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Surgical transversus abdominis plane block versus surgical rectus sheath block for postoperative pain control in morbid obese patients undergoing major gynaecological surgery: a prospective, randomized, blinded study

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Abstract

Background: Postoperative analgesia for major abdominal surgeries, especially with midline incisions, can be challenging particularly in morbid obese patients. This study aimed to compare surgical transversus abdominis plane (TAP) block and surgical rectus sheath (RS) block for postoperative analgesia in patients undergoing major gynaecological surgery regarding their efficacy and adverse effects. Sixty female patients aged 18–60 years were randomly allocated to two equal groups; (group TB, $n = 30$) patients received surgical TAP block, or (RB group, $n = 30$) patients received surgical RS block.

Results: Postoperative total morphine consumption was significantly higher among patients in the TB group than patients in the RB group (Mean ± SD; 18.2 ± 4.4 mg versus 14.3 ± 3.5 mg respectively, P value < 0.001). There was no significant difference between patients in either group regarding pain scores at rest and cough except at 6-h postoperatively when patients in the RB group experienced lower pain scores (P value < 0.001). The RB group showed better respiratory functions at the first hour, 6 h and 12 h postoperatively. There was no significant statistical difference between both groups regarding the incidence of postoperative complications.

Conclusions: Surgical RS block provided more favourable outcomes than surgical TAP block concerning postoperative analgesia in morbid obese patients with similar incidence of postoperative complications.

Trial registration: We carried out this trial at Ain-Shams University Hospitals, Cairo, Egypt, between October 2018 and January 2020. The study was approved by the Research Ethics Committee at the Faculty of Medicine, Ain Shams University (code number: FMASU R55/2018), and then registered in the ClinicalTrials.gov (registration no. NCT03732027) https://clinicaltrials.gov/ct2/show/NCT03732027.

Keywords: Postoperative, Analgesia, Obesity, Gynaecology, Pain, Abdominal wall

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Background

Recently, obesity has emerged as a worldwide problem, and Egypt was ranked as one of the top countries in the prevalence of adult obesity (The GBD 2015 Obesity Collaborators et al., 2017). This problem can make an additional burden on anaesthesiologists and surgeons to search for the best modalities in order to achieve a safe perioperative care and enhanced recovery.

Multimodal pain control regimen which includes pharmacological and non-pharmacological approaches is essential to provide optimal postoperative analgesia in abdominal operations particularly in this category of patients (Alvarez et al., 2014), and thus avoiding the risk of complications such as respiratory insufficiency and haemodynamic instability (Woo, 2009).

Several studies have investigated anterior abdominal wall blocks such as transversus abdominis plane (TAP) block and rectus sheath (RS) block as a part of multimodal analgesia (Chin et al., 2017; Desai et al., 2021; Godden et al., 2013). They gain popularity because they are relatively simple to perform and have a high success rate (Lissauer et al., 2014; Uppal et al., 2019).

The TAP block was described by Rafi in 2001 as a regional anaesthesia technique for anterior abdominal wall surgeries (Rafi, 2001). It provides analgesia by blocking nerves originated from the anterior rami of thoracolumbar spinal nerves (T6–L1) as they traverse the transversus abdominis plane (Rozen et al., 2008).

RS block is another popular technique that has been used for postoperative analgesia after open abdominal operations. It was first introduced by Schleich in 1899 (Schleich, 1899). Traditionally, the RS block has been performed to provide analgesia in operations around the umbilicus, from [T9–T11] (Willschke et al., 2006). Recently, satisfactory clinical results have been obtained for higher dermatomes, up to T6, especially when the injection is done higher. As a result, the block may be suitable for midline laparotomies (Uppal, et al. 2019).

Both blocks are commonly performed using landmark techniques. Nowadays, ultrasound-guided techniques have been introduced with better visibility (Yarwood and Berrill, 2010). However, obesity may render both approaches difficult (Brodsky and Lemmens, 2007; Ruiz-Tovar et al., 2019). Application of local anaesthetic under direct visualization by the surgeon could be of potential benefit in this category of patients.

