

A COMPARATIVE STUDY BETWEEN ULTRASOUND GUIDED QUADRATUS LUMBORUM BLOCK (TRANS MUSCULAR APPROACH) VS ULTRASOUND GUIDED ERECTOR SPINAE BLOCK IN PERCUTANEOUS NEPHROLITHOTOMY SURGERIES FOR POST OPERATIVE ANALGESIA.

Dr. VK. SWAPNA, Dr. SWATHI GUNDLAKUNTA, Dr. GEETHA BHARGAVI

Dr. BATHENAPATLA SRIKANTH REDDY, Dr. B. HARI PRASAD REDDY

Dr. KRISHNA CHAITHANYA. KANDUKURU

Assistant Professor^{1,2}, senior resident³, postgraduate⁴, Professor^{5,6}.

Department of Anaesthesiology, Narayana Medical College Hospital, Nellore, Andhra Pradesh, India.

Corresponding Author: Name: Dr. V.K. SWAPNA

Address: General OT complex, 2nd floor, general hospital

Narayana medical college and hospital

Nellore

Abstract:

BACKGROUND: In percutaneous nephrolithotomy surgeries post operative pain due to dilatation of the renal capsule, the parenchymal tract and placement of the nephrostomy tube is distressing to the patient. Quadratus lumborum (QL) block and Erector spinae (ESP) block are two emerging myofascial plane blocks that leverage multimodal analgesia to improve postoperative pain control.

AIM: To compare the efficacy of ultrasound guided Quadratus lumborum block with 20 ml of 0.25% Bupivacaine and 8 mg Dexamethasone vs Erector Spinae block with 20 ml of 0.25% Bupivacaine and 8 mg Dexamethasone for post operative analgesia in patients undergoing PCNL surgeries under general anaesthesia.

METHODS AND MATERIALS: Sixty patients scheduled for percutaneous nephrolithotomy were randomly allocated into two groups QLB and ESPB groups, patients received unilateral (QLBIII or ESPB) respectively, with 0.3–0.4 ml/kg of bupivacaine 0.25%. The primary outcome was the Pain relief by using Visual Analogue Score (VAS), time for the first rescue analgesic (inj. tramadol 2mg/kg I.V), number of rescue analgesics in first 24 hours post operatively, total dose of opioid in 24hrs of post op period. The secondary outcomes were the Hemodynamic parameters, any adverse events in the post operative period.

RESULTS: Demographic parameters i.e., age and sex (only male patients were included) showed no significant differences in the two groups. The Mean time of first rescue analgesia

in group Q and group E was 486 ± 75 and 352 ± 67 mins. and p value of 0.02 was statistically significant. Number of patients required analgesia in 24 hrs of post op in group Q and Group E was 10 and 19, and p value of 0.001 was statistically significant. Total dose of opioid consumption (mg) 33.33 ± 40.46 and 96.44 ± 94.4 in group Q and Group E.

CONCLUSION: Ultrasound guided quadratus lumborum block provides better post operative analgesia than ultrasound guided erector spinae block in percutaneous nephrolithotomy.

Key words: Postoperative analgesia, quadratus lumborum block (QLB), Erector Spinae block (ESPB), Percutaneous nephrolithotomy, ultrasound guided.

INTRODUCTION

Percutaneous nephrolithotomy (PCNL) is a minimally invasive procedure for removing renal calculi that is associated with a high incidence of intense postoperative pain and chronic pain in the months following surgery.¹ The physiopathology of acute surgical pain is explained as pain mediated by inflammatory cell infiltration, activation of pain pathways in the spinal cord, and reflexive muscle spasm. During postoperative recovery, one of the three mechanisms of acute pain is typically alleviated. In some cases, the persistence of previous pain experiences and the activation of pain pathways leads to postsurgical chronic pain. The main sources of acute pain after PCNL are visceral pain originating from the kidneys and ureters and somatic pain from the incision site. Moreover, cutaneous innervation of the incision site is predominantly supplied by T10–T11 (T8–T12) because the incision site and tract for PCNL is usually used in the tenth to eleventh intercostal space, or in the subcostal area.² Regional anaesthesia techniques are commonly recommended for pain management because they reduce the need for parenteral opioids and improve patient satisfaction.

