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Ultrasound-Guided Transmuscular and Thoracic Paravertebral Block Effective for Acute Postoperative Pain Management in Open Renal Surgeries

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Systemic analgesics should be used carefully when treating patients following renal surgery since these patients often have compromised renal function. Therefore, in such individuals, the localized nerve block may be a useful choice. This study's objective was to assess the effectiveness of transmuscular and anterior subcostal QLBs as a secure substitute for thoracic paravertebral blocks guided by ultrasonography for treating immediate postoperative pain in patients having open kidney operations.
Methods: This prospective randomized double blinded study was carried out on 54 adult patients who underwent elective open renal surgeries.

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Patients were randomly classified into three equal groups, all were guided by ultrasonography: Group I: Transmuscular QLB, group II: Anterior Subcostal Quadratus Lumborum (ASQL) Block, and group III: Thoracic Paravertebral (TPV) Block.
Results: Regarding the beginning of sensory block, overall intraoperative fentanyl usage, period to first rescue analgesic demand, and overall morphine consumption, there was a substantially significant difference between the three groups (P-value <0.001). VAS revealed a substantial difference between the three groups (P<0.001) at T0 before discharging from PACU, 2, 4 and 6 hours. There was statistically significant increase in patients' satisfaction in group II&III compared to group I where (P =0.03).
Conclusions: Ultrasound-guided anterior subcostal QLB produced safe and adequate analgesia during and after open renal surgeries that was comparable to thoracic paravertebral block, but the transmuscular QLB failed to provide adequate analgesia compared to anterior subcostal QLB and thoracic paravertebral block.

Keywords: Ultrasound-guided transmuscular; anterior subcostal quadratus lumborum blocks; thoracic paravertebral block; pain management; open renal surgeries.

1. INTRODUCTION

Numerous physiological and psychological issues are brought on by pain, including poor ventilatory performance, increased myocardial oxygen need, anxiety, disturbed sleep, and psychosis. Controlling pain during the perioperative period is crucial and calls for the attending anesthesiologist to put in a lot of effort because poorly managed acute pain may develop into chronic pain syndrome, which is highly upsetting to the patient. Most often, severe postoperative pain follows renal operations [1].

Systemic analgesics should be used carefully when treating patients following renal surgery since these patients often have compromised renal function. Therefore, in these individuals, the local nerve block may be a useful option [2].

Ultrasound guided paravertebral block is a well-established analgesic modality after thoracic and abdominal surgeries where the local anaesthetic is administered just lateral to the point where spinal nerves originate from the intervertebral foramina. [3].

Blanco [4] was the first to identify the quadratus lumborum (QL) block. Nowadays, all generations (children, pregnant women, and adults) having abdominal surgery get the QL block as one of the perioperative pain control techniques [5].

Local anaesthetic is administered next to the QL muscle using one of four possible techniques for ultrasound-guided QLB. These include intramuscular, anterior (transmuscular), posterior, and lateral QLB [6].

Transmuscular QLB and anterior subcostal QLB have been recently created to reduce pain during retroperitoneal and intraperitoneal surgical operations. The method of action depends on local anaesthetic spreading cranially in the direction of the thoracic paravertebral space by different level of dermatomal distribution [7].

Following hip replacement surgery, nephrectomy, and lower abdominal surgery, anterior subcostal QLB has been utilised for analgesia with documented sensory impairments between T8 and L2 [8].

Up to date, no prospective randomized trials compared the analgesic effectiveness of transmuscular QLB and anterior subcostal QLB with other regional techniques after open renal surgeries. Therefore, the present investigation compared safety and analgesic effectiveness of these blocks with US guided thoracic paravertebral blockade.

This study's objective was to assess the effectiveness of transmuscular and anterior subcostal QLBs as a secure substitute for thoracic paravertebral blocks guided by ultrasonography for treating immediate postoperative pain in patients having open kidney operations.

2. METERIALS AND METHODS

This prospective randomized double blinded study was carried out on 54 adult individuals aged from 21 to 65 years old of both sexes, who underwent elective open renal surgeries and had physical status I or II according to American society of anesthesiologists (ASA) classification.

