

## EVALUATION OF THE PREEMPTIVE ANALGESIC EFFICACY OF ULTRASOUND GUIDED QUADRATUS LUMBORUM BLOCK IN NEPHRECTOMY

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### ABSTRACT:

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**Background:** Nephrectomy is a particularly painful procedure especially the open type rather than the laparoscopic type. There are multiple techniques for postoperative pain management after nephrectomy; opioid therapy, neuraxial analgesia and Quadratus lumborum block.

**Aim of the study:** to evaluate the preemptive analgesic efficacy of ultrasound guided lateral quadratus lumborum block during the intraoperative period of nephrectomy regarding opioids sparing effect and at the early postoperative period regarding pain relief, early mobilization and opioids sparing effect.

**Patients and Methods:** This study included forty patients aging 18-65 years old, admitted to operating room in Ain Shams University hospitals for elective open and simple nephrectomy. The patients were divided into two equal groups, **Group 1:** The patients received general anesthesia with conventional pain management by intravenous opioids, **Group 2:** received preoperative unilateral ultrasound guided quadratus lumborum block using 0.4 ml/kg bupivacaine 0.25% combined with general anesthesia.

**Results:** The current study showed significant decrease of the opioid consumption in the patients of the quadratus lumborum block group in both the intraoperative and postoperative periods with less pain score compared to the patients of the opioid group.

**Conclusion:** Our results showed that the ultrasound guided quadratus lumborum block was an effective technique in providing preemptive analgesia in patients undergoing nephrectomy surgery. The patients who received QLB required less intraoperative and postoperative analgesic requirements, as well as postoperative rescue analgesia.

**Key words:** nephrectomy, quadratus lumborum block, analgesia.

### INTRODUCTION:

Nephrectomy is a particularly painful procedure because the subcostal wound is often long (10-12 cm in length) making breathing and coughing extremely painful. Inadequately controlled postoperative pain may have harmful physiologic and psychological consequences which potentially increase the morbidity and mortality. It is also

found that 20% of patients reported chronic postsurgical pain (CPSP) 6 months after nephrectomy<sup>(1)</sup>.

Quadratus lumborum block (QLB) was first described in 2007 by Doctor Blanco as a posterior approach to perform TAPB<sup>(2)</sup>.

QLB is an extension of the local anesthetic beyond the transversus abdominis

plane block spreading into the thoracic paravertebral space with the provision of both visceral and somatosensory blockade of the abdominal wall without the complications of the neuraxial blocks. Currently ultrasound guided QLB is performed as one of the perioperative pain management procedures with opioid sparing effect as well as rescue analgesia for different types of abdominal surgery<sup>(3)</sup>.

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### **AIM OF THE WORK:**

The aim of this study is to evaluate the preemptive analgesic efficacy of ultrasound guided lateral quadratus lumborum block during the intraoperative period of nephrectomy regarding opioids sparing effect and at the early postoperative period regarding pain relief and opioids sparing effect.

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### **PATIENTS AND METHODS:**

This randomized controlled study has been carried out in Ain Shams University Hospitals between January 2019 till January 2020 after approval of Research Ethics Committee (REC) at Ain Shams University and written informed consent from all the patients.

Eligibility of patients for the study included patients of both sexes age of 18-65 years, ASA physical status I-II, and undergoing elective unilateral nephrectomy.

#### **Exclusion criteria:**

Patients were excluded from the study if they had coagulopathy, severe organ impairment, localized infection at the proposed site of block injection and who were unable to comprehend the scoring systems to be employed due to physical or mental problems. In case we failed to perform the bloc; we replaced the patient with another one according to the randomized protocol.

Patients complying with all inclusion and exclusion criteria were randomly assigned to two equal groups 20 patients each.

#### **Group 1 (20 patients):**

The patients received general anesthesia with conventional pain management by intravenous opioids.

#### **Group 2 (20 patients):**

The patients received unilateral ultrasound guided quadratus lumborum block using 0.4 ml/kg bupivacaine 0.25% combined with general anesthesia.

#### **Study procedure:**

Routine preoperative assessment was done to all patients on the day before operation, including history, clinical examination, and laboratory investigations (complete blood picture, kidney function tests, liver function tests, prothrombin time, and partial thromboplastin time), chest X-ray (CXR) and electrocardiogram (ECG).