There is scarce literature about the effectiveness of surgical TAP and RS blocks for postoperative pain control in morbid obese patients. Nevertheless, the results are controversial about which block could be the most effective approach (Abo-Zeid et al., 2018; Cowlishaw et al., 2017; Shields et al., 2020). So, the purpose of this study was to compare between surgical TAP block and surgical RS block morbid obese patients regarding their efficacy and potential adverse effects.

Methods

After obtaining approval from the ethical committee of Faculty of Medicine, Ain-Shams University, (code number: FMASU R55/2018), registration in the ClinicalTrials.gov (registration no. NCT03732027), this prospective randomized study was conducted on sixty female patients undergoing elective major gynaecological surgery with midline incision for the first time in Ain-Shams Gynaecological and Maternity hospital between October 2018 and January 2020. Patients included in the study were of aged from 18 to 60 years with body mass index (BMI) more than 40 kg/m^2. Exclusion criteria included patient refusal to participate in the study, severe cardiac or respiratory disease, reoperation, alcohol abuse, addiction, hypersensitivity or allergy to the study drugs.

After obtaining written informed consent from every patient, they were randomized into two groups; (group TB, n = 30) in which patients received surgical TAP block, or (RB group, n = 30) in which patients received surgical rectus sheath block, by using computer-generated randomized table in 1:1 ratio; allocation was done by a sealed opaque envelope which contained the selected random number and opened by a nurse staff who was not involved in the study.

Patients underwent careful preoperative assessment including detailed history, physical examination and investigations including complete blood picture, renal and liver functions, coagulation profile, arterial blood gases and pulmonary function tests. One day before surgery, patients were instructed by the anaesthetist about how to use the patient-controlled analgesia (PCA) device and how to describe their level of postoperative pain on the numerical scale. In addition, they were instructed prior to induction of general anaesthesia about the usage of incentive spirometer then a basal measurement was obtained. These instructions were confirmed in the recovery room whenever patients become oriented.

In the operating room, patients were attached to standard monitors including electrocardiogram (ECG), automated non-invasive blood pressure (NIBP), pulse oximetry and capnography. Drug dosing was calculated according to the lean body weight (LBW) for all drugs except neostigmine for which total body weight was used. LBW was calculated using James's equation for women (1.07 × actual BW) − (148 × [actual BW/Height]^2) (De Baerdemaeker and Margarson, 2015).

General anaesthesia was induced after adequate preoxygenation for 3 min with intravenous (IV) fentanyl 2 μg/kg LBW slowly administered, and IV titration dose of propofol was followed till the loss of verbal contact. To

facilitate endotracheal intubation, rocuronium 0.5 mg/kg LBW was administered intravenously.

After securing endotracheal tube, maintenance of anaesthesia was done using isoflurane 1–1.5% in oxygen:air [40:60 mixture] supplemented with boluses of fentanyl. Lungs were mechanically ventilated with volume-controlled mode to maintain an end tidal CO_2 35–40 mmHg and positive end expiratory pressure 5 mmHg was applied for protection against atelectasis. Increment doses of 0.1 mg/kg LBW rocuronium were given according to the nerve stimulator monitoring.

At the end of operation and after haemostasis, in the TB group, palpation of the lateral margin of the rectus muscle and localizing inferior epigastric vessels took place after elevation of the rectus muscle using a retractor. In the anterior axillary line, the surgeon advanced a blunt ended 18-gauge needle, at the middle of a line joining the crista illiaca and the inferior costal margin, through the parietal peritoneum and transversus abdominis muscle until loss of resistance was achieved. Careful aspiration was done to avoid vessel puncture, and this was followed by injection of 20 ml of 0.25% bupivacaine from the intraabdominal side into the TAP. The volume was divided equally between the determined site and at two other locations in the lateral abdominal wall at 3–4 cm inferior to the previous injection. The same procedure was repeated using an equal volume of local anaesthetic on the contrary side. Total volume administered was 40 ml in each patient.

