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ORIGINAL ARTICLE

A prospective observational study of the impact of the quadratus lumborum block (QLl1B) on post operative pain after laparoscopic ventral hernia repair

Amrita Patkar,[1,*] Neha Kalwadia,[1] Ojas Potdar,[2] Rajendra Sonawane[3] and Harshal Wagh[4]

[1]*Registrar, Department of General Surgery, Kokilaben Dhirubhai Ambani Hospital, Andheri West, Mumbai 400053*
[2]*Registrar, Department of Urology, Kokilaben Dhirubhai Ambani Hospital, Andheri West, Mumbai 400053*
[3]*Consultant, Department of General Surgery, Kokilaben Dhirubhai Ambani Hospital, Andheri West, Mumbai 400053*
[4]*Consultant, Department of Anaesthesiology, Kokilaben Dhirubhai Ambani Hospital, Andheri West, Mumbai 400053*

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Abstract

Aims & Objectives: To evaluate the outcome of addition of a pre operative quadratus lumborum type 1 nerve block (QL1B) in an elective laparoscopic ventral hernia repair.

Material and Methods: Prospective, observational, single-center study with patients scheduled for elective laparoscopic ventral hernia repair. After taking informed consent, patients underwent Laparoscopic IPOM (Intra Peritoneal Onlay Mesh) Repair of the hernia with mesh fixed using tackers. Preoperative QL1 Block was given to all patients after induction of anaesthesia. Pain scores at 2-, 6-, 12-, and 24-hours post-surgery were noted using a visual analogue scale (VAS). The need for rescue analgesics and total requirement of analgesics postoperatively was noted.

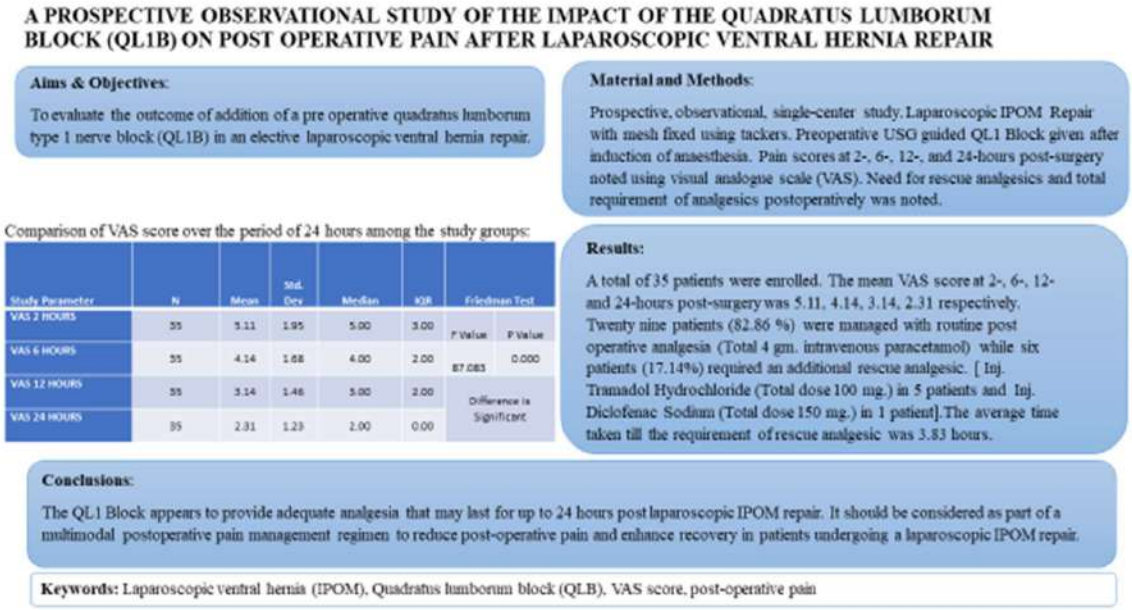
Results: A total of 35 patients were enrolled for the study. The mean VAS score at 2-, 6-, 12- and 24-hours post-surgery was found to be 5.11, 4.14, 3.14, 2.31 respectively. Twenty nine patients (82.86 %) were managed with routine post operative analgesia (Total 4 gm. intravenous paracetamol) while six patients (17.14%) required an additional rescue analgesic. [Inj. Tramadol Hydrochloride (Total dose 100 mg.) in 5 patients and Inj. Diclofenac Sodium (Total dose 150 mg.) in 1 patient].The average time taken till the requirement of rescue analgesic was 3.83 hours.