All patients were informed about the study design and objectives as well as tools and techniques. Informed consent was signed by every patient prior to inclusion in the study. All patients were informed about the analgesic regimen and were instructed on how to express pain intensity with use of the numerical rating scale; in which 0=no pain, 10 = the worst imaginable pain.

The American Society of Anesthesiology recommendations of basic monitoring; including Electrocardiogram (ECG), pulse-oximetry (SpO<sub>2</sub>), non-invasive blood pressure (NIBP) and capnography were applied to all patients, starting before anesthesia till end of surgery and then at the postoperative period.

Intraoperative hemodynamic measurements for all patients in the two groups included SpO<sub>2</sub>, heart rate, mean arterial blood pressure and capnography (EtCO<sub>2</sub>). Postoperative hemodynamic

measurements included heart rate and mean arterial blood pressure for all patients in the two groups.

### **Analgesic regimen:**

#### **Group 1:**

Patients of this group received general anesthesia (which will be discussed later) and then IV (Fentanyl 0.5-1 Mg/ kg) intraoperatively as required judging by the heart rate and the blood pressure and at postoperative period IV (nalbuphine 0.05-0.1 mg/kg) for pain score > 3.

#### **Group 2:**

Before induction, the patient is placed in the lateral position with the side to be anesthetized turned upwards. Skin preparation with povidone iodine solution is done, and a high-frequency linear probe is placed in the transverse plane at the area of the triangle of Petit. The transducer is then moved dorsally keeping the transverse orientation until the quadratus lumborum muscle is identified. The needle is inserted in-plane to the transducer and the tip of the needle is placed at the anterolateral border of the quadratus lumborum muscle at the junction of quadratus lumborum with the tranversalis fascia, and the local anesthetic is injected. It was confirmed via ultrasound that the local anesthetic is deep to the transversus abdominis aponeurosis.

Anesthetic Techniques for all patients in the two groups:

#### **Induction:**

Pre-medication was given in the form of midazolam (0.02 -0.04 mg/kg). on arrival to the operative room after establishing a peripheral intravenous access under complete aseptic conditions.

After pre-oxygenation for 3 minutes, general anesthesia was induced with IV fentanyl (1 µg/kg), IV propofol (2 mg/Kg), and IV atracurium (0.5 mg/Kg) to facilitate endotracheal intubation. After placement of endotracheal tube, intermittent positive

pressure ventilation of both lungs was applied (to maintain O<sub>2</sub> saturation >98% and EtCO<sub>2</sub> around 35-38 mmHg).

#### **Maintenance:**

Maintenance of anesthesia was obtained using intermittent positive pressure ventilation with inhalation of 1- 1.5% isoflurane in 50% O<sub>2</sub>/air and atracurium (0.1 mg/Kg every 30 minutes IV) to maintain muscle relaxation and 1 gram of paracetamol.

#### **Recovery:**

At the end of surgery, awake extubation of all patients, in a semi-sitting position, was done when the patient can follow verbal commands, sustain head lift, or hand grasp for 5 seconds, and achieve tidal volume of more than 6 ml/kg and respiratory rate of less than 35 breaths/min, with stable hemodynamics. Then, the patient was transferred to the post- anesthesia care unit (PACU).

All patients received at the postoperative period paracetamol 1 gm every 8 hours as a part of multimodal analgesia.

#### **Primary outcome:**

Cumulative opioids consumption in 36 hours in milligrams [ Time Frame: intraoperative then within the first 36 hours after surgery].

Pain scores every 2 hours measured by numerical rating scale (0 to 10) [Time Frame: within the first 36 hours after surgery].

#### **Secondary Outcome:**

Hospital length of stay.

#### **Statistical analysis:**

Statistical presentation and analysis of the present study was conducted, using the mean, standard Deviation, unpaired student t-test by (*IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.*).

**RESULTS:**

difference among groups with p-value > 0.05 (Table 1).