The investigation was conducted at Tanta University Hospital, Urology department for two years from (December 2019 to November 2021).

2.1 Exclusion Criteria

Patient refusal, analgesic usage for chronic condition or drug abuse history, inability to define postoperative pain (due to language barriers or neuropsychiatric disease), bleeding disorders, infection at the site of injection, and a historical background of local anaesthetic allergy.

Patients were randomly classified into three equal groups, all were guided by ultrasonography: Group I: Transmuscular QLB, group II: Anterior Subcostal Quadratus Lumborum (ASQL) Block, and group III: Thoracic Paravertebral (TPV) Block.

All patients underwent preoperative complete medical and surgical histories, clinical assessment, standard laboratory tests (complete blood count, renal function test, liver function test, and coagulation profile).

Group I: Ultrasound-guided Transmuscular Quadratus Lumborum (TQL) Block: The patients were placed in a lateral position and under complete aseptic precautions with Povidone iodine 10%, a curved (C5-1 MHz) probe of the Philip CX50 Ultrasound Scanner was located at the posterior axillary line, horizontal to the iliac crest, to identify the Shamrock sign (The 3 leaves of the shamrock are made up of the QL, the erector spinea, and the psoas major muscles, while the stem is made up of the TP. The QL muscle is known as the darker triangular shape attached to the top of the transverse process of L4). The 22-G spinal needle was introduced in plane from posterior to anterior and directed to the QL muscle. A 20 ml injection of plain bupivacaine 0.25% was administered into the interfascial plane after the needle tip's accurate placement in between the QL and psoas major muscles was verified. The diffusion of local anaesthetic surrounding the QL muscle and the loss of sensation in the region served as evidence that the block was successful [9].

Group II: Ultrasound-guided Anterior Subcostal Quadratus Lumborum (ASQL) Block: The patient was placed in a lateral position and under complete aseptic precautions with Povidone iodine 10%. The Philip CX50 ultrasound scanner's curved (C5-1 MHz) probe was positioned posteriorly underneath the 12th rib, about 6–8 cm from the spinous process, on a parasagittal oblique plane angled medially at L1-2 level.

The kidney, perinephric fat, and fascia were located anterior to the transversalis fascia and QL muscle, whereas the latissimus dorsi (LD) muscle was detected posterior to the QL muscle, where it was seen at its place of insertion on the inferior border of the 12th rib. Under the assistance of ultrasonography, a 22 G spinal needle was inserted in plane in the caudal-to- cranial direction till the needle tip was placed anterior to the QL muscle and between the transversalis fascia (anterior layer of the thoracolumbar fascia) and the investing layer of the QL muscle. In order to create LA distribution between the transversalis fascia, investing layer of the QL muscle and cranially towards the 12th rib, 20 mL of 0.25% bupivacaine was administered after a negative aspiration. Loss of localised sensory function was deemed an effective block [8].

Group III: Ultrasound-guided Thoracic Paravertebral (TPV) Block: Patients of the TPVB group were positioned in a lateral position, the spinous processes of 10th thoracic vertebra were identified and marked 2 cm lateral to the spinous processes. After sterilization of the back of the patient with Povidone iodine 10%, 3 ml Lignocaine was injected subcutaneously lateral to the spinous process of T10 making a wheel, the Philip CX50 ultrasound scanner's curved (C5-1 MHz) probe was positioned transversely at the mark to detect the paravertebral space. The paravertebral space, which is encompassed by the parietal pleura and the superior costo-transverse ligament, was accessed by inserting a 22-G spinal needle (B. Braun, Melsungen, Germany) in-plane and moving it forward. The 10th thoracic vertebra's paravertebral space was then filled with 20 millilitres of 0.25% bupivacaine. The parietal pleura showing signs of being compressed by the local anaesthetic served as proof that the block was effective. Loss of sensation in the region was considered to be an effective block [3].

