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A Comparative Study between Ultrasound Guided Quadratus Lumborum Block Versus Ultrasound Guided Transversus Abdominis Plane Block in Laporoscopic Bariatric Surgery

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ABSTRACT

Background: ultrasound-guided quadratus Lumborumblock is performed as one of the perioperative pain management procedures for patients undergoing abdominal surgeries.

Objective: the aim of this study was to compare the analgesic efficacy of ultrasound-guided trans-muscular quadratus lumborum block with transversus abdominis plane (TAP) block and intravenous opioid drugs during laparoscopic bariatric surgery and in the early postoperative period regarding pain relief, provision of comfort, early mobilization and improved respiratory functions.

Patients and Methods: Setting and design: pilot exploratory study was conducted on 60 patients scheduled for elective laparoscopic bariatric surgeries. All patients received general anesthesia using IV fentanyl (1-2 μg/kg LBW). **Group QLB (20 patients):** received bilateral ultrasound-guided quadratus lumborum block after induction of general anesthesia using 0.2 ml/kg bupivacaine 0.125%. **Group TAP (20 patients):** received bilateral ultrasound-guided TAP block after induction of general anesthesia using 0.2 ml/kg bupivacaine 0.125%. **Group GA (20 patients):** received general anesthesia and then IV Morphine (0.1 mg/Kg LBW).

Results: there was statistically significant difference between the three groups as regardsthe first call for rescue analgesia (morphine), total morphine consumption and pain scores; indicating that tansversus abdominis plane block was more effective than intravenous opioid drug analgesia, while quadratus lumborum block was more effective than tansversus abdominis plane block.

Conclusion: this study concluded that quadratus lumborum block was the most effective technique in providing analgesia after laparoscopic bariatric surgery without associated hemodynamic instability in comparison to transversus abdominis plane block and intravenous opioid drugs.

Keywords: QLB, TAP, Morphine, Bariatric, Obesity.

INTRODUCTION

Obesity has been associated with an increased hazard ratio for all-cause mortality, as well as significant medical and psychological co-morbidity. Nonsurgical management can effectively induce 5%-10% weight loss and improve health in severely obese individuals resulting in cardio-metabolic benefit. Bariatric surgery procedures are indicated for patients with clinically severe obesity. Currently, these procedures are the most successful and durable treatment for obesity. The best choice for any bariatric procedure (type of procedure and type of approach) depends on the individualized goals of therapy, available local expertise, patient preferences and personalized risk stratification. In general, laparoscopic bariatric procedures are preferred over open bariatric procedures due to lower early postoperative morbidity and mortality [(1)].

In the obese patient, the goal of postoperative pain management is provision of comfort, early mobilization and improved respiratory function without causing inadequate sedation and respiratory compromise. The pathophysiology of obesity, typical co-morbidities and the high prevalence of obstructive sleep apnea (OSA) amongst obese patients make safe analgesic management difficult. In particular, pain control after bariatric surgery is a major challenge. Advice on general management includes multimodal analgesic therapy, preference for regional techniques, avoidance of sedatives, non-invasive ventilation with supplemental oxygen and early mobilization [(2)].

In the past few years, transversus abdominis plane (TAP) block, which was first described by Rafiin [(3)] in 2001, has been increasingly used for postoperative pain relief after laparoscopic surgery. As a part of multimodal analgesic regimen, TAP block results in less analgesic consumption and less pain at two hours and slightly at six hours after laparoscopic surgery in comparison with the usual opioids alone.

The quadratus lumborum block (QLB) was first described by Blanco in 2007. The main advantage of QLB compared to the transversus

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abdominis plane (TAP) block is the extension of local anesthetic agent beyond the transversus abdominis plane to the thoracic paravertebral space. The wider spread of the local anesthetic agents may produce extensive analgesia and prolonged action of the injected local anesthetic solution [(4)].

PATIENTS AND METHODS

After approval of anesthesia department scientific and ethical committees, this prospective randomized clinical trial study was conducted in Ain Shams University Hospitals. This study was considered to be a pilot exploratory study. Sixty morbidly obese patients with body mass index [BMI] between 35 and 50 kg/m² were included in the study scheduled for elective laparoscopic bariatric surgeries (e.g.; laparoscopic sleeve gastrectomy (LSG), and laparoscopic mini-gastric bypass). The patients' age was ranged from 21 to 45 years, of both sex, and with American Society of Anesthesiologists (ASA) class II.