Conclusions: The QL1 Block appears to provide adequate analgesia that may last for up to 24 hours post laparoscopic IPOM repair. It should be considered as part of a multimodal postoperative pain management regimen to reduce post-operative pain and enhance recovery in patients undergoing a laparoscopic IPOM repair.

Keywords: Laparoscopic ventral hernia (IPOM), Quadratus lumborum block (QLB), VAS score, post-operative pain

Corresponding author: Amrita Patkar
Email: amrita26m92@gmail.com

Graphical Abstract



Introduction

A hernia is an abnormal protrusion, bulge, or projection of an organ or part of an organ through the body wall that normally contains it [1].

Ventral hernias occur anteriorly including primary ventral hernias (epigastric, umbilical, Spigelian), parastomal hernias, and most of the incisional hernias (ventral incisional hernias). They may be repaired with sutures, mesh, or advanced techniques such as component separation. Simple sutured repair is performed using an open approach while mesh repair and component separation may use open, laparoscopic or robotic techniques [2].

Mesh may be placed above the fascia (onlay), between the rectus muscles and peritoneum/posterior rectus sheath (sublay), below the peritoneum (underlay or intraperitoneal onlay [IPOM]), or in between fascial edges (inlay). The onlay and sublay techniques use an open surgical approach, whereas underlay (IPOM) technique may be open or laparoscopic. The inlay technique bridges the fascial defect with mesh and is used only when the fascial defect is too large to primarily close with any other techniques [3,4,5].

Laparoscopic ventral hernia repair involves placement of a mesh in an underlay/IPOM position which is fixed to the anterior abdominal wall with transfascial sutures, tacks, or a combination of the two.

This is a commonly performed procedure associated with significant postoperative pain. This leads to increased morbidity and a delayed postoperative recovery with prolonged hospital stay, thus negating the benefits of short hospital stay and early return to normal activities offered by laparoscopy [6,7,8]. Persistent unrelieved postoperative pain is associated with complications like hypoxemia, pulmonary atelectasis, deep vein thrombosis, and delayed ambulation [9,10,11,12].

Postoperative pain is managed with intravenous (IV) and oral analgesics, however, these have their own risks, such as nausea, sedation, respiratory depression, constipation, increased bleeding, kidney or liver dysfunction.

Peripheral nerve blocks may help reduce this post-operative pain and facilitate an early return to daily activity. If these blocks are

given pre operatively, the intraoperative anaesthetic and analgesic requirements, especially of opioid analgesics may be reduced leading to early recovery and reduced opioid side effects. The use of regional anaesthetic blocks like the transversus abdominis plane (TAP) block has been shown to reduce post-operative pain and facilitate an early recovery [13].

The quadratus lumborum (QL) block involves injection of local anaesthetic (LA) in a fascial plane formed partly by the posterior surface of the QL muscle under ultrasound guidance. It has been shown to produce anaesthesia of the anterior abdominal wall in the T7 to L1 dermatome distribution. Compared with ultrasound-guided TAP blocks, QL blocks can cover more extensive dermatomes with better cephalad and posterior spread. QL blocks may provide both visceral and somatic analgesia, likely due to paravertebral and possibly epidural spread[14,15].

There is insufficient data available for the correlation of quadratus lumborum blocks and their effects in laparoscopic ventral hernia repair surgeries. There is also a lack of Indian studies available on the impact of these regional anaesthetic blocks on post-operative recovery following laparoscopic ventral hernia (IPOM) repair.

This study aims to evaluate if the addition of the quadratus lumborum peripheral nerve block (QL1 block) pre operatively can decrease post-operative pain scores up to 24 hours and decrease the overall need of post-operative analgesics.

Patient and Methods in Clinical Studies

A prospective, observational, single center study was conducted at Kokilaben Dhirubhai Ambani Hospital and Medical Research Institute from 31st August 2020 to 31st May 2021.

Inclusion Criteria:

Patients of either sex, 18 years and above, ASA class 1-3, scheduled for elective laparoscopic ventral hernia repair who voluntarily agreed to sign informed consent form.

Exclusion Criteria:

Patients known or believed to be pregnant; with significant renal, hepatic disease; ASA class 4-5; known hypersensitivity and/or allergies to local anaesthetics or emergency/complicated surgery in view of obstruction/perforation of bowel.

Procedure followed:

Patients were admitted one day prior to surgery and pre-operative evaluation done. After taking written informed consent for surgery and pre-operative QL1 block, patients underwent Laparoscopic Ventral Hernia Repair (IPOM) under general anaesthesia. Standard ASA monitoring of heart rate, electrocardiogram, noninvasive blood pressure, pulse oximeter and end tidal carbon dioxide with anaesthesia gas analyzer used.