Erector Spinae Plane Block (ESPB) was first described in 2016 for analgesia in thoracic neuropathic pain, and despite its recent description in literature, it has also been widely used in both adults and children at different levels for indications such as thoracic surgery and breast surgery (T4-5), and upper abdominal surgery (T7-8).³

Quadratus Lumborum Block (QLB) is another popular regional anaesthesia technique. It has been used to alleviate postoperative pain following a caesarean section, laparotomy or laparoscopic procedure, or hip surgery. Various approaches for QL block^{4,5,6} are anterolateral aspect of the QL muscle (type I QLB), anterior aspect of the QL (type III QLB), posterior aspect of the QL muscle (type II QLB), intramuscular QLB (type IV QLB).

Here in, we compare the effectiveness of ultrasound guided quadratus lumborum block (trans muscular approach) vs ultrasound guided erector spinae block in percutaneous nephrolithotomy surgeries for post operative analgesia.

MATERIALS AND METHODS

Randomized observational double-blinded study was conducted from February 2022 to December 2022. After receiving informed written consent, the present investigation was carried out on 60 patients at Narayana Medical College and Hospital in Nellore. After receiving clearance from the institutional ethical committee (IEC/NMC/15/02/2022_8), this study was carried out with the participation of all patients who provided written informed consent.

Sample size: 60 patients (Two groups of 30 each).

We hypothesized that Ultrasound guided quadratus lumborum block provides better post operative analgesia than ultrasound guided erector spinae block in percutaneous nephrolithotomy. Sample size was calculated by keeping two-sided alpha error at 5% and power at 80% by using below formula Minimum of 23 patients were required for each group, for better validation 30 patients were selected in each group.

SUBJECTS

INCLUSION CRITERIA:

- Patients belonging to ASA 1 & 2 posted for PCNL surgeries.
- Patients between age group 18-60 years.
- Valid informed / explained consent

Exclusion criteria:

- Patient refusal.
- Patients with haemorrhagic diseases.
- Patients on anticoagulant therapy.
- Diseases and deformities of spinal cord.

METHODOLOGY: -

All participating patients were visited during preoperative planning to explain the technique, and to obtain informed written consent from each patient. During the physical examination, special attention was paid to recording vital signs, cardiac and chest symptoms, and excluding contraindications. Complete blood count, coagulation profile, blood sugar levels, serum electrolytes, liver and kidney function tests were performed on all patients. Patients were taught to rate their postoperative pain on a scale of 0 to 10, with 0 representing no pain and 10 representing the most severe pain. Prior to the operation, patients were kept nil per oral for 6 hours for solids and 2 hours for clear fluids.

On the day of surgery, Intravenous access was ensured when the patient entered the operating room with 18 G cannula, ASA standard monitors were connected and baseline parameters were registered. Preoxygenation with 100% O₂ (6 l/min of O₂ for 5 min) was carried out. Anaesthesia was induced using with inj. glyco10mic/kg, inj. midazolam 0.05mg/kg, fentanyl 2 µg/kg, propofol 2 mg/kg, endotracheal intubation was facilitated with atracurium 0.5 mg/kg. Anaesthesia was maintained with (O₂, medical air, Sevoflurane mixture). Lungs were ventilated using volume-controlled ventilation and the tidal volume and ventilation rate were adjusted to maintain end-tidal carbon dioxide concentration (EtCO₂) at 35–45 mmHg. Fentanyl was given intraoperatively as an additional bolus dose of 1 µg/kg with an increase in MAP or HR more than 20% from baseline values, atracurium 0.1 mg/kg every 20 to 40 min was given as maintenance of muscle relaxation.

Quadratus Lumborum block

Procedure: Patients undergo general anaesthesia, will be put in prone position.

