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Efficacy of Posterior Quadratus Lumborum Block for Post-Operative Pain Management in Patients Undergoing Laproscopic Cholecystectomy

Aroosa Nawaz, Rabia Ashraf, Iram Shahzadi, Salman Iqbal, Adnan Ahmed Khan, Abid Khan

Department of Anaesthesia, Sheikh Khalifa Bin Zayed Al Nahyan Hospital/Combined Military Hospital, Muzaffarabad/ National University of Medical Sciences (NUMS) Pakistan

ABSTRACT

Objective: To evaluate the effectiveness of ultrasound guided posterior quadratus lumborum (QL) block against multimodal analgesics for post-operative pain in patients undergoing laproscopic cholecystectomy.
Study Design: Quasi-experimental study.
Place and Duration of Study: Sheikh Khalifa Bin Zayed Al Nahyan Hospital/Combined Military Hospital (SKBZH-CMH), Muzaffarabad, Pakistan, from Jan to Jun 2024.
Methodology: After seeking permission of hospitals ethical committee this Quasi-experimental study was performed with a sample of fifty patients undergoing laproscopic cholecystectomy. The Groups were named as Group Q and Group P after randomization. At the end of surgery, the patients comprising Group Q were given quadratus lumborum block and patients in Group P were given local wound infiltration of local anesthetic along with intravenous ketorolac 30mg. The primary outcome variable was time to first analgesic request.
Results: The mean time to first analgesic request (FAR) in Group Q patients was 9.26±2.21 hours and the mean time to first analgesic request (FAR) in Group M patients was 3.66±1.37 hours with p value of less than 0.001. There were 24(92.3%) patients who were satisfied with linker score greater than four in Group Q while only 2(7.7%) patients conveyed dissatisfaction. There were 9(37.5%) patients who were satisfied with linker score greater than four in Group M while 24(62.5%) patients were not satisfied with *p*-value <0.001.
Conclusion: We arrived at the conclusion that quadratus lumborum block prolongs the time to breakthrough pain in patients with laproscopic cholecyctectomy compared to intravenous multimodal analgesia.

Keywords: Breakthrough pain, ketorolac, Multimodal analgesia, Nalbuphine, Opioid and quadratus lumborum block.

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INTRODUCTION

Nociceptor activation following surgical stress triggers an emotional and hemodynamic reaction in patients, exacerbating their pain and discontent. Effective pain management following surgery prevents prolonged hospital stays and expenses of hospice, lowers morbidity, and improves surgical outcomes.[1] According to a careful estimate, over fifty percent of individuals undergoing any kind of surgery may have moderate to severe pain afterwards.[2] The laparoscopic cholecystectomies have been evolved rapidly overtime as these offer several advantages, including reduced pain after surgery, a shorter hospital stay, and quick recovery.[3] However there is a large number of patients who still experiences moderate to severe pain in the early postoperative phase even after this minimally invasive surgery probably due to stretch of nerve plexuses traversing the fascial planes of anterior abdominal wall due to pneumoperitonium.[4] Early rehabilitation by virtue of effective postoperative analgesia, early mobilization and early restoration of gastrointestinal function following surgery are critical to enhanced recovery after surgery (ERAS) specially when surgery is minimally invasive and is aimed as early convalescence. The successful management of post-operative pain is the principal factor which dictates the clinical recovery and affects the rest of parameters of ERAS.[5]

The transversus abdominis plane (TAP) block is the common interfascial plane block used in lower abdominal procedures like cesarean sections and appendectomies. It is widely used in laproscopic cholecystectomies for post-operative analgesia, but in some patients rectus sheath block is required with TAP block for complete analgesia which makes it less attractive options at times.[6] One of the novel block modalities that is being widely employed in abdominal surgeries is the quadratus lumborum (QL)

Correspondence: Dr Abid Khan, Department of Anaesthesia, SKBZH/ Combined Military Hospital, Muzaffarabad, Pakistan
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block. Like TAP block, various techniques have been devised to access the fascial plane surrounding quadratus lumborum muscle, such as the anterior, posterior, and lateral approaches.[7] The efficacy of TAP versus QL block is advocated to be equivalent by some authors.[8] Some authors have recommended that TAP block provides a superior analgesia to QL block for laproscopic cholecystectomy.[9] According to study of Merve Kacan *et al*., QL provided better analgesia than TAP block.[9] The posterior QL is considered better for laproscopic cholecystectomies by some authors.[10]

In our setup we mostly rely on multimodal intravenous analgesia in all patients with laproscopic cholecystectomy and we are in search of a good field block that can augment post-operative analgesia in our patients. Therefore, the rationale of our study is to measure the analgesic efficacy of posterior QL block which is novel to practice of anesthesia in Pakistan.