Inj. Propofol 2-3 mg/kg and Inj. Fentanyl1- 2 mcg/kg used for induction of anaesthesia. Muscle relaxation achieved by Inj. Atracurium or Inj. Cisatracurium. Sevoflurane or Desflurane with oxygen and air was used for maintenance. Inj. Paracetamol 1g. was administered intravenously to all patients.

Under all aseptic precautions, a pre-operative quadratus lumborum 1 block under ultrasound guidance was given, after induction of anaesthesia, with patient in supine position. A linear ultrasound transducer (6 to 18 Hz) (Sonosite™ Turbo probe, Bothell, WA, USA) was placed in axial plane at midpoint between costal margin and iliac crest, in the mid axillary line.

The external oblique, internal oblique (IO), transversus abdominis (TA) muscles, and the peritoneal cavity were visualized, muscles traced laterally until a tail was seen where the TA merges with the IO, becoming the transversalis fascia. The QL muscle was identified deep to the transversalis fascia.

At the point where the transversus abdominis muscle ends and the quadratus lumborum (QL) muscle begins, a 22-gauge, 100- to 150-mm echogenic needle was inserted in-plane in medial to lateral direction until the needle tip penetrates the posterior aponeurosis

of the transversus abdominis muscle. Position was confirmed by injecting normal saline between the aponeurosis and TLF at the lateral margin of the QL muscle.

After negative aspiration, 20 mL of 0.2% Ropivacaine was injected in 5-mL increments, with gentle aspiration between injections. Expansion of the fascial space visualized as LA was injected and quadratus muscle displaced downward. Similar procedure repeated on the opposite side. Totally 40 ml of 0.2% ropivacaine (20 ml. on either side) was used for the block. Maximum toxic dose of 2mg/kg of body weight was not exceeded.

All patients received Inj. Cefuroxime 1.5 gm. intravenous single dose perioperatively. Standard 3 trocar placement with 2 working ports (5 mm and 10 mm), one camera port (5 mm 30-degree standard laparoscope) and pneumoperitoneum created. Hernia sac was identified, adhesiolysis done, contents of hernia reduced.

A dual mesh of appropriate size as per size of defect was selected and fixed using double layer of permanent titanium tacks (double crown technique) delivered by ProTack™ 5mm (Autosuture, Tyco Healthcare, USA) device. Haemostasis checked, pneumoperitoneum evacuated, 10 mm camera port site sheath closed using synthetic absorbable surgical suture polyglactin No. 1, and skin incisions sutured using absorbable sutures.

All patients were given intravenous paracetamol 1 gm. 6 hourly as routine post-operative analgesia. NSAIDs were the primary rescue analgesics used, opioid analgesics being the next option if NSAIDs were contraindicated or pain relief was inadequate after the first dose of NSAIDs.

Measurement of outcome of interest:

1. Visual Analogue Scale for assessment of pain at 2, 6, 12 and 24 hours post-surgery.

2. In case of requirement of rescue analgesic, time till use of rescue analgesic (in hours).

3. Total requirement of analgesics in the post-operative period.

Results and Analysis

On analyzing the results using standard statistical analysis tools, the mean VAS score at 2-, 6-, 12- and 24-hours post-surgery was 5.11, 4.14, 3.14, 2.31 respectively which is lower than that observed in available historical data.

Out of 35 patients, 29 patients (82.86 %) required only routine post-operative intravenous analgesics; 6 patients (17.14%) required additional intravenous rescue analgesic (NSAIDs or opiates) for adequate pain relief.

Thus, within the first 24 hours of surgery, 29 of 35 patients (82.86%) received 4 gm. intravenous paracetamol; 1 of 35 patients (2.86%) received 4 gm. intravenous paracetamol and 150 mg. diclofenac sodium; and 5 patients (14.29%) received 4 gm. intravenous paracetamol and 100 mg. tramadol hydrochloride.

The average time taken till the requirement of rescue analgesic was 3.83 hours.

