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EVALUATION OF ULTRASOUND GUIDED QUADRATUS LUMBORUM - TYPE I BLOCK FOR POSTOPERATIVE ANALGESIA AFTER LAPAROSCOPIC CHOLECYSTECTOMY.

Anaesthesiology

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ABSTRACT

Objectives: We evaluated the effect of Quadratus Lumborum - type I Block (QLB) on postoperative pain scores after laparoscopic cholecystectomy.

Methods: After ethical committee approval, 48 patients of ASA I/II were randomly administered ultrasound guided QLB prior to extubation. Q group(n=24) received 0.375% Inj. Ropivicaine 20 ml, bilaterally and the control group C(n=24) received 0.9% normal saline 20 ml, bilaterally. Surgery was performed under standard general anesthesia. Primary outcome measure was pain scores (NRS) at rest and movement. Secondary outcome measures; time to administration of first rescue analgesic, number of rescue analgesics, and adverse effects if any, were recorded

Results: The mean NRS score of C group was >4.1 at 0, 2, 4, 8, 12 and 24 hours and that of Q group was<2.5at rest. The mean NRS score of C group was >5 at 0, 2, 4, 8, 12 and 24 hours and that of Q group always remained <4 during movements which was statistically significant ($P < 0.05$). Mean time to first analgesic requirement was 12 hours in Q group(n=3) and 2.96 hours in C group(n=23), total number of rescue analgesic doses was 0.13 in Q group, compared to 3.30 in C group. Patients of Q group (85%) had effective visceral and somatic analgesia, lasting for up to 24 hours and did not require any rescue analgesics (Mean NRS < 3, P value <0.0001). There were no adverse reactions in either of the groups.

Conclusion: In 85% of our patients, QLB provided adequate and effective postoperative analgesia for laparoscopic cholecystectomies by achieving sensory blockade from T4 to L1 levels and thereby reducing the need for opioid analgesics in our study.

KEYWORDS

Quadratus lumborum block, postoperative analgesia, laparoscopic cholecystectomy

INTRODUCTION:

Laparoscopic cholecystectomy is one of the minimal invasive and day care procedures that frequently results in significant acute pain in the immediate postoperative period. Pain after laparoscopic cholecystectomy is a conglomerate of visceral pain (deep intra-abdominal pain due to handling of the viscera), somatic pain (at the site of incision) and shoulder tip pain (caused as a result of peritoneal stretching and diaphragmatic irritation). [1] Effective postoperative analgesia after surgery is important because it enables early ambulation and helps in managing acute pain. The Quadratus Lumborum Block (QLB) was described by R. Blanco[2] which provides sensory blockade of the abdominal wall extending from T6 to L1.[3] QLB has been used for postoperative analgesia following gynecological laparoscopic procedures [4,5] for open and laparoscopic nephrectomy.[6,7,8] There are no studies reported using only lateral QLB to alleviate pain and to provide effective post operative analgesia after laparoscopic cholecystectomy.

In our study we considered the QLB to alleviate pain and to provide effective post operative analgesia after laparoscopic cholecystectomy. The primary objective of this study was to determine the efficacy of Lateral QLB in reducing post operative pain scores upto 24 hour, after laparoscopic cholecystectomies. The secondary objectives were to evaluate the duration of analgesia, number of rescue analgesics required, level of sensory blockade achieved and adverse effects if any.

Patients And Methods:

This was a hospital based, clinically oriented, randomized study conducted from 11th November, 2017 to 16th September, 2018. Institutional ethical committee approval (RRMCH-IEC/87/2017-18) was obtained. Patients aged between 20 and 70 years belonging to American Society of Anaesthesiologists (ASA) grade I and II undergoing laparoscopic cholecystectomy were included. Patients with known hypersensitivity to local anaesthetic drugs, with bleeding disorders, pregnant women and those who were mentally unstable or unable to comprehend/use the Numeric Rating Score (NRS) for pain assessment, morbidly obese patients, those with severe respiratory, cardiac, liver or renal disorders and patients with infection at the site of injection were excluded from the study. The purpose, procedure and risk involved with the procedure was explained to all the patients and written consent was obtained. Simple randomization was performed by creating a computer generated table and the patients were allocated into QLB group (Group Q) or Control group (Group C) as per the table. All the investigators including the anaesthesiologist, surgeons, nurses, technicians and person collecting the data were blinded to the group allocation of the study. A study coordinator was responsible for enrolling patients, obtaining informed consent and requesting randomization.