2.2 Anesthesia Technique

In all patient’s general anesthesia induction was done by Intravenous (Propofol 2 mg/ kg, Fentanyl 2 mic/kg, atracurium 0.5 mg/kg). Three minutes after administering atracurium, a tracheal tube of the appropriate size was inserted and volume-controlled mechanical ventilation was initiated. Anesthesia state was maintained with mixture of oxygen –air (50-50%) and end tidal expiratory isoflurane 1.2 -1.5%. Fentanyl was administered as needed to control HR and MAP to be within 20% of the baseline values. The ventilator setting was adjusted to maintain normocapnia (ETCO2 =35-40 mmHg) using (Avance CS2Ventilator, USA). Finally patient positioning in lateral position was done and operation was performed by subcostal flank incision. 0.05 mg/kg of neostigmine and 0.02 mg/kg of atropine were used to reverse any remaining neuromuscular blocking after surgery, and the patient was then extubated. Finally, the patient was discharged to post anesthesia care unit (PACU). Postoperative all patients were received postoperative analgesia in the form of paracetamol (1 gm intravenous drip) every 6 hours.

The primary outcome was assessment of pain using Visual Analogue Score (VAS) in the first day after surgery and the secondary outcomes were the amount of analgesics consumed throughout the first day after surgery, the time to initial rescue analgesic requirement, and the occurrence of complications as (hypotension, pneumothorax, kidney injury, bowel injury and Local Anesthetic Systemic Toxicity (LAST).

2.3 Sample Size Calculation

The sample size was calculated using G. power 3.1.9.2. as N ≥16 in each group based on the following considerations: 0.05 α error, 0.05 β error (95% power of the study). According to a previous pilot study of Yaun Qing et al, [10] mean VAS in the first day after surgery was 3.08 with thoracic paravertebral block and 3.35 with transmuscular QLB with SD 0.5. The expected mean VAS of anterior subcostal QLB was 2.62 (15% decrease than thoracic paravertebral block). After adding two cases to each group to overcome dropout, 18 patients were allocated in each group.

2.4 Statistical Analysis

The SPSS 25 statistical analysis programme was used (IBM Inc., Chicago, IL, USA). In order to determine whether parametric or nonparametric statistical testing should be utilised, the distribution of quantitative data was tested using the Shapiro-Wilks normality test and histograms. The three groups' parametric variables were compared using the ANOVA test, with the post hoc (Tukey) test used to evaluate each pair of groups separately. Parametric variables were represented as mean and standard deviation (SD). The Kruskal-Wallis test was used to evaluate non-parametric variables, which were reported as the median and interquartile range (IQR). Mann-Whitney (U) test was then used to compare each pair of groups. Categorical variables were statistically examined using the Chi-square test and presented as frequency and percentage. Statistical significance was defined as a two-tailed P value less than 0.05.

3. RESULTS

Fig. 1 shows consort flow chart of the participants during the study.

Heart rate showed insignificant difference between the 3 groups intraoperatively at base line values p-value (0.668), but showed significant increase at skin incision, 30, 60, 90, 120 minutes and at end of surgery in group I as compared to groups II & III p-value (<0.05). MAP showed insignificant difference between the 3 groups intraoperatively at base line values p-value (>0.05),but showed significant increase at skin incision, 30, 60, 90, 120 minutes and at end of surgery in group I as compared to groups II & III p-value (<0.05).

Heart rate showed insignificant difference between the 3 groups at 12, 18 and 24 hours postoperatively p-value (>0.05) but showed significant increase after surgery before discharging from PACU (T0), 2, 4 and 6 hours postoperative in group I as compared to groups II & III p-value (<0.05). MAP showed insignificant difference between the 3 groups at 12, 18 and 24 hours postoperatively p-value (>0.05) but showed significant increase after surgery before discharging from PACU (T0), 2, 4 and 6 hours postoperative in group I as compared to groups II & III p-value (<0.05).

There was a statistically significant difference among the 3 groups as regards onset of sensory block, total fentanyl consumption intraoperatively, time to first rescue analgesic requirement and total morphine consumption (P <0.001). The onset of sensory block showed more rapid onset in group III compared to group II (P3= 0.013) and group I (P2 =0.043). In comparison to group II, group I did not display any statistically significant differences. There was early request of rescue analgesia in group I compared to group II & III (P <0.001). There was a significant higher in total intraoperative fentanyl consumption and total morphine consumption in group I than groups II and III (P <0.001), but there was no significant difference between group II & III.