Table 1. Comparison of VAS score over the period of 24 hours among the study groups

Study Parameter	N	Mean	Std. Dev	Median	IQR	Friedman Test	
VAS 2 HOURS	35	5.11	1.95	5.00	3.00	F Value	P Value
VAS 6 HOURS	35	4.14	1.68	4.00	2.00	87.083	0.000
VAS 12 HOURS	35	3.14	1.46	3.00	2.00	Difference is Significant	
VAS 24 HOURS	35	2.31	1.23	2.00	0.00		

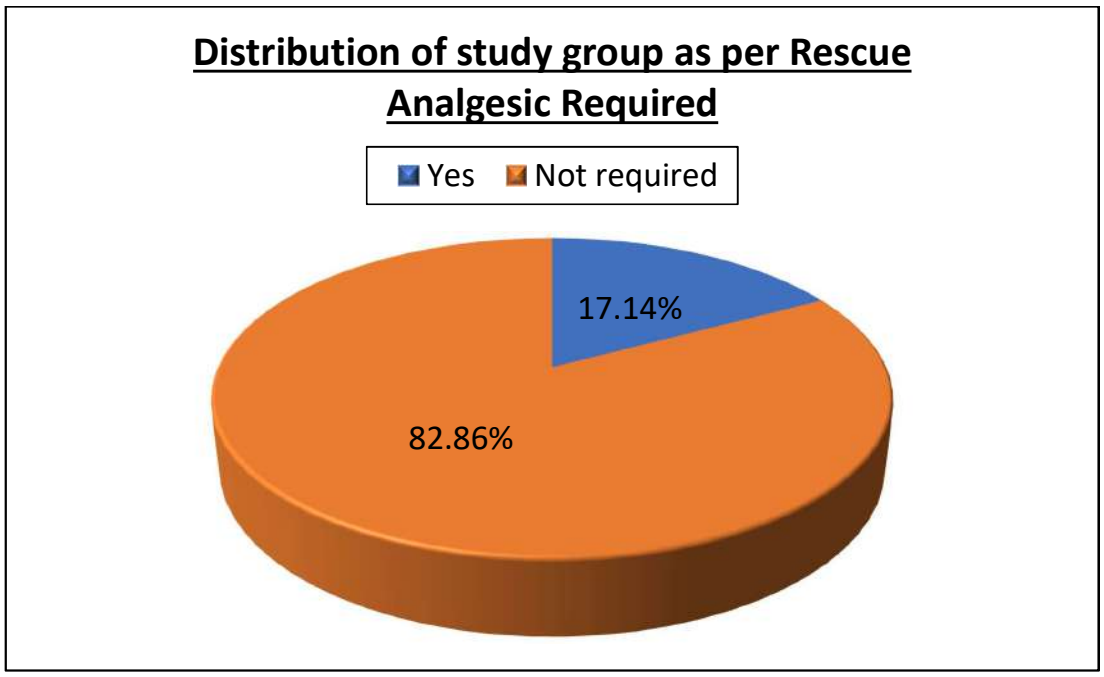


Figure 1. Distribution of study group as per requirement of rescue analgesic

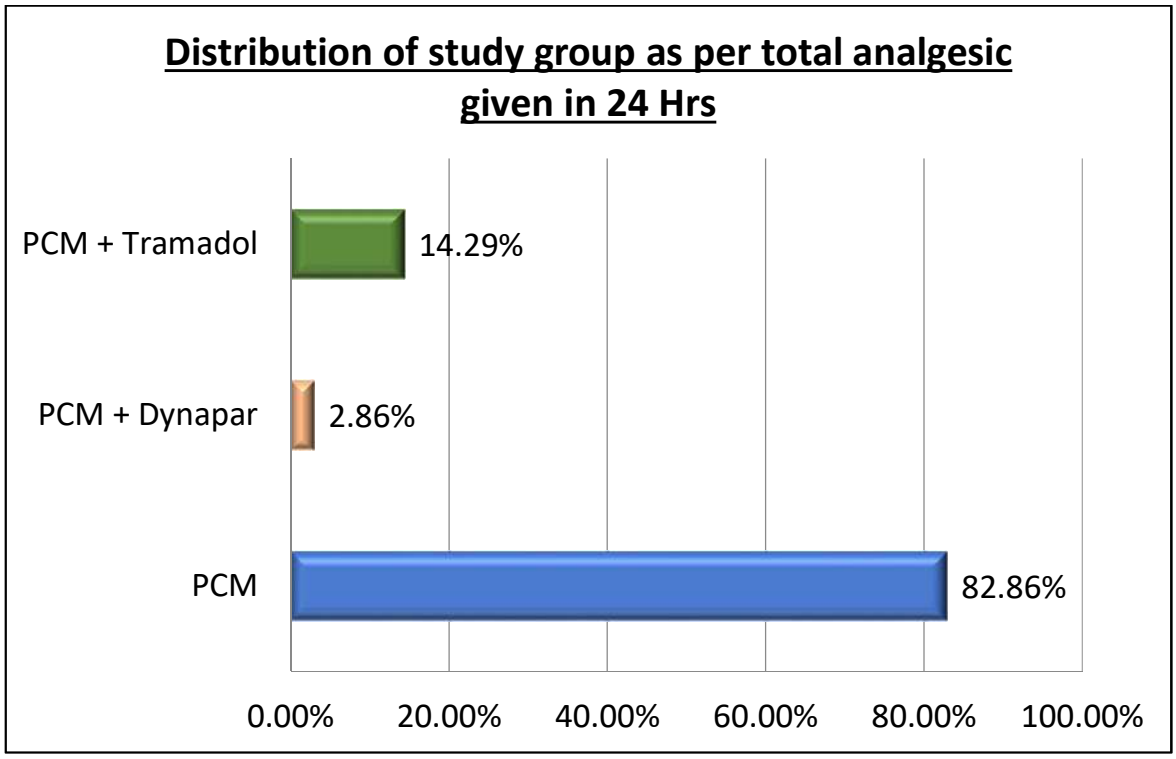


Figure 2. Total analgesic given in first 24 hours

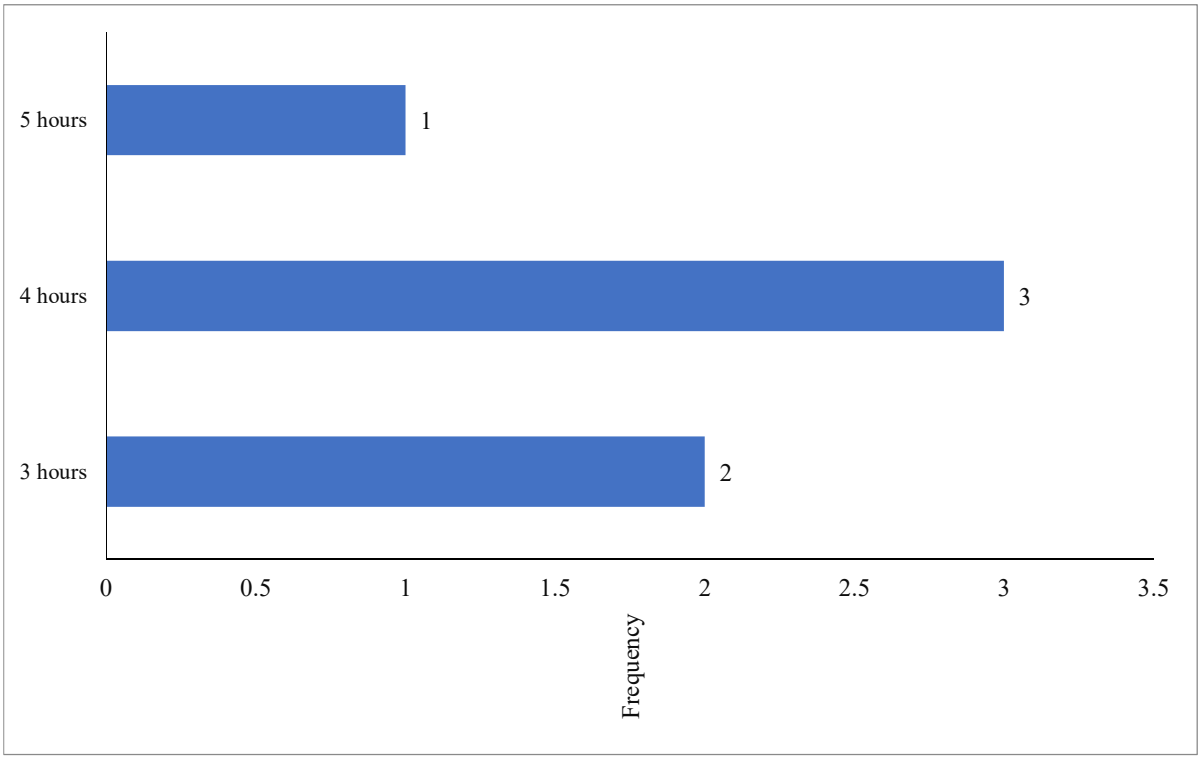


Figure 3. Time till rescue analgesic was required

Table 2. VAS score over 24 hours when classified according to patients who required rescue analgesics

	Required					Not required					Mann-Whitney U	P Value
	No	Mean	Std Dev	Median	IQR	No	Mean	Std Dev	Median	IQR		
VAS 2 HOURS	6	7.50	1.38	7.00	1.00	29.00	4.62	1.68	4.00	2.00	-3.196	0.001
VAS 6 HOURS	6	6.00	2.10	5.50	4.00	29.00	3.76	1.33	4.00	1.00	-2.466	0.014
VAS 12 HOURS	6	4.67	1.21	4.00	1.00	29.00	2.83	1.31	2.00	2.00	-2.866	0.004
VAS 24 HOURS	6	4.00	1.67	4.00	1.00	29.00	1.97	0.78	2.00	0.00	-3.442	0.001