All the patients were admitted as in-patients in the wards the previous day and were subjected to thorough pre-anaesthetic evaluation. Surgery was performed under general anaesthesia with standard ASA monitoring of Heart rate, Electrocardiogram, noninvasive blood pressure, arterial oxygen saturation, body temperature and end tidal carbon dioxide using Spacelabs Health care Multipara monitor. Inj Propofol 2-3 mg/kg, Inj Fentanyl 2 mcg/kg was used for induction. Inj Vecuronium 0.1 mg/kg was used for relaxation and the patients were intubated. Isoflurane 0.8 to 1.2 Minimum alveolar concentration (MAC) along with oxygen and nitrous oxide was used for maintenance of anaesthesia. Inj Paracetamol 1g was administered intravenously to all the patients.

Surgical procedure and Interventions: Surgery was performed by senior surgeons using four trocar tecnique. The intra abdominal pressure was kept between 12 to 14 mmHg in all the patients. All patients were intubated and the respiratory rate was determined to maintain the EtCO2 < 40mmHg. At the end of surgery after wound closure and before extubation, the block was performed under

ultrasound guidance (Sonosite Turbo, Bothell, WA, USA) [Figure 1a] by senior anesthesiologist. The patients were positioned in lateral position, linear ultrasound probe (5-10MHz) was placed in the anterior axillary line, mid way between the iliac crest and the costal margin to visualize the triple abdominal muscle layers [Figure 1b]. At the point where the transversus abdominis muscle ends and the quadratus lumborum (QL) muscle begins, a 23 gauge spinal needle (Quinke's needle) was inserted in plane such that it pierces the thoracolumbar fascia and its position was confirmed by injecting normal saline [Figure 2a and 2b].

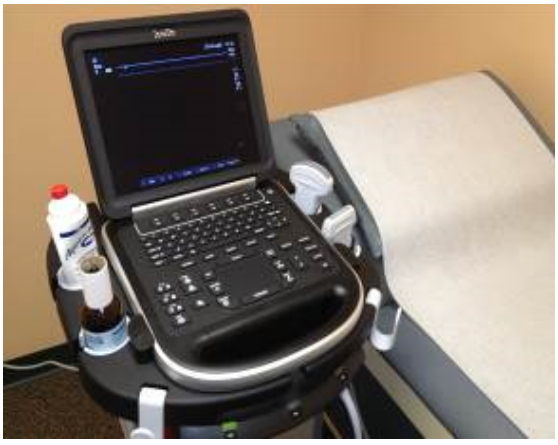


Figure 1a: Depicting The Ultrasound Machine Used.

Fig1b: Needle And Probe Placement While Administering The Block Respectively

Under ultrasound (US) guidance, and the hydrodissection with saline was observed. In patients belonging to Group Q, 20 ml of 0.375% Inj Ropivacaine not exceeding the toxic dose (3mg/kg body weight) calculated for each patient was injected. This procedure was then performed on the contralateral side. In patients belonging to C group, 20 ml of 0.9% saline was injected bilaterally. All the patients were then reversed with Inj Neostigmine 0.05 mg/kg + Inj Glycopyrrolate 0.01 mg/kg and extubated.