The patients were randomized using a random number table and the use of a closed envelopes technique to receive either combined general anesthesia and quadratus lumborum block (Group QLB), combined general anesthesia and TAP (transversus abdominis plane) block (Group TAP), or general anesthesia (group GA). Each group constitutes of 20 patients (*n*=20).

- **Group QLB:** Bilateral injection of 0.2 ml/kg bupivicaine 0.125% at the posterior border of the quadratus lumborum muscle (after induction of general anesthesia).
- **Group TAP:** Bilateral injection of 0.2 ml/kg bupivicaine 0.125% between internal oblique and transversus abdominis muscles (after induction of general anesthesia).
- **Group GA:** received general anesthesia and then IV Morphine (0.1 mg/Kg LBW).

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 Visual Analogue Scale (VAS); 10 cm unmarked line in which 0=no pain, 10 cm = the worst imaginable pain.

Basic monitoring; including Electrocardiogram (ECG), pulse-oximetry (SpO_2), non-invasive blood pressure (NIBP) and capnography ($EtCO_2$), was applied to all patients, starting before anesthesia till the end of surgery and then recovery. Intraoperative hemodynamic measurements for all patients in the three groups included SpO_2, heart rate, mean arterial blood pressure and $EtCO_2$. Postoperative hemodynamic measurements included SpO_2, heart rate, mean arterial blood pressure and respiratory rate for all patients in the three groups as well.

General anesthesia was induced to all patients with IV fentanyl (1-2 µg/kg of lean body weight LBW), IV propofol (2mg/Kg of lean body weight), and IV atracurium (0.5mg/Kg of Ideal Body Weight IBW) in order to facilitate endotracheal intubation. Intermittent positive pressure ventilation of both lungs was applied (to maintain O2 saturation >98% and $EtCO_2$ around 35-38 mmHg).

Maintenance of anesthesia was obtained using intermittent positive pressure ventilation with inhalation of 1-1.5% isoflurane in 50% O_2/air and atracurium (0.1 mg/Kg every 30 minutes IV) to maintain muscle relaxation.At the end of surgery, awake extubation, in a semi-sitting position, was done when the patient could 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 PACU. In the post-anesthesia care unit (PACU), all patients were assessed for presence and severity of pain; using Visual Analog Scale (VAS), and received IV morphine (0.1 mg/Kg LBW on 4-6 hours basis) for VAS pain scores > 3.

Technique of ultrasound-guided Transversus Abdominis Plane (TAP) Block

While the patient is in the supine position, skin preparation with povidone iodine solution was done, and a high frequency ultrasound probe was placed transverse to the abdominal wall between the costal margin and iliac crest. The needle was introduced in plane of the ultrasound

probe directly under the probe and advanced until it reached the plane between the internal oblique and transversus abdominis muscles. The probe had to follow the needle entry point medially in its superficial path and was then returned to its original position in the mid-axillary line as the needle was directed deeper. Upon reaching the plane, 2 ml of saline was injected to confirm correct needle position after which local anesthetic solution was injected. The transversus abdominis plane was visualized expanding with the injection (appeared as a hypoechoic space).

Technique of ultrasound-guided Trans-muscular Quadratus Lumborum (TQL) Block

The patient was placed in the lateral position with the side to be anesthetized turned upwards. Skin preparation with povidone iodine solution was done, and curved array transducer (6-2 MHz) was placed in the transverse plane at the abdominal flank immediately cranial to the iliac crest. The transducer was then moved dorsally keeping the transverse orientation until the quadratus lumborum muscle was identified with its attachment to the lateral edge of the transverse process of the L4 vertebral body. With the psoas major muscle anteriorly, the erector spinae muscle posteriorly and the quadratus lumborum muscle adherent to the apex of the transverse process, in a well-recognizable pattern of a shamrock with three leaves. The needle was inserted in-plane to the transducer (lateral edge) and the tip of the needle was advanced through the quadratus lumborum muscle, penetrating the ventral proper fascia of the quadratus lumborum muscle and local anesthetic was finally injected between the quadratus lumborum and psoas major.