Clinical Images (Figures 4-7):

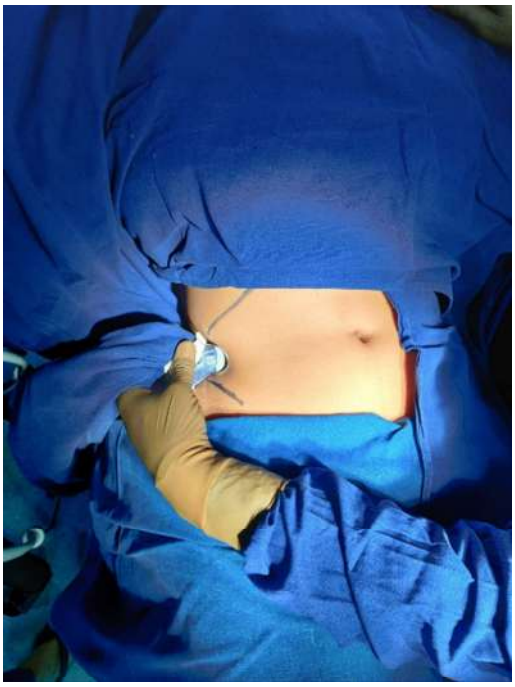


Figure 4. Probe position for QB type 1 block

Figure 5. Needle position for Ultrasound guided QL type 1 block

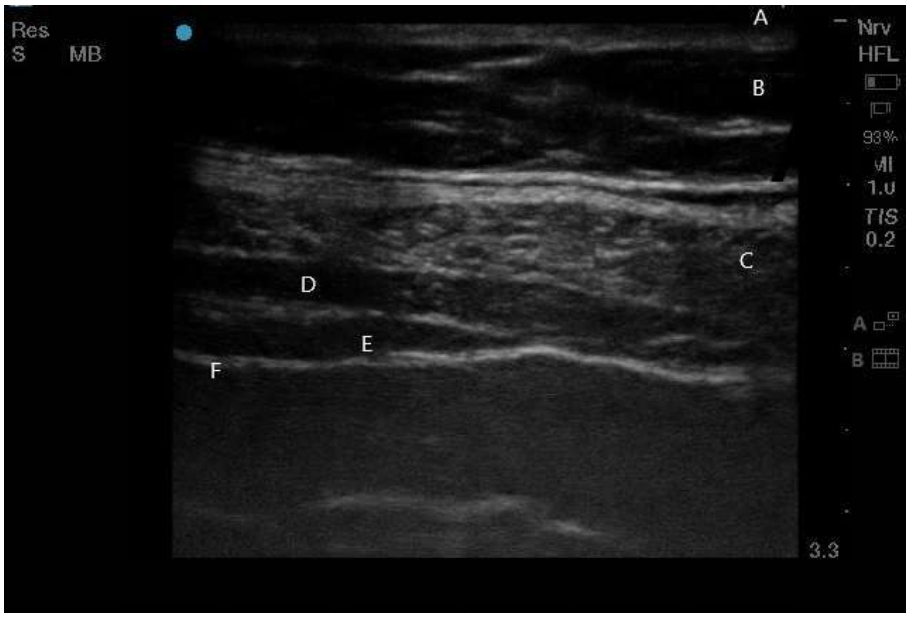


Figure 6. Normal anatomy visualized during QL type1 Block

A – Skin, B – Subcutaneous tissues, C – External Oblique, D – Internal Oblique, E – Quadratus Lumborum, F – Transversalis Fascia