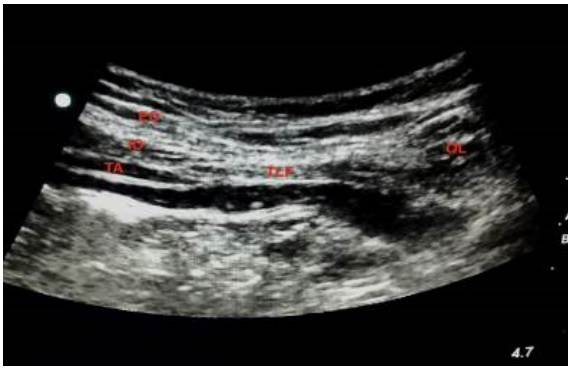
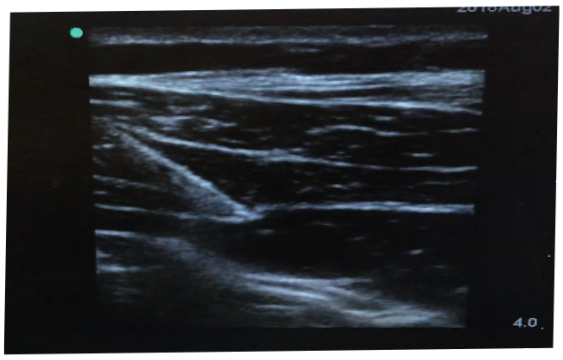


Figure 2a : The sonoanatomy of the junction between the lateral abdominal layers and the quadratus lumborum. EO : external obliquus, IO : internal obliquus, TA : transversus abdominis, TLF : thoraco lumbar fascia, QL : quadratus lumborum



2b : Needle Placement Before Hydrodissection.

Patients were observed by a resident anesthesiologist, who was not present at the time of administering the block performed the post-operative assessments in the post anaesthetic care unit (PACU), post operatively for 24 hours after surgery and then shifted to the wards with an Aldrete score of >/= 9. They were monitored for pain at 0(at the end ofsurgery30minutes),2,4,8,12 and 24 hours after the administration of the block in the PACU. Severity of pain was measured using the 10 point Numeric rating score (NRS 0 : no pain, 10 : worst imaginable pain). When the NRS was 4 or more, bolus dose of Inj Fentanyl, upto 1mcg/kg was administered intravenously as a rescue analgesic with an interval of at least 4 hours. If required additional 1gm of Inj. Paracetamol was also administered. The time to administration of the first rescue analgesic, the total number of rescue analgesics used along with side effects like nausea, vomiting, or respiratory depression if present were recorded. RR of < 10cpm was considered significant/ depressed.

Sensory level achieved was assessed using a cotton swab soaked in spirit and evaluating for perception of change in temperature at 0(at the end ofsurgery30minutes),2,4,8,12 and 24 hours after the administration of the block.

Statistical Analysis:

Based on outcome variables from previous literature[5] for pain assessment (using NRS) at 24 hours, with a mean difference of 0.4 and standard deviation of 0.33, 95% statistical power and 5% level of significance, a sample size of 38 with 19 patients in each group was required. We used a statistical formula to calculate the sample size:$N=2(Z\ alfa + Z[1\text{-}Beta])^2\ XSD^2\ /d^2$. To account for the possibility of missing data, we recruited 50 patients out of which 2 refused to participate and 24 patients were allocated in each group.

All data were collected in an MS excel sheet and statistical analysis was performed using the SPSS (Statistical Package for Social Sciences) software version 23. Mann Whitney U test was applied for comparing ordinal and continuous variables as Shapiro Wilk's test was applied to check the distribution of data. The values were expressed as mean +/- SD. Nominal/categorical data was compared between the two groups using the Pearson's Chi Square test. A P-value < 0.05 was considered as statistically significant.