There was no statistically significant  
Table (1): Comparison of the two groups regarding demographic data.

| Demographic Data         | Group (QLB)<br>[N=20] | Group (control)<br>[N=20] | t/X <sup>2</sup> | P-value |
|--------------------------|-----------------------|---------------------------|------------------|---------|
| Age (years)              | 38.67±4.51            | 40.05±5.31                | 0.886            | 0.381   |
| Sex n (%)                |                       |                           |                  |         |
| Male                     | 7(35%)                | 9(45%)                    | 0.417            | 0.519   |
| Female                   | 13(65%)               | 11(55%)                   |                  |         |
| BMI (kg/m <sup>2</sup> ) | 25.19±1.16            | 24.97±1.29                | 0.567            | 0.574   |
| ASA status               |                       |                           |                  |         |
| ASA I                    | 14(70%)               | 17(85%)                   | 1.290            | 0.256   |
| ASA II                   | 6(30%)                | 3(15%)                    |                  |         |
| Surgical time in minutes | 109.28±25.7           | 112.5±23.64               | 0.412            | 0.682   |

Intraoperative fentanyl consumption was significantly lower in the QLB group than the control group (P value <.001) (table 2 and figure 1).

Table (2): Comparison between the two groups regarding Intraoperative Fentanyl (mcg).

| Group         | Intraoperative Fentanyl |   |    | T-test |         |
|---------------|-------------------------|---|----|--------|---------|
|               | Mean                    | ± | SD | t      | P-value |
| QLB group     | 60                      | ± | 10 | 8.485  | <0.001* |
| Control group | 120                     | ± | 30 |        |         |

Data are presented as mean ± SD.

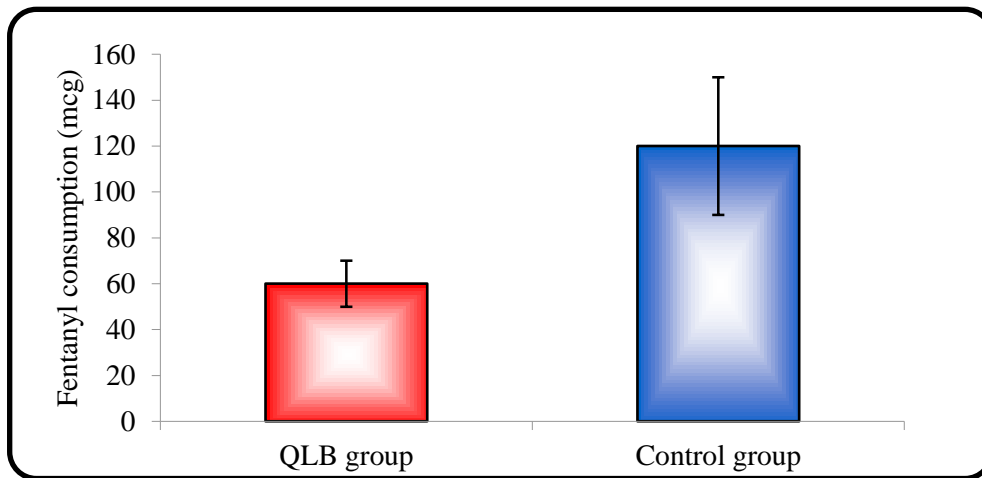


Figure (1): Bar chart of the Intraoperative Fentanyl between in two groups. Data are presented as mean ± SD.

Postoperative Nalbuphine consumption was significantly less in QLB group than the control group (P value <.001) (table 3 and figure 2).

Table (3): Comparison between two groups regarding Postoperative Nalbuphine (mg).

| Group         | Postoperative Nalbuphine |   |      | T-test |         |
|---------------|--------------------------|---|------|--------|---------|
|               | Mean                     | ± | SD   | t      | P-value |
| QLB group     | 4.00                     | ± | 3.08 | 14.671 | <0.001* |
| Control group | 15.75                    | ± | 1.83 |        |         |

Data are presented as mean ± SD.

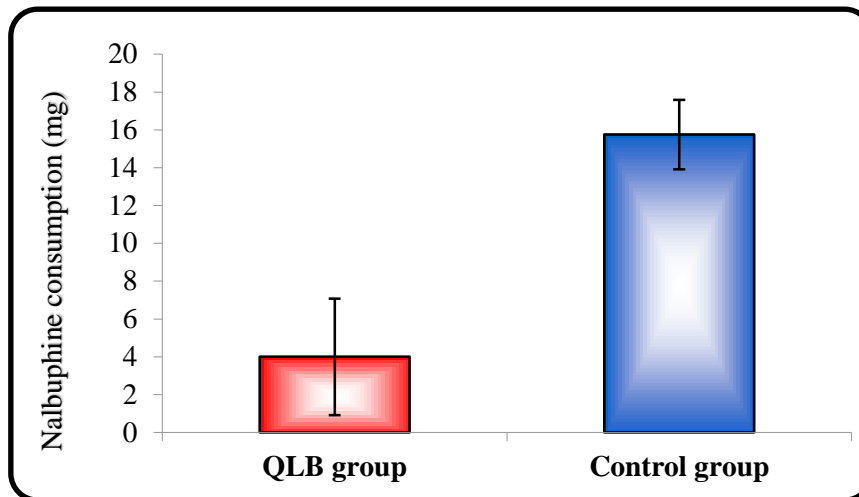


Figure (2): Bar chart of the dose of Postoperative nalbuphine (mg) in the two groups. Data are presented as mean  $\pm$  SD.