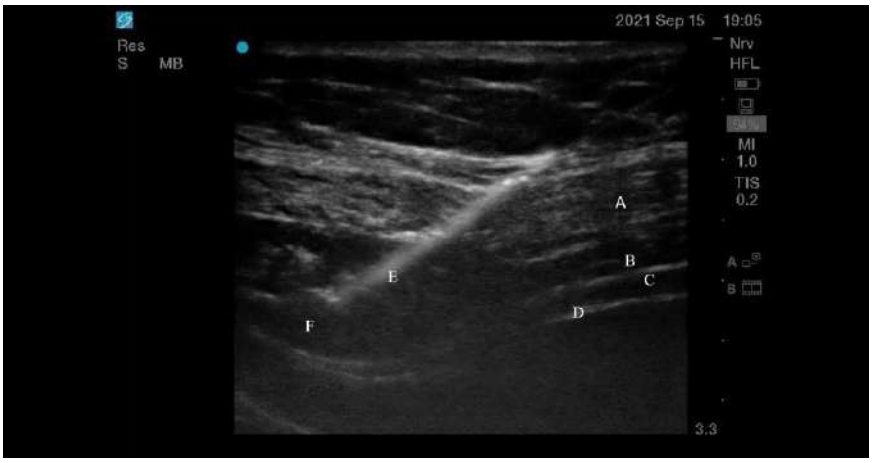


Figure 7. QLB1 block in progress

A – External Oblique, B – Internal Oblique, C – Quadratus Lumborum, D - Transversalis Fascia, E – Needle tip, F – Local Anaesthetic spread

Discussion

This was a hospital based, prospective, observational, single center study to evaluate the efficacy of an ultrasound guided Quadratus Lumborum type 1 Block in providing postoperative analgesia in patients who underwent an elective laparoscopic ventral hernia repair.

Current literature on the QL block describes 4 different types/approaches. The lateral, anterior, posterior and the trans muscular variants [16,17]. In our study we used the type 1 i.e., lateral QLB.

A total of 35 patients presenting with ventral hernias were enrolled in the study. Of these, 23 patients (65.71%) were females while 12 patients (34.29%) were males, indicating a female preponderance. This is similar to previous studies which suggest that ventral hernias occur more frequently in females than in males with a ratio of 3:1 [18].

The mean age of presentation of patients was 55 years. 24 out of 35 patients (68.57%) belonged to ASA II category, 9 patients (25.71%) were ASA I whereas only 2 (5.71%) was ASA III. 32 patients (91.43%) had no history of allergies to any medications. No patient had a history of allergy to any local anaesthetic.

The mean VAS score in our study at 2, 6-, 12- and 24-hours post-surgery was found to be 5.11, 4.14, 3.14, 2.31 respectively. When the VAS scores at 2-, 6-, 12- and 24-hours post-surgery were examined within the study group, a statistically significant difference was identified between scores at 2 hours and those at 6 hours, 12 hours and 24 hours.

The pain seen after a laparoscopic ventral hernia repair is largely related to mesh fixation techniques. Early post-operative pain is thought to be secondary to dissection in the area of mesh application. A large number of studies have been done comparing various mesh fixation techniques and their outcomes including early and chronic post-operative pain [19,20,21,22,23].

A randomized control study conducted by Bansal et al. compared the long-term outcome and quality of life after laparoscopic repair of incisional and ventral hernias with suture fixation with and without tacks [22]. In this study, mean VAS score at 1, 6 and 24 hours was observed to be 6.1 ± 1.7 (2–10), 5.6 ± 1.8 (1–10) and 3.9 ± 1.5 (1–8) in the group using transfascial sutures and tacker (double crown method). Persistently higher pain scores were seen in the patients who had undergone tacker mesh fixation as compared to those with only suture fixation.

A study conducted by Muysoms et al. [23] compared mesh fixation using the ‘double crown’ technique with fixation using sutures

and tacker. It showed a significant lower mean VAS score 4 hours post-operatively at rest and during coughing in the double crown group as compared to the group where both sutures and tacker were used (3.1 and 5.2 versus 4.4 and 6.8 respectively).

A randomized clinical trial by Eriksen et al. [20] comparing fibrin sealant and titanium tacks for mesh fixation in laparoscopic ventral hernia repair reported significantly lower pain scores during post-operative day (POD) zero to POD 10 when fibrin sealant was used.

A trial by Chawla et al. [24]studying the impact of mesh soakage with bupivacaine solution versus normal saline solution on post-operative pain found a statistically significant difference in mean VAS at 6 hours post surgery where bupivacaine solution was used (5.05 ± 1.2) compared to where normal saline was used (5.54 ± 1.1). However, mean VAS at 24 hours post operatively was not significantly different (3.16 ± 1.2 and 3.58 ± 1.4 respectively).

A simple way to prevent pain caused by fixation materials would be to use no fixation at all. A few studies have compared tacks versus no fixation, both in TEP repairs for inguinal hernias. There was a tendency towards less pain in the no fixation group[25,26].

VAS scores of the patients over 24 hours were compared among the study population when classified according to gender, ASA grade, reducibility and duration of hernia, whether the hernia was recurrent or a primary ventral hernia and as per requirement of rescue analgesic. There was no significant difference found in VAS score when patients were classified as per gender. The mean VAS score at 2, 6, 12 and 24 hours was 5, 4, 3.25 and 2.25 respectively in males and 5.17, 4.22, 3.09 and 2.35 respectively in females.