There were no recorded serious complications as LAST, kidney injury and bowel injury among the 3 groups. There was statistically significant increase in patients' satisfaction in group **II&III** compared to group I where (P =0.03).

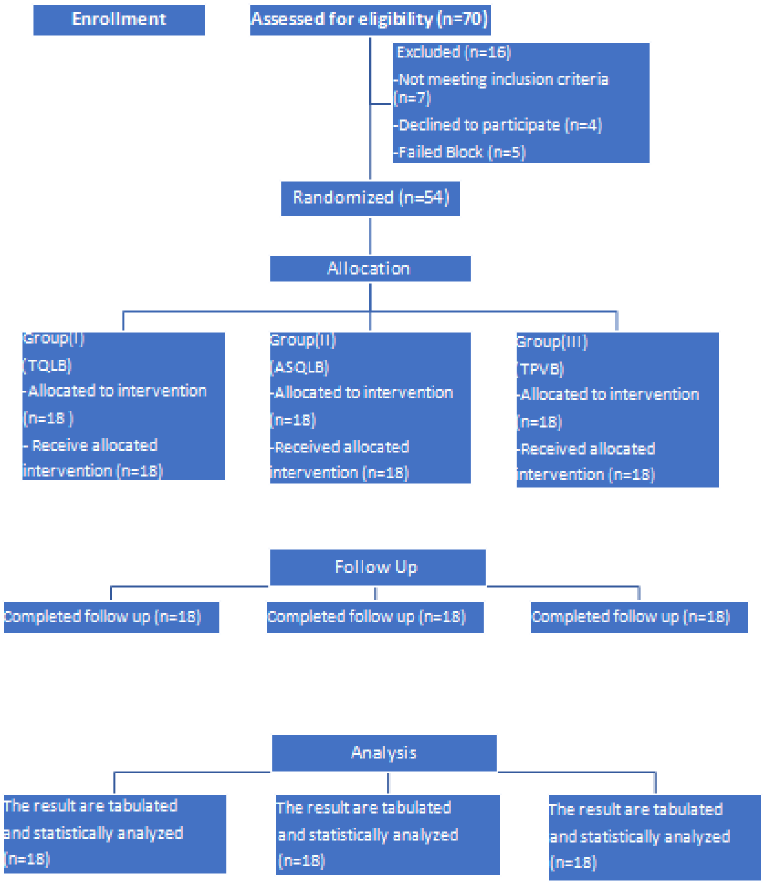

Fig. 1. Consort flow chart of the participants during the study

There was no significant difference between the three groups as regards demographic data

Table 1. Demographic data of the three groups

		Group I (n = 18)	Group II (n = 18)	Group III (n = 18)	P value
Age (years)		50.44 ± 8.62	48.94 ± 8.76	49.06 ± 9.36	0.854
Sex	**Male**	11 (61.1%)	10 (55.6%)	13 (72.2%)	
	Female	7 (38.9%)	8 (44.4%)	5 (27.8%)	0.574
Weight (Kg)		74.77 ± 9.25	73.22 ± 9.11	75.88 ± 9.06	0.696
Height (m)		1.72 ± 0.07	1.73 ± 0.08	1.69 ± 0.07	0.321
BMI (Kg/m2)		25.4 ± 3.70	24.79 ± 4.72	26.6 ± 3.79	0.397
ASA	**ASA I**	5 (27.8%)	7 (38.9%)	4 (22.2%)	
	ASA II	13 (72.2%)	11 (61.1%)	14 (71.8%)	0.537
Duration (min)		165.27 ± 26.43	164.16 ± 27.18	162.5 ± 27.77	0.316
Type of surgery	**Open nephrectomy**	9 (50.0%)	8 (44.4%)	9 (50.0%)	
	Pyeloplasty	3 (16.7%)	5 (27.8%)	4 (22.2%)	0.622
	Pyelolithotomy	6 (33.3%)	5 (27.8%)	5 (27.8%)	

Data are presented as mean ± SD or frequency (%), BMI: Body Mass Index, ASA: American Society of Anesthesiologists

Table 2. Comparison of intraoperative heart rate and MAP changes between the three studied groups (beats/min)