Data collection

- Intraoperative hemodynamic measurements; including heart rate and mean arterial blood pressure, and ventilatory measurements; including SpO_2 and $EtCO_2$, were recorded every 5 minutes for the first 15 minutes, every 15 minutes till the end of the first hour, and then every 30 minutes till the end of surgery.
- Postoperative hemodynamic measurements; including heart rate and mean arterial blood pressure, and ventilatory measurements; including SpO_2 and respiratory rate, were recorded at 0, 15, 30, and 60 minutes post-emergence, every one hour for the first 4 hours, and then every 4 hours till then end of the 24 hours postoperatively.
- Severity of postoperative pain was assessed using Visual Analog Scale (VAS), at 1, 2, 4, 6, 12 and 24 hours postoperatively.
- Frequency of administration of the IV morphine titration as postoperative analgesia and the time of the first call for it, together with total consumption of morphine in 24 hours postoperatively.
- Postoperative sedation was evaluated; using Ramsay scoring system (2-4: satisfactory sedation, >4: excessive sedation), at 1, 2, 4 and 6 hours postoperatively.
- Signs of side effects of opioids and local anesthetics were recorded: Hypotension (defined as mean arterial blood pressure ≤60 mmHg), bradycardia (defined as heart rate ≤50 beats/min, if affecting the blood pressure with mean arterial blood pressure ≤60 mmHg), respiratory depression (SpO_2 ≤94% and/or respiratory rate ≤8 breaths/min), nausea and vomiting.

  The study was approved by the Ethics Board of Ain Shams University.

Statistical analysis

Data were analyzed using Statistical Program for Social Science (SPSS) version 20.0. Quantitative data were expressed as mean± standard deviation (SD). Qualitative data were expressed as frequency and percentage. A one-way analysis of variance (ANOVA) was used when comparing between more than two means. Chi-square (X^2) test of significance was used in order to compare proportions between two qualitative parameters. The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the probability (P-value) $\leq$0.05 was considered significant, P-value $\leq$0.001 was considered highly significant, and P-value >0.05 was considered insignificant.

RESULTS

Table (1): Comparison between groups according to demographic data:

Demographic Data	Group (QLB) [N=20]	Group (TAP) [N=20]	Group (GA) [N=20]	F/x2#	p-value
Age (years)	41.01±5.76	41.31±5.45	41.67±5.76	0.397	0.735
Sex Male Female	 2 (10%) 18 (90%)	 1 (5%) 19 (95%)	 3 (15%) 17 (85%)	1.274#	0.213
BMI [Wt/Ht^2]	44.65±1.36	46.74±8.79	45.13±1.55	2.965	0.169
ASA II	20 (100%)	20 (100%)	20 (100%)	0.000#	1.000
Duration of Surgery (min)	108.90±25.77	104.96±27.57	112.75±26.84	1.653	0.787

- Table (1) shows no statistically significant difference between groups according to demographic data.

Table (2): Comparison between groups according to intra-operative heart rate:

Heart Rate	Group (QLB) [N=20]	Group (TAP) [N=20]	Group (GA) [N=20]	ANOVA	p-value
After 5 min.	81.42±5.79	82.95±6.22	79.40±4.78	1.366	0.650
After 10 min.	79.84±3.63	81.56±4.29	83.20±4.42	1.252	0.596
After 15 min.	74.62±3.50	77.08±5.80	80.15±5.13	1.426	0.679
After 30 min.	73.11±3.44	76.13±10.55	79.70±4.82	4.673	0.038*
After 45 min.	74.97±3.59	78.49±7.68	82.71±9.12	8.401	0.007*
After 60 min.	75.02±2.76	78.49±7.57	82.84±6.73	6.061	0.033*
After 90 min.	74.97±5.73	78.99±6.57	84.07±6.12	5.007	0.027*
After 120 min.	75.27±5.75	79.31±6.60	84.40±6.14	4.592	0.025*

* Statistically significant difference.

- Table (2) shows statistically significant difference between groups in intra-operative heart rate, from after 30 min to after 120 min.

Table (3): Comparison between groups according to intra-operative mean arterial blood pressure:

Mean Arterial Blood Pressure	Group (QLB) [N=20]	Group (TAP) [N=20]	Group (GA) [N=20]	ANOVA	p-value
After 5 min.	90.10±5.46	90.95±7.16	91.25±5.93	1.678	0.799
After 10 min.	88.04±6.27	87.64±6.53	88.59±6.37	0.708	0.337
After 15 min.	76.28±3.42	76.98±4.45	78.64±4.52	1.880	0.895
After 30 min.	75.88±4.44	78.64±4.47	86.93±2.41	5.230	0.028*
After 45 min.	76.94±3.29	77.72±3.76	82.78±20.27	6.154	0.033*
After 60 min.	74.67±4.77	76.99±3.22	85.22±4.02	6.893	0.037*
After 90 min.	76.88±3.62	80.01±5.03	86.33±3.42	5.368	0.029*
After 120 min.	77.19±3.63	80.33±5.05	86.67±3.43	4.971	0.027*

* Statistically significant difference.