Mean VAS score at 2, 6, 12 and 24 hours was 5.27, 4.18, 3.09 and 2.27 respectively where duration of hernia was up to six months and 2.05, 1.70, 1.40 and 1.01 respectively when more than 6 months. The mean VAS score was observed to be lower in those with long standing hernias however the difference was not found to be statistically significant (p value > 0.05).

There was no statistically significant difference seen when VAS score was compared amongst patients with recurrent and primary ventral hernias. The mean VAS score at 2, 6, 12 and 24 hours was 4.68, 3.95, 2.86 and 2.14 respectively in patients with a reducible hernia and 1.63, 1.71, 1.56 and 1.61 respectively in those with irreducible hernias.

Although the mean VAS score was observed to be lower in those patients who had an irreducible hernia; the difference was not found to be statistically significant (p value >0.05). There was no statistically significant difference seen in VAS score when patients were classified as per ASA grade, however it was observed that ASA III patients appeared to have a higher pain score at all time intervals when compared to ASA 1 and ASA II patients.

The VAS score was significantly higher (p value < 0.05) in patients who required a rescue analgesic when compared to those who did not require one. The mean VAS score at 2, 6, 12 and 24 hours was 7.50, 6, 4.67 and 4 respectively in those who required a rescue analgesic and 4.62, 3.76, 2.83 and 1.97 respectively in those who did not.

Alleviation of postoperative pain after laparoscopic ventral hernia repair in patients given a preoperative QLB may be effective as majority of the patients remained comfortable. Analgesia lasted for 24 hours in most patients. Ishio and colleagues conducted a study [27] on the efficacy of ultrasound-guided posterior QLB in treating postoperative pain following laparoscopic gynaecologic surgeries and concluded that posterior QLB significantly reduces postoperative pain in movement and at rest.

A study conducted by Kadam et al.[28] used QL block under ultrasound guidance as the postoperative analgesia technique in a laparotomy case and recommended QL block for major abdominal surgeries. A study conducted by Hesham Elsharkwy et al., using anterior QL block with liposomal bupivacaine

showed analgesia lasting up to 48 hours and a sensory level from T7 to L1 [29].

Various studies have proven that duration of analgesia achieved with single shot technique exceeds expectations and lasts for more than 24 hours especially when a long acting local anaesthetic agent is used [30,29].

Although QLB 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 [28,31].

Studies show the main advantage of QLB is the wider spread of the local anaesthetic agent which produces an extensive analgesia and prolonged duration of action. QL blocks cover more extensive dermatomes and may also provide somatic and visceral analgesia likely due to paravertebral and possible epidural spread [14,15].

Ultrasound guided TAP blocks might not consistently produce a sensory level above the umbilicus unless a subcostal injection is added. The localized effects of the TAP block have minor contributions to pain control in comparison with analgesia achieved by extension into paravertebral space [29]. Studies have shown a reduction in 24-hour postoperative opiate consumption after administration of the quadratus lumborum block [32,31].

As QLB involves manipulation of the fascia where blood vessels exit from the paravertebral space, it should be used with caution in people receiving anticoagulant therapy due to risk of hematoma formation. Lower-extremity muscle weakness after 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 [33].

Needle trauma like unintentional puncture of the peritoneum, intestine, liver, kidney, large blood vessels associated with blind methods 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.

Epidural anaesthesia used to be considered the standard for perioperative analgesia, however a shift from open to laparoscopic surgery has diminished its advantages. Analgesia employing epidural techniques is often not clinically superior to its alternatives; is associated with a small but relevant number of serious complications; and has a relatively high failure rate[34].

Studies have shown less post-operative nausea and vomiting, decreased post-operative sedation, decreased length of hospital stay and earlier urinary catheter removal when abdominal trunk blocks are used [35]. Improved early oral intake and early mobilization are easily achieved with good pain control. Quadratus Lumborum Block has a great potential in this area of Enhanced Recovery After Surgery (ERAS) protocol.

Conclusion

This study showed that the quadratus lumborum type I block appears to provide adequate analgesia that may last for at least up to 24 hours post-surgery. In the majority of patients enrolled in the study, only the routine non opioid post-operative analgesic medications were required for adequate pain relief. In the setting of availability of adequate infrastructure and clinical expertise for giving safe and efficient regional anaesthetic blocks such as the quadratus lumborum block; and in absence of contraindications for the same, the practice of peri operative blocks may be included in routine practice to enhance the postoperative recovery of patients undergoing laparoscopic ventral hernia (IPOM) repair.

Conflicts of interest

The authors declares that they do not have conflict of interest.

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