		Baseline	At skin incision	30 min	60 min	90 min	120 min	End of surgery
Group I	Mean	83.44	99.22	92.94	90.39	94.28	92.72	90.67
(n = 18)	SD	9.78	13.21	10.69	10.78	13.62	12.55	9.98
Group II	Mean	80.83	78.78	80.22	81.50	80.72	81.11	81.44
(n = 18)	SD	8.57	10.70	8.34	8.60	9.27	9.72	9.03
Group III	Mean	82.44	80.61	82.22	82.28	83.22	82.00	81.06
(n = 18)	SD	7.37	10.54	11.53	7.42	10.08	7.38	8.49
P value		0.668	<0.001*	0.001*	0.009*	0.002*	0.002*	0.004*
P1		……	<0.001*	0.002*	0.015*	0.002*	0.004*	0.013*
P2		…….	<0.001*	0.009*	0.028*	0.014*	0.008*	0.009*
P3		…….	0.886	0.835	0.695	0.786	0.963	0.991
MAP								
Group I	**Mean**	87.89	104.33	98.50	98.39	99.39	100.06	98.11
(n = 18)	**SD**	12.17	15.81	10.74	11.56	12.22	13.51	11.79
Group II	**Mean**	87.50	86.28	87.28	87.72	87.83	87.61	87.94
(n = 18)	**SD**	11.96	13.16	12.51	11.85	11.95	11.26	12.56
Group III	**Mean**	86.50	84.94	85.06	85.11	87.39	85.22	85.11
(n = 18)	**SD**	9.83	10.13	12.72	10.31	11.24	9.75	10.79
P value		0.933	<0.001*	0.004*	0.002*	0.006*	0.001*	0.005*
P1		---	0.001*	0.023*	0.020*	0.016*	0.007*	0.036*
P2		---	<0.001*	0.005*	0.003*	0.012*	0.001*	0.006*
P3		---	0.952	0.851	0.774	0.993	0.817	0.758

**: significant as P value <0.05, p: p-value for comparing between the 3 groups, p1: p-value for comparing between G I and G II, P2: p-value for comparing between G I and G III, p3: p-value for comparing between G II and G III*

Table 3. Comparison of postoperative heart rate and MAP changes between the three studied groups (beats/min)

		Baseline	T0	T2	T4	T6	T12	T18	T24
Group I	**Mean**	83.44	90.11	92.11	92.56	94.06	89.83	94.56	91.61
(n = 18)	**SD**	9.51	10.29	13.23	14.92	9.73	11.38	14.92	11.12
Group II	**Mean**	80.83	81.22	81.00	80.72	81.83	94.61	86.39	85.61
(n = 18)	**SD**	8.57	9.16	9.39	9.78	8.11	13.91	14.62	9.54
Group III	**Mean**	82.44	82.06	83.06	82.78	84.11	96.78	87.22	87.11
(n = 18)	**SD**	7.37	6.89	5.98	8.20	9.98	11.82	11.98	9.22
P value		0.688	0.009*	0.005*	0.008*	0.001*	0.258	0.18	0.201
P1		0.647	0.014*	0.006*	0.01*	0.001*	0.505	0.21	0.197
P2		0.938	0.029*	0.029*	0.039*	0.008*	0.242	0.282	0.395
P3		0.846	0.96	0.82	0.858	0.757	0.867	0.983	0.9
MAP									
Group I	**Mean**	87.89	98.22	100.94	101.83	101.78	94.17	98.78	97.17
(n=18)	**SD**	11.83	10.89	15.34	13.53	15.25	15.05	16.87	12.70
Group II	**Mean**	87.50	87.78	87.72	87.94	89.28	100.67	94.50	89.61
(n=18)	**SD**	11.96	11.67	10.92	12.18	11.83	18.80	14.50	10.79
Group III	**Mean**	86.50	86.78	86.44	86.78	87.28	101.67	90.50	90.50
(n=18)	**SD**	9.83	9.99	9.92	9.44	11.59	14.35	13.84	12.84
P value		0.933	0.005*	0.002*	0.001*	0.004*	0.348	0.289	0.151
P1		0.994	0.019*	0.008*	0.003*	0.019*	0.476	0.69	0.175
P2		0.931	0.009*	0.003*	0.001*	0.006*	0.374	0.257	0.255
P3		0.964	0.961	0.951	0.956	0.895	0.982	0.722	0.975