- Table (3) shows statistically significant difference between groups in intra-operative mean arterial blood pressure, from after 30 min to after 120 min of surgery.

Table (4): Comparison between groups according to intra-operative SpO_2:

SPO2	Group (QLB) [N=20]	Group (TAP) [N=20]	Group (GA) [N=20]	ANOVA	p-value
After 5 min.	98.26±0.44	98.65±0.69	98.70±0.73	0.728	0.347
After 10 min.	99.61±0.50	99.40±0.66	98.70±0.40	1.464	0.697
After 15 min.	99.71±0.47	99.45±0.43	99.45±0.60	1.356	0.646
After 30 min.	99.71±0.42	99.60±0.50	99.60±0.50	1.353	0.644
After 45 min.	99.71±0.48	99.50±0.54	99.60±0.50	1.673	0.797
After 60 min.	99.68±0.52	99.30±0.45	99.90±0.10	1.268	0.604
After 90 min.	99.71±0.48	99.50±0.54	99.60±0.50	1.368	0.652
After 120 min.	99.74±0.48	99.54±0.54	99.64±0.50	1.124	0.535

Table (4) shows no statistically significant difference between groups in intra-operative SpO_2.

Table (5): Comparison between groups according to intra operative end-tidal CO_2:

End-tidal CO2	Group (QLB) [N=20]	Group (TAP) [N=20]	Group (GA) [N=20]	ANOVA	p-value
After 5 min.	34.39±0.44	34.53±0.69	34.54±0.73	1.782	0.848
After 10 min.	35.06±0.40	34.52±0.62	34.54±0.66	1.882	0.896
After 15 min.	34.32±0.36	35.12±0.56	34.54±0.59	2.076	0.989
After 30 min.	34.29±0.32	34.52±0.50	34.53±0.53	0.529	0.608
After 45 min.	34.32±0.29	34.55±0.45	34.57±0.48	3.366	0.118
After 60 min.	34.35±0.26	34.58±0.41	34.56±0.43	0.818	0.796
After 90 min.	34.38±0.23	34.61±0.37	34.63±0.39	0.794	0.736
After 120 min.	34.41±0.21	34.64±0.33	34.66±0.35	0.754	0.699

Table (5) shows no statistically significant difference in intra-operative end-tidal CO_2 between groups.

Table (6): Comparison between groups according to post-operative heart rate:

Heart Rate	Group (QLB) [N=20]	Group (TAP) [N=20]	Group (GA) [N=20]	ANOVA	p-value
At 0 min.	73.67±4.52	76.13±6.62	83.92±4.62	4.962	0.027*
After 15 min.	72.36±3.79	77.98±5.29	83.16±3.42	6.135	0.033*
After 30 min.	72.94±2.99	76.88±2.84	83.67±3.81	4.648	0.025*
After 60 min.	72.11±2.93	74.67±2.21	83.16±3.39	5.017	0.027*
After 2 hrs.	71.96±2.71	75.48±2.15	83.42±3.00	6.533	0.035*
After 3 hrs.	72.11±2.95	75.12±7.00	83.67±2.76	6.902	0.037*
After 4 hrs.	72.61±6.13	74.87±5.44	82.71±4.15	7.614	0.041*
After 8 hrs.	72.96±4.49	76.13±3.81	83.16±2.71	9.537	0.005*
After 12 hrs.	73.37±2.91	76.63±2.23	77.66±2.76	0.331	0.865
After 16 hrs.	73.73±2.93	77.01±2.24	77.06±2.78	1.062	0.761
After 20 hrs.	74.10±2.94	77.40±2.25	78.47±2.79	2.471	0.141
After 24 hrs.	74.47±2.96	77.79±2.26	78.89±2.81	0.991	0.101

* Statistically significant difference.

Table (6) shows statistically significant difference between groups in post-operative heart rate, from 0 min to 8 hrs. after the operation.