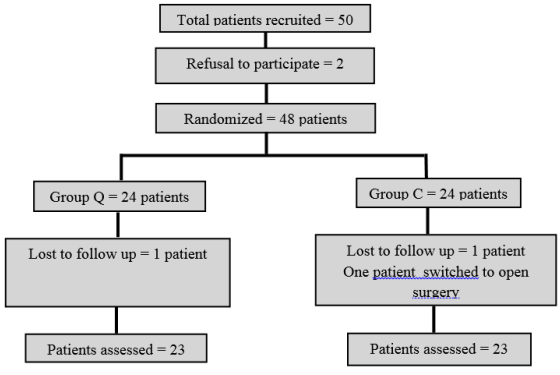


Figure 3 : Illustrates Consort Flowchart For Patient Recruitment.

RESULTS :

Table 1 depicts the demographic data of both the groups. Patients from both the groups were comparable with respect to age, gender, weight

and ASA classification with P values > 0.05.

We can see the comparison of NRS scores between the two groups at rest (Table 2) and with movements. When the NRS scores during rest and activity were examined, a statistically significant difference was identified between all of the measurement times in favour of the study group. The mean NRS score of C group was >4.1 at 0, 2, 4, 8, 12 and 24 hours and that of Q group always remained <2.5at rest. The mean NRS score of C group was >5 at 0, 2, 4, 8, 12 and 24 hours and that of Q group always remained <4 during movements. Upon applying the Mann Whitney U test, the Q group showed a statistically significant (P < 0.05) lesser pain scores as compared to group C at all time points of observation.

Table 1: Demographic Data Of Both The Groups. Q-QLB Group, C-Control Group, Data Are Presented As Percentages And Mean +/- Standard Deviation.

	Q Group N = 23	C Group N = 23	P value
Gender in %	47.8% female 52.2% male	46% female 54% male	1.000
Age in years (mean +/- SD)	42.22 +/- 12	42.26 +/- 6.743	0.739
Weight in kgs (mean +/- SD)	66 +/- 7.31	65.7 +/- 7.22	0.638
ASA I/II	46% / 54%	53 % / 47 %	0.396

Table 2: Q-QLB group,C-Control group. NRS-Numerical rating pain scale at rest, NRSM- Numerical rating pain scale on movements, SD = Standard Deviation, IQR = Interquartile range. Data were analysed using Mann Whitney U test and P<0.05 was considered significant.

	Group Q			Group C			
	Mean	SD	Median (IQR)	Mean	SD	Median (IQR)	P value
NRS at 0 hrs	2.260	0.915	2 (2-3)	5.74	1.176	6 (5-6)	0.000
NRSM at 0 hrs	3.36	1.096	3(2-4)	6.43	1.080	6(6-7)	0.000
NRS at 2 hrs	1.70	0.703	2 (1-2)	4.87	1.100	5 (4-6)	0.000
NRSM at 2 hrs	2.17	0.887	2(1-3)	5.52	1.442	6(4-6)	0.000
NRS at 4 hrs	2.13	0.869	2 (2-3)	5.74	1.176	6 (5-6)	0.000
NRSM at 4 hrs:	3.13	1.0583	3(2-4)	6.48	1.082	7(6-7)	0.000
NRS at 8 hrs	1.570	0.590	2 (1-2)	4.13	0.920	4 (3-5)	0.000
NRSM at 8 hrs	1.61	0.583	2(1-2)	4.70	1.020	5(4-5)	0.000
NRS at 12 hrs	2.170	0.834	2 (2-3)	5.74	1.176	6 (5-6)	0.000
NRSM at 12 hrs	3.13	1.0583	3(2-4)	6.26	1.137	6(6-7)	0.000
NRS at 24 hrs	1.390	0.499	1 (1-2)	3.96	0.706	4 (3-4)	0.000
NRSM at 24 hrs	1.61	0.583	2(1-2)	6.96	1.676	4(4-5)	0.000

The time at which the first dose of rescue analgesic was demanded by the patients in control group is the duration upto which the effect of block lasted. Once the patient complained of pain, the rescue analgesic was administered and monitoring was continued for 24 hours. The total number of rescue analgesic doses demanded by the patient in 24 hours was determined. This value gives us an idea about the fentanyl consumed by the patient.