For the RB group, 20 ml 0.25% bupivacaine was administered slowly under direct vision after careful aspiration to the rectus sheath space which is present in between rectus abdominis muscle and the posterior layer of its sheath at the upper pole of the midline incision by time of closure of the anterior abdominal wall. The procedure was repeated on the opposite side with total volume administered was 40 ml. Drugs were prepared by the same anaesthetist and blocks were performed by the same surgeon.

At the end of surgery, patients received 2 g of paracetamol and 30 mg of ketorolac intravenously. Since the maximum dose of ketorolac is 120 mg/day, it was repeated every 6 h started 20 min from the end of the operation, and then muscle relaxant was reversed before extubation. Patients were extubated when they were able to open their eyes on verbal command, and the T4/T1 ratio was ≥ 90%. All patients were transferred to the post-anaesthesia care unit to continue the standard monitoring, then to the intensive care unit (ICU).

To achieve blindness, the managing nurse staff, and the anaesthetist involved in data collection were not aware of group assignment.

Preparation and administration of PCA (Accufuser Plus®, Woo Young Medical Co, Korea) was done by 60 ml total volume normal saline containing 60 mg morphine. In the recovery room, PCA was programmed to provide 0.5 ml bolus dose with lockout interval of 8 min. No basal infusion was allowed. Monitoring of the vital signs was continued in the ICU by a nurse to avoid any complications such as respiratory depression or hypotension. PCA was discontinued at 24 h after surgery, and the analgesia regimen was according to the ICU protocol.

Postoperative pain was assessed at rest and coughing using numerical rate scale (NRS) (ranging from 0 to 10 cm: where 0 = no pain, 10 = worst pain) at 0 (immediately postoperative) and at 2, 6, 12 and 24 h postoperatively and total morphine consumption (mg) per 24 h was recorded. Also, postoperative adverse effects or complications such as hypotension (which was defined as mean blood pressure less than 20% of the basal value), respiratory depression (defined as respiratory rate less than ten breaths per minute), sedation [assessed on a four-point scale where 1–fully awake; 2–somnolent, responds to call; 3–somnolent, responds to tactile stimulation; and asleep, responds to painful stimulation], nausea or vomiting (was treated with 8 mg of IV ondansetron), pruritus or any signs or symptoms of local anaesthetic toxicity were noted and treated.

Postoperative respiratory function was measured using a simple flow-oriented incentive spirometer (Pulmogain; Italian Medical Touch CA-MI, Italy). This device is formed of three series of chambers, each containing a ball.

While the patient in a semirecumbent position (45°) with a pillow under her knees, she was advised to inhale slowly and deeply then holding her breath for 5 s followed by passive exhalation. The patient was told to hold the Triflow device straight and to inhale slowly and deeply and thereby elevating the ball. An inspirational flow of 600 ml/s, and 900 ml/s was required to lift the first and the second ball respectively, while a flow of 1200 ml/s was needed to raise the three balls. Failure to raise the ball to the uppermost of the chamber was considered as no reading.

After recovery, measurements were obtained on 60 min, 6 h, 12 h and 24 h. Patient satisfaction was documented after 24 h on a scale between 1 and 5 points where (1: poor, 2: fair, 3: good, 4: very good, 5: excellent). Length of postoperative hospital stay was also assessed.

The primary outcome was the total dose of morphine consumption during the first 24 h postoperatively, while secondary outcomes were postoperative pain scores, respiratory functions and the incidence of postoperative complications.

Sample size calculation

Using STATA program, setting alpha error at 5% and power at 90%, results from a previous study by

Narasimhulu et al. (2016) showed that morphine consumption in TAP block was (Mean ± SD; 28 ± 16.8) compared to (Mean ± SD; 8.8 ± 8.3) for RS block in a study by Bakshi et al. (2016). Based on this difference, with taking in consideration 20% dropout rate, the minimal needed sample is 15 cases per group.