Table (7): Comparison between groups according to post-operative mean arterial blood pressure:

Mean Arterial Blood Pressure	Group (QLB) [N=20]	Group (TAP) [N=20]	Group (GA) [N=20]	ANOVA	p-value
At 0 min.	77.96±3.67	81.13±5.10	87.54±3.47	2.016	0.039*
After 15 min.	77.57±3.65	80.72±5.07	87.10±3.45	3.612	0.017*
After 30 min.	77.19±3.63	80.32±5.04	86.67±3.43	2.419	0.047*
After 60 min.	76.80±3.62	79.92±5.02	86.24±3.41	4.334	0.020*
After 2 hrs.	76.42±3.60	79.53±4.99	85.81±3.40	2.117	0.037*
After 3 hrs.	76.12±3.58	79.20±4.97	85.47±3.39	3.793	0.016*
After 4 hrs.	73.93±4.72	76.22±3.19	84.37±3.98	2.540	0.045*
After 8 hrs.	76.17±3.26	76.94±3.72	81.96±20.07	4.551	0.019*
After 12 hrs.	75.12±4.40	77.86±4.43	78.07±2.39	1.378	0.656
After 16 hrs.	75.52±3.39	76.21±4.41	77.86±4.48	1.138	0.542
After 20 hrs.	87.15±6.21	86.76±6.47	87.71±6.31	1.044	0.497
After 24 hrs.	87.19±5.41	86.05±7.09	87.34±5.87	1.189	0.566

* Statistically significant difference.

- Table (7) showing statistically significant difference between groups in post-operative mean arterial blood pressure, from 0 min to 8 hrs. after the operation.

Table (8): Comparison between groups according to post-operative SpO_2:

SPO2	Group (QLB) [N=20]	Group (TAP) [N=20]	Group (GA) [N=20]	ANOVA	p-value
At 0 min.	97.17±0.44	97.47±0.68	97.52±0.72	1.399	0.666
After 15 min.	98.51±0.50	98.21±0.65	97.52±0.40	0.590	0.281
After 30 min.	98.60±0.47	98.26±0.43	98.26±0.59	1.567	0.746
After 60 min.	98.60±0.42	98.41±0.50	98.41±0.50	0.607	0.289
After 2 hrs.	98.60±0.48	98.31±0.53	98.41±0.50	1.220	0.581
After 3 hrs.	98.57±0.51	98.11±0.45	98.80±0.10	1.130	0.538
After 4 hrs.	98.60±0.48	98.31±0.53	98.41±0.50	1.128	0.537
After 8 hrs.	98.64±0.48	98.35±0.53	98.45±0.50	1.394	0.664
After 12 hrs.	99.14±0.48	98.84±0.54	98.94±0.50	1.056	0.503
After 16 hrs.	97.62±0.48	99.33±0.54	99.43±0.50	1.140	0.543
After 20 hrs.	98.11±0.48	97.81±0.54	97.91±0.50	0.937	0.446
After 24 hrs.	98.60±0.48	98.30±0.55	98.40±0.50	1.485	0.707

- Table (8) shows no statistically significant difference between groups in post-operative SpO_2.

Table (9): Comparison between groups according to post-operative respiratory rate:

RR	Group (QLB) [N=20]	Group (TAP) [N=20]	Group (GA) [N=20]	ANOVA	p-value
At 0 min.	11.86±1.16	14.27±1.20	19.55±1.89	5.607	0.032*
After 15 min.	11.76±1.01	12.91±1.20	18.39±1.21	10.082	0.006*
After 30 min.	11.96±0.30	12.36±1.31	17.89±1.40	7.274	0.027*
After 60 min.	11.86±0.52	12.76±1.01	16.28±1.31	6.009	0.022*
After 2 hrs.	12.06±0.27	12.16±0.40	16.38±1.11	5.511	0.021*
After 3 hrs.	12.16±0.22	12.26±1.41	15.38±2.44	6.276	0.023*
After 4 hrs.	12.26±1.01	12.06±1.11	14.87±1.11	7.385	0.028*
After 8 hrs.	12.06±2.31	12.06±1.11	14.77±0.50	8.272	0.031*
After 12 hrs.	12.12±2.32	12.12±1.11	13.24±0.51	1.569	0.747
After 16 hrs.	12.18±2.33	12.18±1.12	13.31±0.51	1.730	0.824
After 20 hrs.	12.24±2.35	12.24±1.12	13.38±0.51	0.441	0.507
After 24 hrs.	12.30±2.36	12.30±1.13	13.46±0.51	2.805	0.098

* Statistically significant difference.