The patient is in the prone position, an ultrasound probe is placed in a transverse, oblique, and paramedian orientation approximately lateral to the posterior axillary line. The needle is then inserted in-plane from the medial side of the transducer and advanced laterally to enter the interfascial plane between the Quadratus Lumborum muscle and the kidney. We confirmed that the local anaesthetic appeared to press down the kidney in the ultrasound image.

In case of Quadratus Lumborum block 1-3 ml of normal saline is injected to produce hydro-dissection and spread cranially between the QL and kidney. The corresponding ultrasonographic sign is a lunar-shaped hypo-echoic fluid collection observed between the long axis of the kidney and QL muscle. 20 ml Bupivacaine 0.25% and 8mg Dexamethasone is injected as shown in figure 1.

Erector Spinae Plain Block.

Procedure: Patients undergo general anaesthesia, will be put in prone position.

Using aseptic technique, an ultrasound probe is placed at the T9 vertebral level. After identifying the ribs and sliding towards the midline in a longitudinal parasagittal orientation, the overlying Erector Spinae is identified by visualization of the transition between the rib and transverse apophysis a block needle is inserted in plane with ultrasound beam and is advanced in a cephalo-caudal direction until the tip contacted the transverse process.

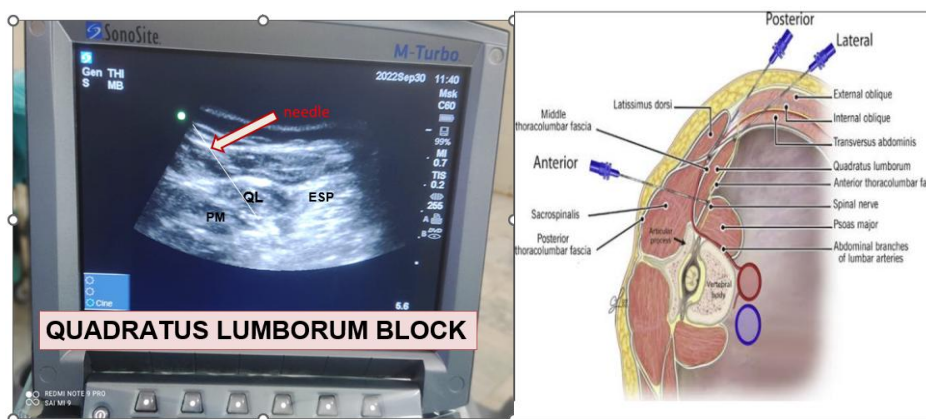
In case of the ESPB, the location of the needle tip is confirmed by hydro-dissection and after visualizing the fluid spread lifting the Erector Spinae off the transverse process, 20 ml Bupivacaine 0.25% and 8mg Dexamethasone is injected as shown in figure 2.

Muscle relaxant reversal with neostigmine 0.05-0.08 mg/kg and glycopyrrolate 0.01 mg/kg allowed the patient to awaken from anaesthesia, be extubated, and kept on O₂ in the postoperative anaesthesia care unit (PACU).

If the postoperative VAS score was 4 or more, an i.v bolus dose of 2mg/kg tramadol was administered.

Figure 1:

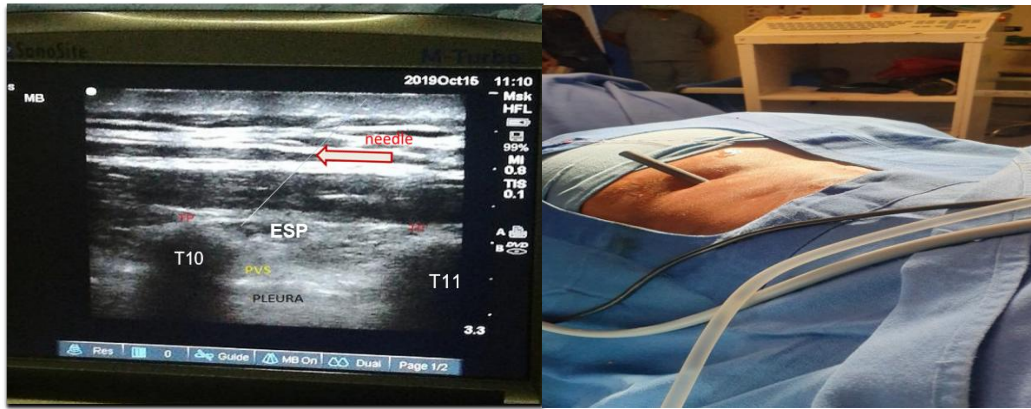
QUADRATUS LUMBORUM BLOCK



ERECTORSPINAE BLOCK

Figure 2:

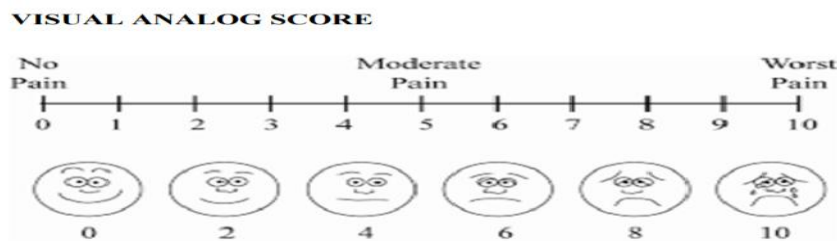
ERECTOR SPINAE BLOCK



DATA COLLECTION

In post operative ward, when a patient developed pain of VAS ≥ 4 , in a 10point scale (where 0, none; 10, very severe) as shown in figure 3, I.V Tramadol was administered at 2mg/kg in both the groups. The VAS scores were recorded at 30min, 2, 4, 6, 12 and 24 hours. The time of requirement of 1st dose of rescue analgesic was noted and it was taken as the duration of analgesia provided the two blocks. The total doses of analgesic required in 24 hours was also noted and compared between the two groups.

Figure 3:



STATISTICAL ANALYSIS

- MS Excel SPSS version 25 software was used to analyse all the data.
- Continuous variables were presented as mean and standard deviation.
- Proportions were compared by using Chi-square test.
- Statistical difference between both the study groups was determined by 'Student t Test'.

- P value <0.05 considered as statistically significant.

RESULTS:

A total of 68 patients scheduled for percutaneous nephrolithotomy under general anaesthesia, were assessed for eligibility to participate in this study, 8 patients were excluded. so the study included 60 patients randomized into two equal groups of 30 each as shown in the CONSORT flow diagram (figure 4).

CONSORT FLOW DIAGRAM:

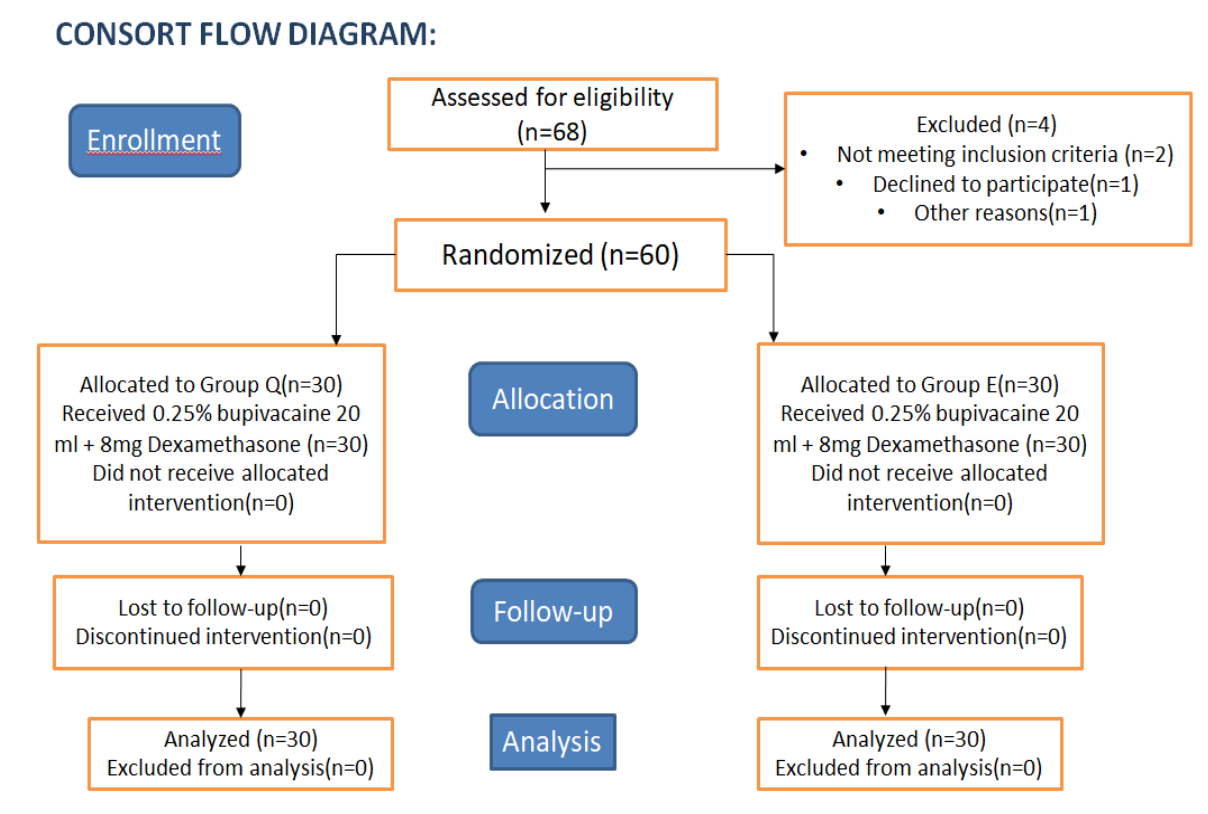


Table 1:

VISUAL ANALOGUE SCORE:

VAS	GROUP Q	GROUP E	P VALUE
30min	0.9±1.99	1.00±1.57	0.943

2hr	0.8±1.2	2.43±2.32	0.001
4hr	0.9±0.90	2.6±2.07	<0.001
6hr	1.93±2.0	2.133±1.52	0.673
12hr	1.86±1.38	2.067±1.70	0.619
24hr	1.633±1.09	1.66±1.12	0.908

The VAS scores at 2nd hr and 4th hr were 0.8±1.2 & 0.9±0.90 in group Q, where as in group E, it was 2.43±2.32 and 2.6±2.07 respectively which was statistically significant as shown in table 1