METHODOLOGY

After seeking permission of hospitals ethical committee (ERC number: 1138), this Quasi-experimental study was performed at anesthesia department of Sheikh Khalifa Bin Zayed Al Nahyan Hospital/Combined Military Hospital (SKBZH-CMH), Muzaffarabad Pakistan from January to June 2024. The sample size was calculated with the help of sample size calculator (WHO) by keeping level of significance 5%, power of test 80%, the anticipated time for first analgesia request with quadratus lumborum block to be 14±6.3 hours,[11] and the anticipated time for first analgesia request without quadratus lumborum block to be 0.8±0.4hours.[11] The minimal sample size came out to be 14 so we included 25 patients in each Group to account for any possible drop outs. The sample of 50 patients undergoing laproscopic cholecystectomy was collected with the help of non-probability consecutive sampling and randomization was achieved through sealed envelope technique. The Groups were named as Group Q and Group P after randomization (Figure).

Inclusion Criteria: Patients of either gender with American Society of Anesthesiology Class who were scheduled for laproscopic cholecystectomy under general anesthesia.

Exclusion Criteria: The patients booked for open cholecystectomy, patients who had coagulopathy or patients who were allergic to local anesthetic, patients with psychiatric disease, patients with BMI greater than 30 and gavid females were excluded from study.

All the patients recruited in the study were admitted through out-patient facility of surgery and they were thoroughly investigated with careful history, examination and labs. Patients who did not have any known comorbid were included to prevent bias. The randomization process was carried out at Operation Theater. After randomization all patients were given standard general anesthesia and standard monitoring was utilized in all patients. The dose of nalbuphine was kept constant in all patients that is 0.1mg per kilograms. Standard laproscopic cholecystectomy was performed in all patients with four ports. At the end of surgery, the patients comprising Group Q were given quadratus lumborum block and patients in Group P were given local wound infiltration of local anesthetic along with intravenous ketorolac 30mg. The Group Q patients were given QL block with help of an in-plane approach using a high frequency linear probe. A 10 cm long insulated 23-gauge needle was visualized and advanced through ab anterior-to-posterior trajectory. 20ml of Local anesthetic (0.25% bupivacaine) was injected along posterior border of quadratus lumborum into the fascial plane at interface of quadratus lumborum and erector spinae muscle.[12] The QL block was performed by an experienced consultant anesthetist in all the patients. In Group P patients the subcutaneous tissue at port-site of was infiltrated with local anesthetic with total 20ml of local anesthetic solution (0.25%). The patients were extubated after the surgery and shifted to post-anesthesia care unit. Following parameters were recorded in all patients including: Age, weight, height, BMI, gender and marital status. The primary outcome variable was time to first analgesic request. The frequency of satisfaction was measured using a six-point Linkert scale,[13] in which score greater than 4 meant the patient was satisfied and a Linkert score less than 4 meant patient was not satisfied.

The data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 26. Means were calculated along with standard deviation for quantitative variables and the frequencies with percentages were calculated for qualitative parameters. The primary outcome was the time to first analgesic request and secondary outcome was patients' satisfaction measured by Linkert scale. The normality of data was checked through Kolmogorov-Smirnov test. The distribution was normal with *p*-value>0.05. Chi-square analysis and independent samples t-test were the statistical tests used to find

significance. The *p*-value less than or equal 0.05 was considered significant.

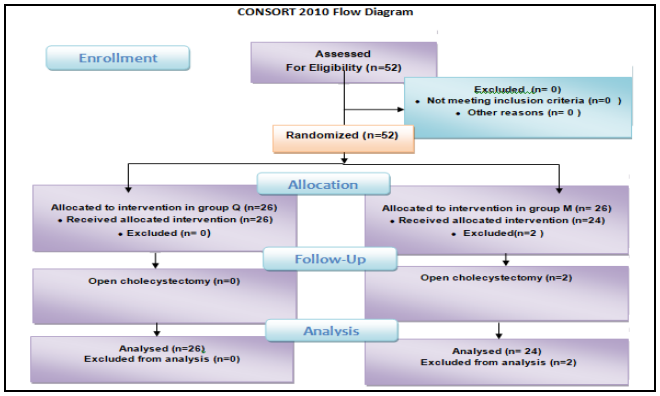

Figure: Patient Flow Diagram

RESULTS

The total number of patients in both Groups was 50. Two patients were dropped from Group M as laproscopic cholecystectomy was converted to open cholecystectomy due to adhesions. There was a total of 26 patients in Group Q and 24 patients in Group M. All fifty patients completed the study protocol. The demographics were comparable in both study Groups. The mean age of Group Q patients was 31.84±6.54 years, mean height was 163.03±6.89 cm and mean weight was 68.73±4.55 kilograms. The mean age of Group M patients was 35.25±11.55 years, mean height was 157.79±5.59cm and mean weight was 66.75±5.38kilograms. Two (7.7%) patients in Group Q had BMI of 18-20 kg/m^2, 7(26.9%) had BMI of 21-25 kg/m^2 and 17(65.4%) patients had BMI of 26-30 kg/m^2. One (4.2%) patient in Group Q had BMI of 18-20 kg/m^2, 11(45.8%) had BMI of 21-25 kg/m^2 and 12(50.0%) patients had BMI of 26-30 kg/m^2. There were 16(61.5%) males and 10(38.5%) females in Group Q. There was equal number of male and female patients in Group M that is 12(50.0%). Twenty-one (80.8%) were married in Group Q and 17(70.8%) were married in Group M. The demographics are presented in Table-I.