- Table (9) shows statistically significant difference between groups in post-operative respiratory rate, from 0 min to 8hrs after the operation.

Table (10): Comparison between groups according to post-operative VAS (Visual Analogue Scale):

VAS	Group (QLB) [N=20]	Group (TAP) [N=20]	Group (GA) [N=20]	Kruskal Wallis	p-value
After 1 hr.	2 (2-3)	3 (3-4)	4 (4-4)	6.442	0.024*
After 2 hrs.	2 (2-3)	3 (3-5)	4 (3-4)	5.965	0.022*
After 4 hrs.	3 (3-5)	4 (4-5)	4 (4-5)	5.954	0.022*
After 6 hrs.	3 (3-4)	4(3-4)	4 (3-4)	7.362	0.028*
After 12 hrs.	2 (2-3)	3 (2-3)	3 (3-3)	0.682	0.663
After 24 hrs.	2 (2-3)	3 (2-3)	3 (3-3)	0.662	0.613

* Statistically significant difference.

- Table (10) shows statistically significant difference between groups in post-operative VAS, from 1 hr. to 6 hrs. after the operation.

Table (11): Comparison between groups according to post-operative Ramsay Score:

Ramsay score	Group (QLB) [N=20]	Group (TAP) [N=20]	Group (GA) [N=20]	Kruskal Wallis	p-value
After 1 hr.	1 (1-2)	1 (1-2)	3 (3-3)	5.577	0.021*
After 2 hrs.	1 (1-2)	1 (1-1)	2 (2-3)	6.021	0.023*
After 4 hrs.	1 (1-1)	1 (1-1)	2 (2-2)	7.839	0.029*
After 6 hrs.	1 (1-1)	1 (1-1)	2 (2-2)	8.283	0.031*

* Statistically significant difference.

- Table (11) shows statistically significant difference between groups inRamsay score, from 1 hr. to 6 hrs. after the operation.

Table (12): Comparison between groups according to time to the first dose of rescue analgesia given:

	Group (QLB) [N=20]	Group (TAP) [N=20]	Group (GA) [N=20]	ANOVA	p-value
Time to first dose	187.66±23.84	128.07±15.25	15.15±5.45	13.137	<0.001*

* Highly, statistically significant difference.

- Table (12) shows highly, statistically significant difference between groups in the time needed to give the first dose of rescue analgesia.

Table (13): Comparison between groups according to number of morphine doses:

Frequency of administration of morphine	Group (QLB) [N=20]	Group (TAP) [N=20]	Group (GA) [N=20]	Chi-square test	p-value
1	2 (10.0%)	0 (0.0%)	0 (0.0%)	11.444	0.004*
2	12 (60.0%)	3 (15.0%)	0 (0.0%)		
3	6 (30.0%)	6 (30.0%)	0 (0.0%)		
4	0 (0.0%)	8 (40.0%)	2 (10.0%)		
5	0 (0.0%)	3 (15.0%)	7 (35.0%)		
6	0 (0.0%)	0 (0.0%)	11 55.0%)		

* Statistically significant difference.

- Table (13) shows statistically significant difference between groups according to number of morphine doses.

Table (14): Comparison between groups according to total morphine consumption:

	Group (QLB) [N=20]	Group (TAP) [N=20]	Group (GA) [N=20]	ANOVA	p-value
Total Morphine Consumption	22.11±3.11	42.01±6.16	75.14±8.66	9.683	<0.001*

* Highly, statistically significant difference.

- Table (14) shows highly, statistically significant difference between groups in total morphine consumption.

Table (15): Postoperative complications of opioids used:

Complications	Group (QLB) [N=20]	Group (TAP) [N=20]	Group (GA) [N=20]	Chi-square test	p-value
Hypotension	0 (0%)	0 (0%)	0 (0%)	0.000	1.000
Bradycardia	0 (0%)	0 (0%)	0 (0%)	0.000	1.000
Respiratory depression	0 (0%)	0 (0%)	4 (20%)	6.297	0.047*
Nausea & Vomiting	0 (0%)	0 (0%)	6 (30%)	8.744	0.024*

* Statistically significant difference.

- Table (15) shows statistically significant difference between groups in respiratory depression, nausea and vomiting.