**: significant as P value <0.05, p: p-value for comparing between the 3 groups, p1: p-value for comparing between G I and G II, P2: p-value for comparing between G I and G III, p3: p-value for comparing between G II and G III*

Table 4. Comparison of the onset of sensory block, total intraoperative fentanyl consumption, time to first rescue analgesic requirement, total morphine consumption between the three studied group

	Group I	Group II	Group III	P value
Sensory block (min)	17.22 ± 5.82	18.05 ± 5.81	12.77 ± 3.81	0.01*
	P1=0.88, P2=0.043*, P3= 0.013*			
Total intraoperative fentanyl consumption (mic)	146.94 ± 28.73	75.28 ± 12.30	79.44	<0.001*
	P1=<0.001*, P2=0.003*, P3=0.68			
Time to first rescue analgesic requirement (hours)	2.72 ± 1.19	13.33 ± 3.2	12.33 ± 3.14	<0.001*
	P1=<0.001*, P2=<0.001*, P3=0.543			
Total morphine consumption(mg/24h)	12.67 ± 1.60	6.50 ± 1.12	6.67 ± 1.25	<0.001*
	P1=<0.001*, P2=<0.001*, P3=0.678			

**: significant as P value <0.05, p: p-value for comparing between the 3 groups; p1: p-value for comparing between G I and G II.; P2: p-value for comparing between G I and G III.; p3: p-value for comparing between G II and G III*

Table 5. Comparison of adverse effects and patient's satisfaction between the three studied groups

	Group I (n = 18)	Group II (n = 18)	Group III (n = 18)	P Value
Bradycardia	0 (0%)	0 (0%)	2 (11.1%)	0.125
Hypotension	0 (0%)	0 (0%)	2 (11.1%)	0.125
Pneumothorax	0 (0%)	0 (0%)	1 (5.6%)	0.361
Kidney injury	0 (0%)	0 (0%)	0 (0%)	----
Bowel injury	0 (0%)	0 (0%)	0 (0%)	----
LAST	0 (0%)	0 (0%)	0 (0%)	----
Patient's satisfaction				
Unsatisfied	5 (20%)	1 (4%)	2 (8%)	0.03*
Neither satisfied nor unsatisfied	7 (28%)	2 (8%)	3 (12%)	
Satisfied	6 (24%)	15 (60%)	13 (52%)	

**: significant as P value <0.05p: p-value for comparing between the 3 groups*

At rest and movement, T0 before discharging from PACU, VAS showed a significant difference among the 3 groups (P<0.001). While there was no substantial difference between groups II and III, there was a significant distinction between groups I & II (P1 <0.001) and I & III (P2 <0.001). The VAS revealed a significant difference between the 3 groups at 2 hours (P <0.001). Groups I & II showed a substantial difference (P1 <0.001), and Groups I & III showed a significant difference (P2 <0.001), whereas Groups II & III showed no significant difference.

The VAS revealed a significant difference between the 3 groups after 4 hours (P <0.001). Groups I & II showed a substantial difference (P1 <0.001), and Groups I & III showed a significant difference (P2 <0.001), whereas Groups II & III showed no significant difference. The VAS revealed a significant difference between the 3 groups after 6 hours (P <0.001). Groups I & II had a significant difference (P1 <0.001), and Groups I & III had a substantial difference (P2 <0.001), while Groups II & III did not. The three groups did not significantly vary at 12, 18, or 24 hours.

4. DISCUSSION

Open kidney operations are linked to substantial postoperative pain, which is worse in the first 48 hours. Patients need efficient analgesia to prevent respiratory and thromboembolic consequences [11].