In Table 3 we observe that the first analgesic requirement among three patients in Q group (15%) was twelve hours after surgery and the remaining 20 patients (85%) did not require any rescue analgesic indicating that QLB provided adequate analgesia lasting for twenty four hours in these patients. Inj Fentanyl was used as the rescue analgesic agent and was given in 1mcg/kg intermittent boluses to the 3 patients with NRS > 3.

In C group, the patients required an average of three doses of the rescue analgesic within the first twenty four hours after surgery. The first dose had to be given within three hours after surgery at 0 and 2 hours as the NRS scores were > 4.

Table 3: Time to administration of the rescue analgesic and average number of analgesic doses used among the groups. Q-QLB group,C-Control group , SD = Standard Deviation, N = number of patients

	Group Q		Group C		
	Mean	SD	Mean	SD	P value
Time to administration of the first rescue analgesic (in hours after surgery)	12 (N=3)	0.00	2.96 (N=23)	1.36	0.004
Total number of rescue analgesics	0.13	0.34	3.30	0.92	0.0001

There were no adverse reactions like nausea, vomiting, local anaesthetic systemic toxicity or respiratory depression noted among either of the groups. In Group Q, sensory level of analgesia as determined by perception of change in temperature (to a spirit soaked swab) was from T4 to L1 dermatomal levels bilaterally.

DISCUSSION:

This was a hospital based, randomized, double blind two arm comparative clinical study to find out the efficacy of lateral QLB in providing postoperative analgesia in patients who underwent laparoscopic cholecystectomies under general anaesthesia. When the NRS scores during rest and activity were examined, a statistically significant difference was identified between all of the measurement times in favour of the study group. Alleviation of postoperative pain after laparoscopic cholecystectomy by performing QLB was effective as the patients remained comfortable and did not complain of pain (Mean NRS < 2.5, P value <0.0001). Analgesia lasted for 24 hours in most patients (N=20, 85%) and they did not receive any opioid or analgesic.In our study adequate levels of sensory analgesia was achieved from T4 to L1 levels in Q group patients lasting for up to 24 hours in 85% of patients. No adverse reactions were encountered in any of the patients.

The QL muscle is a posterior abdominal wall muscle lying dorso-lateral to the psoas major muscle along the posterior abdominal wall. The thoracolumbar fascia (TLF) provides a retinaculum for the paraspinal and posterolateral abdominal wall muscles and it is along this fascia that the spread of drug occurs.[9,10] Posteriorly the drug spreads to the paravertebral spaces and acts on the nerves lying in that region. Anteriorly, it spreads such that it acts on the subcostal, iliohypogastric, and ilioinguinal nerves that pass between the QL muscle and transversalis fascia.[9]

Current literature on the QL block reports 4 different types/approaches. The lateral, anterior, posterior and the trans muscular variants. In our study we use the lateral QLB (QLB 1).[10] Here the local anesthetic injected, extends beyond the transversus abdominis plane (TAP) providing analgesia to anterior and posterior abdominal walls. Due to its technical ease and safer method of approach, QLB Type 1 was performed in our study.

The results observed in our study were similar to the results of J.Ishio and his collagues. They conducted a study to know the efficacy of ultrasound-guided posterior quadratus lumborum block (QLB) in treating postoperative pain following laparoscopic gynecologic surgeries and concluded that posterior QLB significantly reduces postoperative pain in movement and at rest following laparoscopic gynecologic surgery.[5] Similar findings were reported by Kadam[8] et al.,who used QL block under US guidance as the postoperative analgesia technique in a laparotomy case and recommended QL block for major abdominal surgeries.

Murouchi and colleagues demonstrated that lower peak arterial ropivacaine concentrations were noted after QL block as compared with those of lateral TAP block after 150 mg ropivacaine injection and did not lead to any adverse effect.[4] Large volumes of the drug used, ensures better spread into the paravertebral spaces above and below the level at which the drug is administered[11] Considering this, in our study we used 20 ml of 0.375% Inj Ropivicaine bilaterally (a total of 148 mg) to achieve analgesia.