There was statistically significant difference between the two groups regarding Numeric rating scale for pain at 2, 4, 10hrs and 14hrs (p-value  $<0.05$ ) (table 4 and figure 3).

Table (4): Comparison between two groups regarding numeric rating scale (every 2 hours).

| Time (hrs.) | QLB group |       |      | Control group |       |      | T-test |            |
|-------------|-----------|-------|------|---------------|-------|------|--------|------------|
|             | Mean      | $\pm$ | SD   | Mean          | $\pm$ | SD   | t      | P-value    |
| 2 hrs.      | 3         | $\pm$ | 0    | 4.2           | $\pm$ | 1.28 | 4.188  | $<0.001^*$ |
| 4 hrs.      | 3         | $\pm$ | 0    | 3.8           | $\pm$ | 1.24 | 2.886  | 0.006*     |
| 6 hrs.      | 3.1       | $\pm$ | 0.45 | 3.45          | $\pm$ | 0.83 | 1.667  | 0.104      |
| 8 hrs.      | 3.55      | $\pm$ | 0.76 | 3.65          | $\pm$ | 0.99 | 0.359  | 0.722      |
| 10 hrs.     | 3         | $\pm$ | 0    | 3.95          | $\pm$ | 1.10 | 3.866  | $<0.001^*$ |
| 12 hrs.     | 3         | $\pm$ | 0    | 3.3           | $\pm$ | 0.73 | 1.831  | 0.075      |
| 14 hrs.     | 3.1       | $\pm$ | 0.45 | 3.6           | $\pm$ | 0.75 | 2.551  | 0.015*     |
| 16 hrs.     | 3.35      | $\pm$ | 0.75 | 3.35          | $\pm$ | 0.59 | 0.000  | 1.000      |
| 18 hrs.     | 3         | $\pm$ | 0    | 3.1           | $\pm$ | 0.31 | 1.453  | 0.154      |
| 20 hrs.     | 3.05      | $\pm$ | 0.22 | 3.05          | $\pm$ | 0.22 | 0.000  | 1.000      |
| 22 hrs.     | 3.05      | $\pm$ | 0.22 | 3             | $\pm$ | 0    | 1.000  | 0.324      |
| 24 hrs.     | 3         | $\pm$ | 0    | 3             | $\pm$ | 0    | 0.000  | 1.000      |
| 26 hrs.     | 3         | $\pm$ | 0    | 3             | $\pm$ | 0    | 0.000  | 1.000      |
| 28 hrs.     | 3         | $\pm$ | 0    | 3             | $\pm$ | 0    | 0.000  | 1.000      |
| 30 hrs.     | 3         | $\pm$ | 0    | 3             | $\pm$ | 0    | 0.000  | 1.000      |
| 32 hrs.     | 3         | $\pm$ | 0    | 3             | $\pm$ | 0    | 0.000  | 1.000      |
| 34 hrs.     | 3         | $\pm$ | 0    | 3             | $\pm$ | 0    | 0.000  | 1.000      |
| 36 hrs.     | 3         | $\pm$ | 0    | 3             | $\pm$ | 0    | 0.000  | 1.000      |

Data are presented as mean  $\pm$  SD.