DISCUSSION

The results of our study demonstrated that tansversus abdominis plane block was more effective than intravenous opioid drug analgesia, while quadratus lumborum block was more effective than tansversus abdominis plane block. The first call for rescue analgesia (morphine), total morphine consumption and pain scores (visual analog score) indicated that the superiority of the two analgesic techniques (TAP block and QL block) was attributed to their opioid sparing effect.

The patients of group GA had highest pain scores and were the first to ask for rescue analgesia; therefore, they had highest total morphine consumption in the first 24 hours postoperatively in comparison to patients of group TAP and group QLB.

Data represented in our study showed that postoperative complications as nausea, vomiting and pruritis which resulted due to systemic use of opioids were mostly among group GA rather than the other two groups; group TAP and group QLB with (P<0.05). The reason for this could be that the requirement of morphine among group GA was higher than that among the other two groups.

Our results agree with the conclusion of Blanco and his coworkers [(5)] in 2016 who found that quadratus lumborum block produces more prolonged analgesia than the TAP block. In addition, their results showed that adopting the QLB as the default technique can significantly decrease opioid use and adverse effects after cesarean delivery.

Similarly, our results agree with the conclusion of Blanco and his coworkers [(6)] in 2015, who studied the effects of QLB versus placebo on PCA morphine doses and demands after caesarean section. They found that the patients who received QLB had significantly less morphine consumption than the control group 6 and 12 h after the operation. They also had significantly fewer morphine demands at all time points after caesarean section. The VAS scores were significantly better at every observation time in the QLB group than in control patients.

Also, in 2017, **Gözen and his coworkers[(7)]** compared the QL and TAP blocks for postoperative pain relief after lower abdominal surgery in children. The results of their study showed that the QL block provided more effective pain relief compared with the TAP block and did not have any adverse effects.

A case report, performed by **Elsharkawy and his coworkers**[(8)] in 2016, compared between anterior QL block and TAP block in a patient undergoing subtotal colectomy through a midline incision extending from above the umbilicus to pubic symphysis. This patient experienced consistent sensory blockade in the distribution of the corresponding dermatomes for about 48 hours in the side of QL block; however, TAP block on the contra lateral side did not cover the whole length of the incision. It showed that QL block can create sensory blockade and analgesia along mid and lower thoracic dermatomes and can prolong the analgesia for appropriately selected abdominal surgeries.

Our results agree with the conclusion of **Takeshi and his coworkers[(9)]** in 2016. They found that the effect of a single injection QL block with 20 mL of ropivacaine could spread to T7 - T12 and could last for almost 24 hours, which means that the duration of analgesia was significantly longer for QL block than for TAP block when applied to laparoscopic ovarian surgery.

In his case report about Ultrasound-guided quadratus lumborum block as a postoperative analgesic technique for laparotomy, **Vasanth[(10)]** in 2013, found reduced pain scores and opioid requirement in the first 24 hours post-laparotomy for duodenal tumor excision. However, the opioid use was similar to the day one after continuous TAP block for major abdominal surgery through supra-umbilical or infra-umbilical incisions; this study was performed on twenty patients with Field[(11)] in 2011. The similarity in the day-one opioid consumption between the case report and the study may be because he was comparing one patient who was given single-injection quadratus block to ten patients who were given continuous TAP block.

Technical problems encountered during the study included the need of assistance to position the patients in lateral decubitus on both sides in order to perform bilateral injections in the group QLB; because we included morbidly obese patients with BMI between 35 and 50 kg/m², whose re-positioning after induction of general anesthesia was quiet difficult. Moreover, ultrasound visualization was also difficult sometimes for the same reason.

Other limitations in our study included that we evaluated only single-injection technique for both quadratus lumborum and TAP blocks, while patients of the three groups were allowed to take intravenous morphine as needed. Despite the

use of ultrasound guidance for performing quadratus lumborum and TAP blocks, we did not test the sensory block plane in these patients. Finally, we excluded the patients with ASA physical status >II and BMI >50 kg/m² or <35 kg/m², which limits the external generalizability of the results.

CONCLUSION

This study concluded that quadratus lumborum block was the most effective technique in providing analgesia after laparoscopic bariatric surgery without associated hemodynamic instability in comparison to transversus abdominis plane block and intravenous opioid drugs. Transversus abdominis plane block has the ability to provide an intermediate option between general anesthesia with intravenous opioids and general anesthesia with quadratus lumborum block and could be an effective modality when quadratus lumborum block cannot be performed.

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