In the study conducted by Hesham Elsharkwy et al., analgesia lasting upto 48 hours and a sensory level from T7 to L1 was demonstrated.[12] They conducted anterior QL block using liposomal bupivacaine. In our study we used ropivacaine and achieved sensory levels from T4 cranially upto L1 caudally, bilaterally, with an analgesia lasting 24

hours post surgeryin majority of patients. However, various studies have proven that the duration of analgesia achieved with this single shot technique exceeds expectations and lasts for more than 24 hours especially when a long acting local anaesthetic agent is being used.[3,12,13] A continuous infusion technique has recently been successfully used for many indications, including major colorectal surgeries, nephrectomy and kidney transplant.[14]

Though it seems similar to Transversus Abdominis Plane (TAP) block, the point of injection, the spread of drug, the levels of analgesia achieved and the duration of action vary widely from that of TAP block.[11,15] Studies have shown that the main advantage of QLB over TAP is that the wider spread of the local anaesthetic agent produces an extensive analgesia and prolonged duration of action.[8,9] Ultrasound guided TAP blocks might not be able to produce a sensory level above the umbilicus consistently unless a subcostal injection is added.[12] The localized effects of the TAP block have minor contributions to pain control in comparison with the analgesia achieved by extension into paravertebral space.[12]

Korgun Okmen and collagues investigated the effect of ultrasound-guided bilateral posterior quadratus lumborum block (QLB) and lateral QLB (Type I Block) on postoperative pain scores after laparoscopic cholecystectomy and found similar postoperative tramadol consumption values and VAS scores in the results of the study.[16,17] Though posterior QLB was successful in achieving a prolonged pain relief with a wider area of analgesic coverage, owing to the technical difficulty involved in using the technique, longer learning curve and increased incidence of complications, the lateral QLB was performed in our study and yielded satisfactory results.

As QLB performance involves manipulation of the fascia where blood vessels exit from the paravertebral space, caution should be exercised in people receiving anticoagulant therapy due to the possible risk of hematoma formation.

Lower-extremity muscle weakness after a QL block has been reported as a complication by Hironobu Ueshima et al. after a posterior and an anterior QL block. However, no such incidents have been reported with respect to lateral QLB.[18]

Since QLB is an inter fascial medication injection, the possibility of introducing an infection is far lower than in performing the neuraxial blocks. So far, infections have not been described during the QLB performance.

Needle trauma in terms of unintentional puncture of the peritoneum, intestine, liver, kidney, large blood vessels associated with blind methods (without ultrasound) could be overcome by performing the block under ultrasound guidance, with mandatory monitoring of the needle tip prior to injection of the drug.

We did not come across any complications due to the QLB technique in our study.

Limitations:

In obese patients with a thick layer of abdominal adipose tissue there may be technical difficulty. Hence patients with morbid obesity were excluded from our study. The shoulder tip pain caused due to diaphragmatic irritation, was not observed in any of the patients in this study, however it is not uncommon. It needs to be addressed if it occurs. and may require additional analgesic support.

Most of the patients in control group had NRS > 4 at all times and recieved intermittent doses of rescue analgesic (Inj Fentanyl) for pain with addition of another analgesic (Inj Paracetamol 1g) only in patients who had inadequate analgesia, as addition of another analgesic in both the groups would mask the effects of QLB.

The use of patient controlled analgesia" (IV PCA) to provide rescue analgesia post operatively would have been a better option as a steady state of analgesia could be achieved. However, owing to the economic constraints, the intermittent intravenous bolus method was opted.

CONCLUSION:

This study showed that type I QLB provides a sensory analgesia extending from T4 to L1 level and lasted 24 for hours in patients, thereby reducing the need for opioids and other analgesics for post-operative pain management after laparoscopic cholecystectomies. In our study we did not encounter any side effects. Type of best technical approach to do the QL block needs further validation and more randomized studies are also warranted.

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