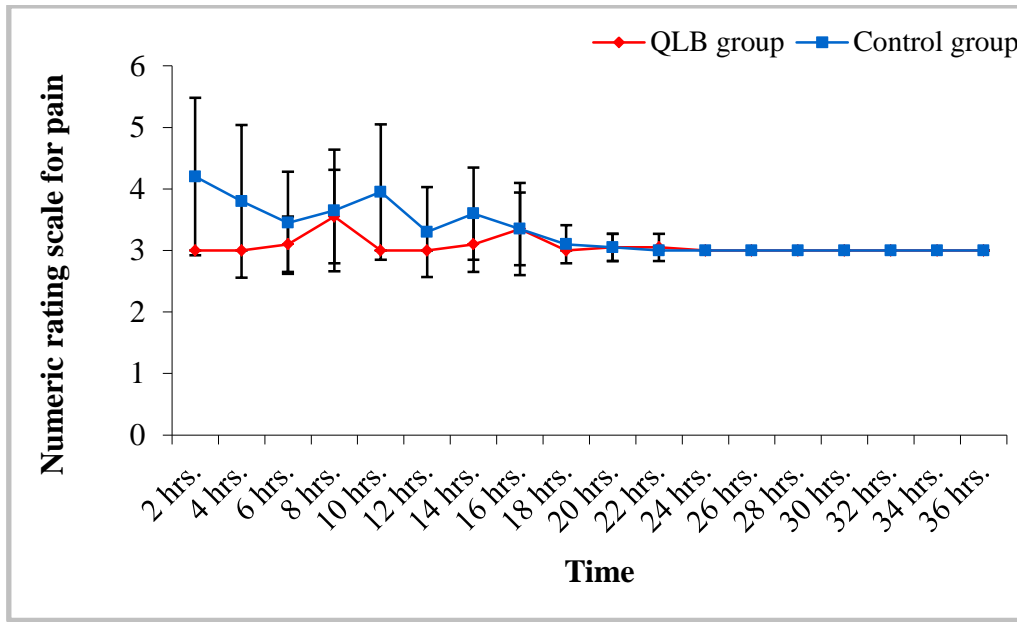


Figure (3): Bar chart of the numeric rating scale for pain in the two groups every 2 hours. Data are presented as mean ± SD.

There was no significant difference between the two groups regarding length of hospital stay (days) (p-value > 0.05) (table 5, Figure 4).

Table (5): Comparison between two groups regarding Hospital stay (days).

| Group         | Hospital stay |   |      | T-test |         |
|---------------|---------------|---|------|--------|---------|
|               | Mean          | ± | SD   | t      | P-value |
| QLB group     | 4.05          | ± | 0.51 | 1.265  | 0.214   |
| Control group | 4.25          | ± | 0.49 |        |         |

Data are presented as mean ± SD or numbers.

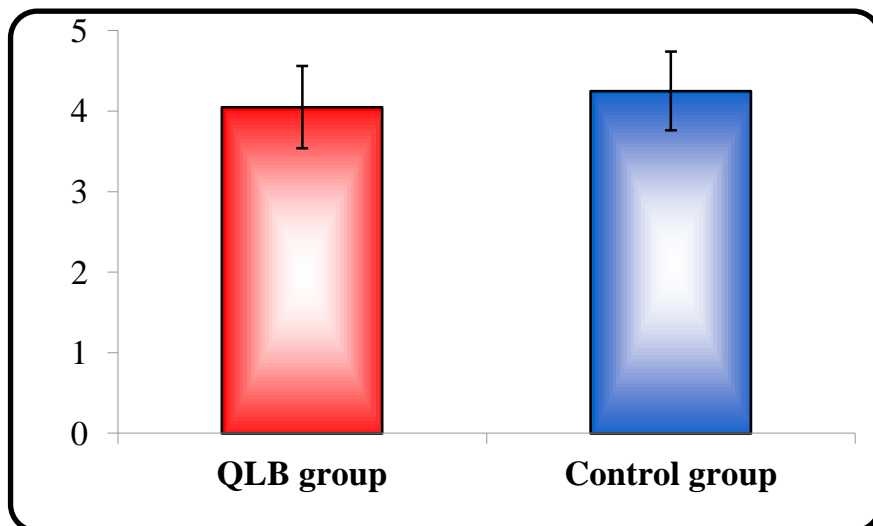


Figure (4): Comparison between the two groups regarding length of hospital stay (days). Data are presented as mean ± SD.

Postoperative nausea and vomiting were observed less frequently in QLB group than the control group (P value < .05) (table 6 and figure 5).