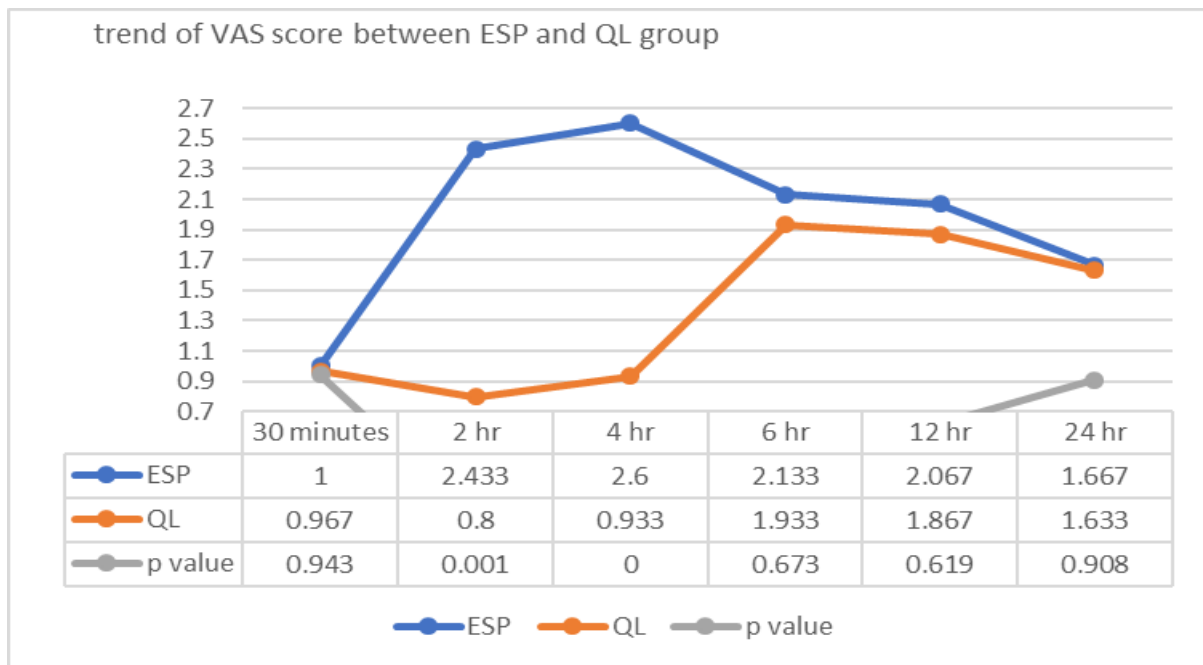


Figure 4. Mean time of first request of analgesia & Total dose of opioid consumption in 24hr post op

Table 2:

	Group Q	Group E	P value
Mean time of first rescue analgesia(mins)	486 ± 75	352 ± 67	0.02

No. of patients required analgesia in 24 hr of post op	10	19	0.001
Total dose of opioid consumption(mg)	33.33±40.46	96.44 ± 94.4	0.002

The Mean time of first rescue analgesia in group Q and group E was 486±75 and 352±67 mins and p value of 0.02, which was statistically significant. Number of patients required analgesia in 24 hrs of post op in group Q and Group E was 10 and 19 and p value of 0.001 which was statistically significant. Total dose of opioid consumption (mg) 33.33±40.46 and 96.44±94.4 in group Q and Group E which was statistically significant as shown in table 2.

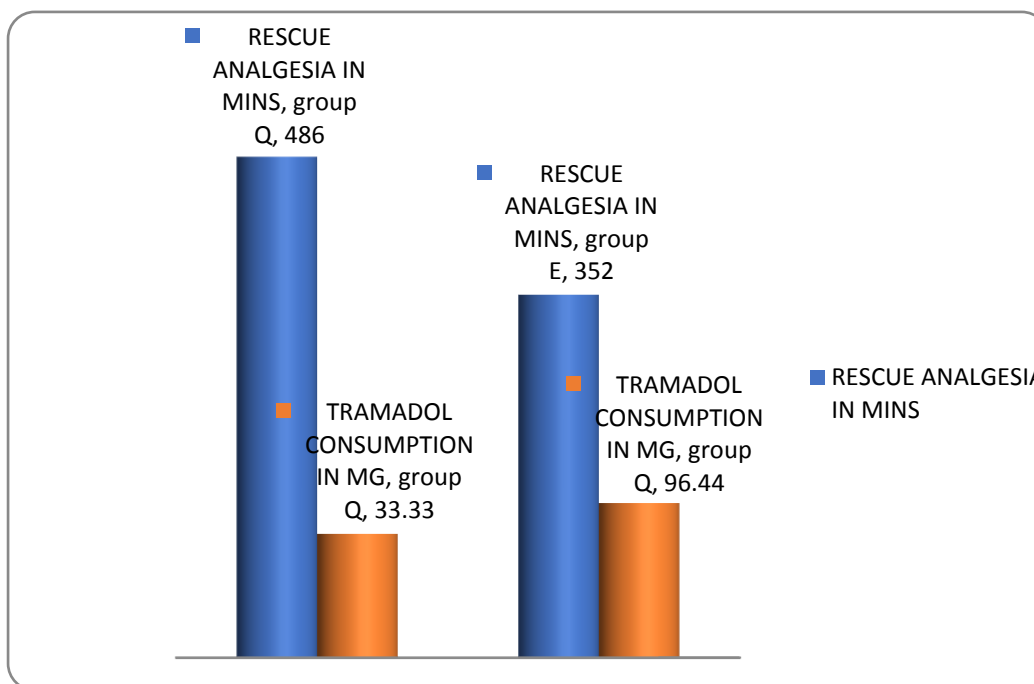


Figure5: Mean time of first request of analgesia & Total dose of opioid consumption in 24hr post op.