Statistical methods

The collected data was coded, tabulated and statistically analysed using IBM SPSS statistics (Statistical Package for Social Sciences) software version 22.0, IBM Corp., Chicago, USA, 2013. Descriptive statistics was done for quantitative data as minimum and maximum of the range as well as Mean ± SD (standard deviation) for quantitative normally distributed data, median and 1st and 3rd inter-quartile range for quantitative non-normally distributed data, while it was done for qualitative data as number and percentage.

Inferential analyses were done for quantitative variables using Shapiro-Wilk test for normality testing, independent *t* test in cases of two independent groups with normally distributed data and Mann-Whitney *U* in cases of two independent groups with non-normally distributed data. In qualitative data, inferential analyses for independent variables were done using Chi-square test for differences between proportions and Fisher's exact test for variables with small, expected numbers. The level of significance was taken at *P* value < 0.050 is significant; otherwise, is non-significant.

Results

Seventy-four patients were recruited for the study. However, 14 patients were excluded as 12 patients did not match the inclusion criteria, whereas two patients refused to participate. Finally, 60 patients meet the study criteria and completed the study after obtaining their consent. They were randomly allocated into two groups (30 patients in each group) (Fig. 1).

There were no significant statistically difference between both groups regarding the demographic data (age, BMI), operative data (type of surgical procedures, length of skin incision, operation time) and average fentanyl consumption (Table 1).

Postoperative total morphine consumption during the first 24 h was significantly higher among patients in TB group than patients in the RB group (Mean ± SD; 18.2 ± 4.4 mg vs. 14.3 ± 3.5 mg respectively; *P* value < 0.001). There was no statistically significant difference between patients in TB group and patients in RB group regarding postoperative NRS scores at rest and cough except at hour-6 where pain scores were higher among patients in TB-group (*P* value < 0.001) (Table 2).

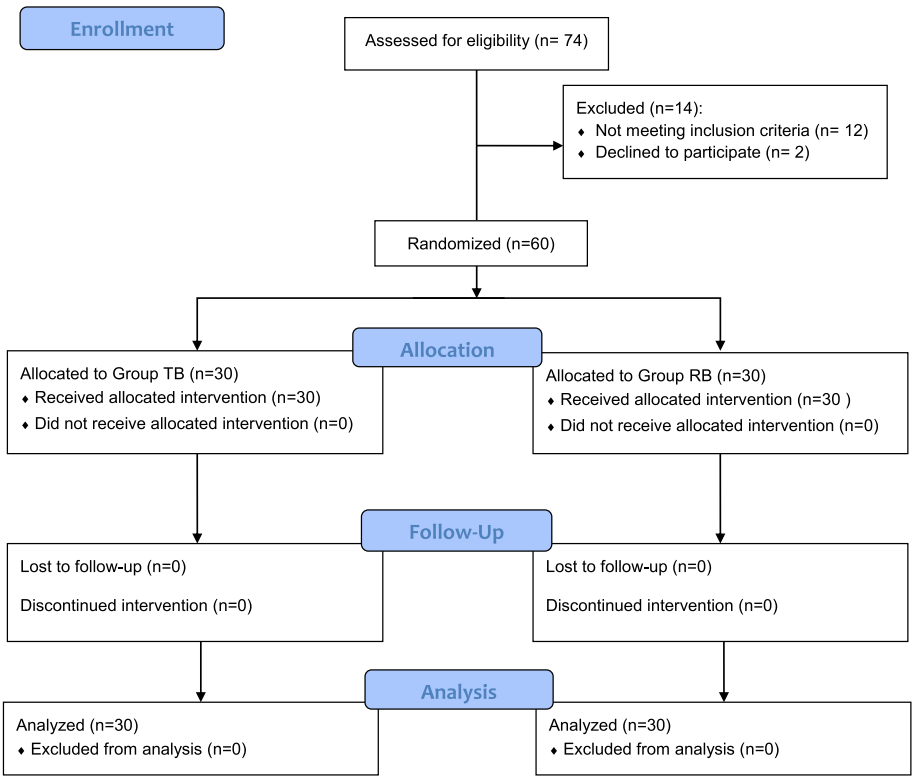

Fig. 1 Consort flow chart for the studied cases. *TB* transversus abdominis plane block, *RB* Rectus sheath block