Table (6): Comparison between the two groups regarding postoperative Nausea and vomiting.

| Postoperative Nausea and vomiting | QLB     |        | Control |     | Total |     |
|-----------------------------------|---------|--------|---------|-----|-------|-----|
|                                   | N       | %      | N       | %   | N     | %   |
| Yes                               | 2       | 10     | 8       | 40  | 10    | 25  |
| No                                | 18      | 90     | 12      | 60  | 30    | 75  |
| Total                             | 20      | 100    | 20      | 100 | 40    | 100 |
| Chi-square                        | X2      | 4.800  |         |     |       |     |
|                                   | P-value | 0.028* |         |     |       |     |

Data are presented as numbers and percent.

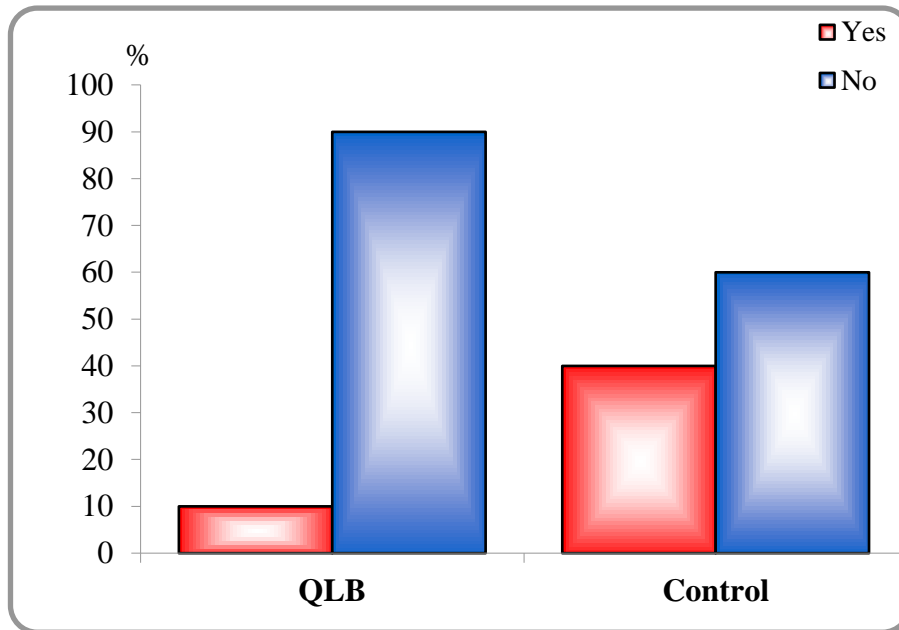


Figure (5): Bar chart showing the difference between groups regarding Nausea and vomiting. Data are presented as percent.

## DISCUSSION:

Preemptive analgesia refers to an analgesic modality that has preceded the noxious stimulus such as the surgical incision, preventing establishment of the central sensitization and covering both periods of the surgery and the initial postoperative period<sup>(4)</sup>.

Therefore, pre-emptive analgesia can pre-empt the injury-induced neuro-physiological and biochemical modulation of the nervous system and reduce both acute pain and development of chronic pain<sup>(5)</sup>.

In the past few decades, quadratus lumborum block (QLB) has been increasingly used for surgical pain relief after different types of surgery<sup>(6)</sup>.

Our randomized controlled study showed that QLB was an effective analgesic modality as regard less pain score, both intraoperative and postoperative opioid consumption and the hospital stay. In this study, the total dose of both intraoperative consumed fentanyl and postoperative required nalbuphine were less than in QLB group with p-value  $\leq 0.001$ . Moreover, we found that QLB prolongs obviously the time to first opioid demand postoperatively with p-value  $\leq 0.001$ .

The patients of opioid therapy group had the higher pain scores, were the first to ask for rescue analgesia, and consumed the higher number of intraoperative fentanyl and postoperative nalbuphine doses. Therefore, they had the highest total opioid

consumption in the first 36 hours postoperatively in comparison to patients of the QLB group.

These results are consistent with Dam and his colleagues in 2021 who tested the efficacy of preoperative QLB in laparoscopic nephrectomy. They concluded that QLB significantly reduced postoperative opioid consumption by 43% and significantly prolonged time to rescue opioid therapy. Another important narrative review of QLB in open nephrectomy was consistent with reduced opioid consumption **postoperatively** <sup>(7)</sup>.

Our team figured out that numerical pain rating scores every 2 hours of the postoperative period were significantly lesser in QLB group with p-value  $\leq 0.001$  especially in the early period. **Rahendra et al in 2019** tested the lateral QLB (the same used in our study) in living kidney donation surgery and mentioned same outcome. They concluded comparable results with the epidural analgesia regarding both static and numerical pain score <sup>(8)</sup>.