There was no significant difference in haemodynamic parameters and no significant side effects observed in both groups.

DISCUSSION

Since its first description in 2007 by Blanco et al⁷, quadratus lumborum block has grown in popularity as a technique for post-operative pain management. Postoperative pain management is a critical component of postoperative recovery (ERAS). Poor postoperative pain management limits ambulation and movement, increases

pneumonia, thromboembolism, wound dehiscence, chronic pain, and lengthens recovery time.⁸

The primary causes of acute pain following PCNL are visceral pain from the kidneys and ureters and somatic pain from the incision site. Renal pain is transmitted via the T10-L1 spinal nerves, while ureter pain is transmitted via the T10-L2 spinal nerves. Furthermore, because the incision site and tract for PCNL is usually used in the tenth to eleventh intercostal space, or in the subcostal area, cutaneous innervation of the incision site is predominantly supplied by T10-T11 (T8-T12).

QL block⁹ provides widespread (T4 to T12 or L1) and long-lasting (up to 48 h) upper and lower abdominal analgesia & can reduce opioid consumption and pain scores in patients. The true mechanism of analgesia provided by QLB has not yet been fully clarified. It is believed that the local anaesthetics spread along the TLF and the endothoracic fascia into the paravertebral space, is responsible in part for the analgesia.

The relatively safe profile of ESP block¹⁰, including the absence of major blood vessels and neural structures, can be advantageous to other invasive techniques such as thoracic epidural analgesia or paravertebral blocks. The mechanism of analgesic action of ESPB is reported to be through the spread of local anaesthetics into the paravertebral space and intercostal spaces at multiple levels, as well as the blockade of dorsal and ventral rami with sympathetic fibres, resulting in somatic and visceral pain relief.

There were studies comparing different techniques for postoperative analgesia in PCNL surgeries. But very limited literature is available comparing QL vs ESP block in percutaneous nephrolithotomy. Many authors compared either of these techniques individually in their studies. We are comparing these two blocks in PCNL surgeries.

Sarkar S et al (2022)¹¹ studied the effect of ultrasound guided lumbar ESP block on the postoperative pain scores after percutaneous nephrolithotomy. This study was done on 34 patients who were divided into 2 groups of 17 each. This study used 0.25% bupivacaine 20 ml for the lumbar ESP block. The 24-hour requirement of rescue analgesic Tramadol was 53.5 ± 29.6 mg.

In our study, same drug concentration was used for the lumbar ESP block. The 24-hour requirement of rescue analgesic Tramadol was 96.44 ± 94.44 mg in our study.

Shereen E. Abd Ellatif et al (2021)¹² compared Ultrasound guided erector spinae plane block versus quadratus lumborum block for postoperative analgesia in patient undergoing open nephrectomy. This study was done on 75 patients who were divided into 3 groups of 25 each. This study used 0.25% bupivacaine 20 ml each for both the lumbar ESP block & QL block. Time to first rescue analgesic was 281.2 ± 18.5 in QL block and 268.1 ± 13.8 in ESP block.

In our study, same drug concentration was used for both the QL block and lumbar ESP block. Time to first rescue analgesic was 486 ± 75 in QL block and 352 ± 67 in ESP block.

Though QL block has superior analgesic efficacy statistically, owing to its ease of technique and single level injection ESP block is also a good alternative for post operative analgesia.

CONCLUSION

Quadratus lumborum block(provided superior post operative analgesia compared to Erector spinae block due to its wider dermatomal distribution.

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