The mean time to first analgesic request (FAR) in Group Q patients was 9.26±2.21 hours and the mean time to first analgesic request (FAR) in Group M patients was 3.66±1.37 hours with p value of less than 0.001. There were 24(92.3%) patients who were satisfied with linker score greater than four in Group Q while only 2(7.7%) patients conveyed dissatisfaction. There were 9(37.5%) patients who were satisfied with linker score greater than four in Group M while 15(62.5%) patients were not satisfied with *p*-value <0.001.

Table-I: Comparison of Demographic Characteristics Between Both Study Groups (n=50)

Demographic Characteristics		Group Q n=26 Mean±SD	Group M n=24 Mean±SD	*p*-value
Age (years)		31.84±6.54	35.25±11.55	0.198
Weight (kilograms)		68.73±4.55	66.75±5.38	0.163
Height (cm)		163.03±6.89	157.79±5.59	0.437
		n (%)	n (%)	0.364
Gender	Male	16(61.5)	12(50.0)	0.296
	Female	10(38.5)	12(50.0)	
Body Mass Index (kg/m2)	18-20	2(7.7)	1(4.2)	0.367
	21-25	7(26.9)	11(45.8)	
	26-30	17(65.4)	12(50.0)	
Marital Status	Married	21(80.8)	17(70.8)	0.312
	Un-married	5(19.2)	7(29.2)	

Table-II: Time to First Analgesic Request and Patient Satisfaction in Patients of both Groups (n=50)

		Group Q n=26	Group M n=24	*p*-value
Mean Time to First Analgesic Request (FAR) hours		9.26±2.21	3.66±1.37	<0.001
Frequency of Satisfaction	yes	24(92.3%)	9(37.5%)	<0.001
	no	2(7.7%)	15(62.5%)	

DISCUSSION

Our study proved that quadratus lumborum block prolonged the time to breakthrough pain for a considerably longer period compared to multimodal analgesia comprising intravenous pain killers and local infiltration. Although laproscopic cholecystectomy is considered to be quick surgery and it is thought that multimodal analgesia would suffice but in reality, is far from true. Some patients develop breakthrough pain in post-anesthesia care unit as one patient in Group M developed pain in recovery room and he was given rescue analgesia. In resource limited setups an absolutely pain free patient in immediate post-oeprative period is at risk of over sedation and respiratory compromise due to tongue fall. According to Jie Luo *et al.*, the pain management is not satisfactory in a significant number of patients who shoud be given perineural analgesia or patient-controlled analgesia if available.[14]

The metanalysis performed by Uppal Vishal *et al.*, made a thorough review of effectiveness of QL block for post-operative analgesia. They compared imaging

guided QL block to multimodal analgesia and placebo comprising data from forty-two trials. They demonstrated that QL block was better to placebo in abdominal surgeries and arthroplasties of hip joint but in cesarean it offered little benefit.[15] We found that QL block was reliable probably due to the fact that we used posterior approach in all patients. They did not specify the approaches they study separately for all surgeries which can be a possible source of bias in their study. The posterior QL block spreads the local anesthetic in injected local anesthetics to fascia surrounding thoracolumbar region and transversus abdominis plane which makes it more reliable than anterior and paramedian QL block.[16] According to Aya Hisham Moussa Ahmad *el al*., the posterior approach is devoid of side effects and provides reliable analgesia without any known complications. It can also be used in pediatric patients safely due to its less invasiveness.[17]

Although there are other neuraxial pain management treatments, such as epidural anesthetic, their frequency of hypotension, allergic responses, and need for constant monitoring adds to the hospital's resource burden. The QL block requires more dexterity than TAP block but it had better dermatomal spread than TAP block. This could be explained by the fact that quadratum lumborum block's targets deeper plane, which offers superior analgesia due penetration into paravertebral space and thoracolumbar fascia.[18]

The analgesia provided by QL block lasted for almost nine hours in our patient while Chilkoti *el al*.,[19] reported it to be around 12 hours. The possible reason for this extended duration is due to slow local anesthetic's dispersion over the facial planes and its sluggish absorption through vascular channels. Therefore, its extended duration makes intravenous analgesia a less attractive alternate.

The patients coming for surgery are mostly those Groups of the population who are exposed to a number of painkillers before coming to operation theatre. They are liable to be refractory to some known NSAIDs and intravenous paracetamol. The pain threshold is increased in most such patients, and they do not get satisfied with seemingly potent analgesics like nalbuphine and ketorolac. Although QL block can be employed for patients undergoing laproscopic cholecyctectomies but it should be meticulously used in patients who have history of frequent pain killer use.

CONCLUSION

We arrived at the conclusion that quadratus lumborum block prolongs the time to breakthrough pain in patients with laproscopic cholecyctectomy compared to intravenous multimodal analgesia.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

AN & RA: Data acquisition, data analysis, critical review, approval of the final version to be published.

IS & SI: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

AAK & AK: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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