**Akerman et al., in 2018** has reviewed many studies which showed less length of hospital stay with QLB and recommended implementing the technique in the enhanced recovery after surgery program. One of the advantages was the less hospital length of stay. However, in our study, the hospital stay was statistically insignificant between both groups (p-value was  $>0.5$ ). We related this to the surgeon concern of the patient discharge which may not depend on the pain score or patient satisfaction as important as the bleeding incidence and the surgical complications <sup>(9)</sup>.

The limitation of our study included that we evaluated only single-injection technique for QLB not the continuous infusion catheter that may make differences in other study. Therefore, future studies can apply this infusion technique in nephrectomy to discuss the cost benefit ratio.

## Conclusions:

Our study showed that the ultrasound guided quadratus lumborum block was an effective technique in providing preemptive analgesia in patients undergoing nephrectomy surgery. The patients who received QLB required less intraoperative and postoperative analgesic requirements. The QLB under ultrasound guidance, was easy to perform without recorded complications either in the intra or the postoperative period. We recommend investigating the continuous infusion QLB in nephrectomy to discuss the cost benefit ratio rather than single injection as in our study.

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## دراسة تقييمية للتخدير الموضعي الوقائي للعضلة المربعة القطنية موجهاً بالموجات فوق الصوتية ودوره في علاج الألم لجراحات استئصال الكلية

د. إسلام محمد .. د. عزه يوسف .. د. عمرو صبحي .. د. شريف فاروق .. د. رأفت عبد العظيم

قسم التخدير والرعاية المركزة وعلاج الألم – كلية الطب – جامعة عين شمس

د. إسلام محمد شحاته، المدرس المساعد بقسم التخدير، كلية الطب، جامعة عين شمس، ٠١٠٠١٢٧٩٢٠٠،

**المقدمة:** تعتبر جراحات استئصال الكلى من العمليات التي يعقبها ألم شديد نتيجة مكان الجرح وقربه من القفص الصدري. ومن الطرق الحديثة لتسكين تلك الأم هي المسكنات الأفيونية والتخدير العصبي المركزي وكذلك التخدير الموضعي للعضلة القطنية المستعرضة، كجزء من المسكنات متعددة الوسائط.

**الهدف من هذه الدراسة:** تقييم فعالية المسكنات الوقائية للعضلة المربعة القطنية الموجهة بالموجات فوق الصوتية خلال فترة استئصال الكلى أثناء الجراحة فيما يتعلق بتأثير تجنب المواد الأفيونية وفي فترة ما بعد الجراحة المبكرة فيما يتعلق بتخفيف الألم والحركة المبكرة وتأثير المسكنات الشبيهة بالمواد الأفيونية.

**طريقة البحث:** شملت الدراسة أربعين مريضاً تتراوح أعمارهم بين ١٨-٦٥ عاماً، من الخاضعين لجراحة استئصال الكلى الاختياري المفتوح والبسيط بمستشفيات جامعة عين شمس. تم تقسيم المرضى إلى مجموعتين متساويتين، المجموعة الأولى: تلقى المرضى تخديراً عاماً مع طرق تخفيف الألم التقليدية باستخدام المواد الأفيونية الوريدية، المجموعة الثانية: وفيها خضعت الحالات لتخدير العضلة المربعة القطنية قبل الجراحة باستخدام ٠,٤ مل/كجم من البوبيفاكين ٠,٢٥٪ والتخدير الكلى.

**النتائج:** أظهرت الدراسة الحالية انخفاضاً ذا دلالة إحصائية كبيرة في استهلاك المواد الأفيونية لدى مرضى المجموعة التي خضعت لتخدير العضلة المربعة القطنية أثناء وبعد الجراحة مع درجة ألم أقل مقارنة بمرضى مجموعة المواد الأفيونية.

**الخاتمة:** أظهرت نتائج الدراسة أن تخدير العضلة المربعة القطنية الموجه بالموجات فوق الصوتية كانت تقنية فعالة في التسكين الوقائي للمرضى الذين يخضعون لجراحة استئصال الكلى. وقد احتاج المرضى الذين تلقوا تخدير العضلة المربعة القطنية إلى مسكنات أقل أثناء وبعد العملية الجراحية، فضلاً عن مسكنات الإنقاذ بعد الجراحة.