less (p=0.001) in patient with subcostal TAP block (Table 3).

Table 3. Comparison of analgesic consumption between the two groups.

Variables	Subcostal TAP	Portsite- infiltration	stats
Time for 1st request of opiods(hrs)	3.36±2.09	1.73±1.60	P<0.001
Total Opiods consumptions(µg)	136±66.31	202±80,58	P=0.001

The overall incidence of nausea and vomiting were 7 in Subcostal TAP block and 10 in Port-site infiltration group but it is not statistically significant. There were no other complications from procedures as bleeding, local anaesthesia toxicity, intraperitoneal injection.

DISCUSSION

Laparoscopic cholecystectomy have been indisputably proven benefit to patients over and above that of open surgery. However pain is still the most common complain after surgery. Postoperative pain is one of the primary concern because of its close ties with clinical outcome and acute post-operative well being.[6-7] Inadequate pain control after surgeries is significant in terms of both physical and psychological trauma and ultimately leads to chronic pain i.e post laparoscopic cholecystectomy syndrome.[8-9] Post-operative pain after laparoscopic cholecystectomy is multifactorial may be incisional pain, stretching of intra-abdominal cavity secondary to pneumoperitoneum, post cholecystectomy wound within the liver causing visceral pain and referred pain shoulder pain.[10] Pneumoperitoneum also causes systemic effect which is due to hypercarbia leading to sympathetic neuron system activation with an amplification of local tissue inflammatory response .[11-12]The conventional methods of post-operative pain management following laparoscopic cholecystectomy are opiod administration, local anaesthesia infiltration, NSAIDS and thoracic epidural analgesia. Opiod administration causes respiratory depression, sedation, nausea and vomiting. Fear of addiction and dependence most often lead to under treatment of pain. Thoracic epidural analgesia has high risk of hematoma so avoided in case of coagulation disorder.[13-14]Recent literature reveled that multimodal analgesia technique has been used to enhance the analgesic effect. Ultrasound - guided sub-costal TAP block is one of effective component of multimodal analgesia and has become more popular for post-operative pain management.[2,10,15,16] The sub--costal TAP block was described by Hebbard et al.[17] Even though the classic approach initially described was through the lumbar triangle of petit to cover upper abdominal dermatomes[18], anterior sub-costal approach was described. Classical approach of TAP block was not free of complication until the introduction of ultrasound regional anaesthesia. [19] Ultrasound guided

TAP block helps in clear visualization of anatomy and accurate deposition of local anaesthesia under vision increases the success rate.[20] The present study aims to compare analgesic efficacy of ultrasound guided regional block with port-site infiltration technique for post-operative pain relief.

In our study 77% in sub-costal TAP and 70% in port-site infiltration were female. The higher in female correlate to fact that gall stone disease are most common in female. In our study we found that VAS pain score was less in subcostal TAP group when comparing with Port-site infiltration at all other time frames. Similar finding was reported by Tolchard at al.[4] Author had compared ultrasound guided subcostal TAP block with port-site infiltration and concluded better analgesia after subcostal TAP in post-operative period ($p<0.01$). In 2014,shin et al.also demonstrated lower pain score and decreased opiod consumption in oblique Subcostal TAP compared to conventional TAP block ($p<0.05$). [16] Similar finding was reported by V.Vrsajkov et al ($p<0.01$).[21] In our study we found that differences in 24 hours VAS score was statistically significant. In study conducted by Suseela et al.[22]with sample size of 40 in each group found ultrasound guided Subcostal TAP block is superior to port-site infiltration in providing post-operative analgesia after laparoscopic cholecystectomy with reduced pain scores($p<0.001$) which is consistent with our study. Bhalekar et al. reported lower VAS score in Subcostal TAP group than control group at 0hr (2.1 vs 4.2), 2hr (2.1 vs 4.2), 4hr (2.0 vs 4.1), 8hr (1.8 vs 4.0), 16hr (1.7 vs 3.9) and 24hr (1.5 vs 3.7) . [23] Our study result were also consistent with previous study done for post-operative analgesia after laparoscopic cholecystectomy.

In our study, the time to first rescue analgesia was significantly prolonged in patient receiving Subcostal TAP block compared to port-site infiltration (3.63±2.09 hours vs 1.73±1.60 hours, $p= 0.0002$). The total fentanyl consumption in first 24 hours was significantly lower in Subcostal TAP block(136±66.31μg vs 202±80.58μg, $p= 0.001$). From this result, it is evident that Subcostal TAP block significantly reduces post-operative opiod consumption. Saxena et al.[3] reported similar finding in their study with sample size of 40 in each group, requiring less than half dose of rescue analgesic in TAP block group(223.60±101.96μg vs 120.22±74.93μg, $p<0.0001$). Tolchard et al. Ibrahim et al. also found that total opiod consumption was significantly decreased in patient receiving Subcostal TAP block. [4, 24]

The incidence of nausea and vomiting was found to be less and statistically insignificant. In our study, there were no any systemic side effect of local anaesthesia noted which might be due to use of real time ultrasound.

CONCLUSION

This study concluded that ultrasound guided bilateral Subcostal TAP block provides better post-operative analgesia with low pain score and decreased post-operative opiod consumption compared to port-site infiltration.

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