Regarding the hemodynamic variables (mean arterial blood pressure and heart rate), our results revealed a significant intraoperative increase of the HR and MAP in group I as compared to group II and group III at skin incision, 30, 60, 90, 120 minutes and at the end of surgery while revealed no significant difference between group II and group III. Postoperatively these parameters showed an early significant increase after surgery before discharging from PACU (T0), 2 hour, 4 hour and 6 hour in group I as compared to group II & group III while revealed no significant difference between group II & III and revealed no significant difference between the 3 groups at 12 hour,18 hour and 24 hour, this was consistent with the early increased VAS scores and early 1st rescue analgesic demand (morphine) in group I compared to other groups II and III.

The efficacy of paravertebral block as a good alternative to epidural block was documented in Moawad et al. [1] who found that single-injection paravertebral block produced adequate analgesia with more hemodynamic stability during the perioperative period for nephrectomy compared to thoracic epidural block where a significant decrease in HR & MAP was detected intraoperatively and early postoperatively due to a dense bilateral sympathetic block in thoracic epidural block while PVB produces a unilateral sympathetic block, so it can used as a safe alternative to the thoracic epidural block. Also when compared it with IV PCA, Mishra et al. [3] found that TPVB provided better haemodynamic stability and excellent postoperative analgesia in comparison to the IV PCA (fentanyl) in patients undergoing open nephrectomy surgery. Zhu et al. [12] discovered that the subcostal anterior QLB group's HR and MAP were much lower and more constant than the control group's values as it provided more effective analgesia and reduced sufentanil consumption postoperatively.

However, the analgesic efficacy of transmuscular QLB was evaluated by Saleh et al [13] who revealed a lower & stable recording in HR & MAP intraoperatively in those having an open nephrectomy surgery due to the higher analgesic efficacy of transmuscular QLB with significantly less fentanyl was consumed than in the control group.

Regarding the onset of sensory block, we found a significant difference between the 3 study groups with a delayed onset of sensory block in group I (TQLB) and in group II (ASQLB) compared to group III (TPVB). In agreement with our results, Borglum et al [14] who reported the delayed onset of the us guided transmuscular QL block which is characterized by a 30 min block onset time after injection of 30 mL of 0.375% ropivacaine.

Regarding the rapid onset of paravertebral block, Liu et al [15] documented the rapid onset of a single shot bilateral thoracic paravertebral block in the PACU for immediate pain alleviation in patients after laparotomy and found a rapid decrease of VAS at rest from (7.9) before the block to (3.3) 10 min after the block performance.

Regarding total intraoperative fentanyl requirement our result revealed a statistically significant difference among the 3 groups due to higher intraoperative fentanyl consumption in group I compared to group II & III, but there was no significant difference between group II & III. The efficacy of transmuscular QLB was evaluated in comparison with epidural block in Kikuchi et al [16] who revealed a higher intraoperative fentanyl requirement in transmuscular QLB group compared to epidural group in patients undergoing robotic-assisted partial nephrectomy and concluded that transmuscular QLB didn't seem to provide a benefit over EA in terms of analgesia for robot-assisted segmental nephrectomy.

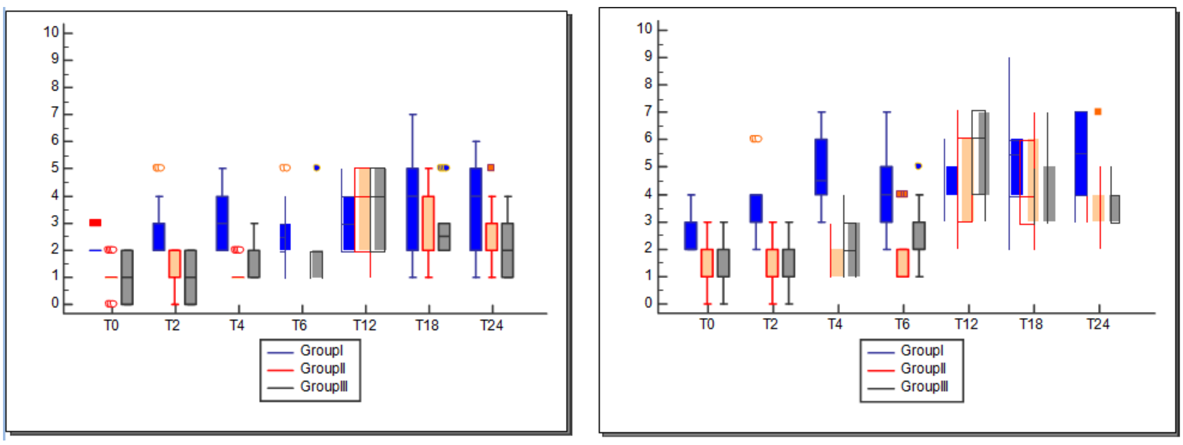

Fig. 2. Comparison of Visual Analogue Score (VAS) (A) at rest and (B) at movement between the three studied groups

Contrary to our findings, Chen et al. [17] discovered that the control group's cumulative intraoperative sufentanil consumption was greater than that of either of the QLB groups, the difference with our results may be due to the less invasive surgical procedure in Chen's et al study.

As regard VAS comparison among the three studied groups during rest and movement, our results showed a significant difference among the 3 groups early postoperatively at T0 before discharging from PACU with higher VAS in group I compared to group II, III while comparison between group II, III showed no significant difference between them.

The lower efficacy of transmuscular quadratus lumborum may be attributed to the limited dermatomal blockade which reported in most cases from T10 to L2, this finding was in agreement with Warusawitharana et al. [18] revealed sharp pain in the area localized under the ipsilateral diaphragm (TQLB) on coughing while no pain on the contralateral side (STAP), this finding may be due to the sparing of the upper intercostal nerves during the TQLB.

However, Sirvastava et al. [19] reported that the dynamic VAS was significantly lower in the QLB group at all time points after the 30th minute and the static VAS rankings were substantially lower in the QLB group at the 2nd, 6th, and 12th hour. The QLB group had considerably fewer patients who needed rescue analgesics than the control group. This may be related to the port-site infiltration block's weak effect.

Regarding the 1st rescue analgesia postoperatively; there was a significant difference among the 3 studied groups due to early rescue analgesia demand in TQLB group compared to ASQLB group and TPVB group, but no significant difference found when comparing ASQLB group with TPVB group. The weak analgesic efficacy of TQLB was matched with the study of Ghanemet et al. [20] who discovered that compared to the QLB, the erector spinae plane block offered lower mean pain ratings measured by NRS during rest and movement, less frequent and easier to regulate breakthrough pain.

Regarding the total analgesic (Morphine) consumption in the first 24 h after surgery, our results showed a significant difference among the 3 groups comparison with decreased morphine consumption in patients who received ASQLB (Group II) and TPVB (Group III) than in patients who received TQLB (Group I) with no significant difference between group II (ASQLB) & III (TPVB). In line with our findings, Li et al. [21] found that within the first 24 h after operation, patients who received preoperative QLB-LSAL utilised a considerably lower iv morphine equivalent dosage than those who had preoperative TQLB.

Regarding complications: Our study showed that there were 2 patients reported bradycardia, hypotension and only one patient reported Pneumothorax in TPVB group (group III) without any significant difference with group I & II. There were no recorded serious complications as last, kidney injury, bowel injury and lower limb weakness among the 3 groups. This finding was in agreement with Venkatraman et al. [22] revaluated the ultrasound-guided transmuscular QLB for post-operative analgesia in unilateral laparoscopic renal surgeries and didn't report any complications in the study in the form of blood hematoma, infections and organ injuries. Finally, patient satisfaction in our study showed statistically significant increase in patients' satisfaction in group II&III compared to group I, and this was consistent with Zhu et al's findings [12], which stated that bruggemann comfort scale (BCS) ratings were considerably higher in the anterior subcostal QLB group compared to the control group up to 12 hours postoperatively in patients having laparoscopic nephrectomy.

5. CONCLUSION

Ultrasound-guided anterior subcostal QLB produced safe and adequate analgesia during and after open renal surgeries that was comparable to thoracic paravertebral block, but the transmuscular QLB failed to provide adequate analgesia compared to anterior subcostal QLB and thoracic paravertebral block.]

CONSENT AND ETHICAL APPROVAL

Each patient gave their written permission after being properly explained. The trial was conducted after being approved from the Ethical Committee Tanta University (approval code: 33494/11/19).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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