Table 1 Demographic data, operative data, and average fentanyl consumption among the study groups

Variable		TB (n = 30)	RB (n = 30)	P value
Age (year)		46.6 ± 5.0	45.7 ± 4.3	0.476^
BMI (kg/m^2)		44.8 ± 1.3	45.2 ± 1.3	0.281^
Type of surgical procedures	Ovarian pathology	12 (40.0%)	11 (36.7%)	0.840[II]
	Uterine pathology	16 (53.3%)	18 (60.0%)	
	Cervical pathology	2 (6.7%)	1 (3.3%)	
Length of skin incision (cm)		17.3 ± 2.1	16.7 ± 1.6	0.238^
Operation time (min)		233.7 ± 14.1	237.1 ± 15.4	0.375^
Average fentanyl consumption (μg)		263.7 ± 22.4	254.3 ± 25.3	0.135^
Time to performing the technique (min)		7.2 ± 1.5	4.7 ± 1.4	**< 0.001^***

Data presented as Mean ± SD or n (%) as appropriate
BMI body mass index, *TB* transversus abdominis plane block, *RB* rectus sheath block.
[II]Fisher's exact test
^Independent t test
*P < 0.001 is highly significant

Regarding the postoperative respiratory functions as measured by the flow-oriented incentive spirometer, patients in the RB group showed improved respiratory functions at first hour, 6 h and 12 h postoperatively more than patients in the TB group which was highly significant. No significant differences were noted between both groups at baseline or at 24 h postoperatively (Fig. 2).

The two groups were not statistically different for postoperative complications such as nausea and vomiting, pruritus, hypotension and sedation. No cases of respiratory depression or local anesthetic toxicity were recorded in the studied groups (Table 3).

Regarding patient satisfaction, it was significantly higher among patients in the RS group than patients in the TB group (Mean ± SD; 3.8 ± 0.8 vs. 2.6 ± 0.5 respectively; P value < 0.001). There was no significance difference between the studied groups regarding hospital stay (Mean ± SD; 3.8 ± 0.7 days in TB group vs. 3.9 ± 0.7 days in RB group; P value = 0.480).

Table 2 Postoperative NRS scores among the study groups

Variable		TB (n = 30)	RB (n = 30)	P value
NRS at rest Median (1st–3rd IQ)	**Hour-0**	0.5 (0.0–1.0)	1.0 (0.0–1.0)	0.440^
	Hour-2	1.5 (1.0–2.0)	2.0 (1.0–2.0)	0.798^
	Hour-6	4.0 (3.0–5.0)	2.0 (1.0–2.0)	**< 0.001^***
	Hour-12	3.0 (2.0–4.0)	2.0 (2.0–3.0)	0.200^
	Hour-24	3.0 (2.0–3.0)	3.0 (2.0–4.0)	0.380^
NRS at cough Median (1st–3rd IQ)	**Hour-0**	1.0 (1.0–2.0)	2.0 (1.0–2.0)	0.124^
	Hour-2	3.0 (2.0–4.0)	2.5 (2.0–3.0)	0.172^
	Hour-6	4.0 (4.0–5.0)	3.0 (2.0–3.0)	**< 0.001^***
	Hour-12	4.0 (3.0–4.0)	3.0 (3.0–4.0)	0.119^
	Hour-24	3.0 (3.0–4.0)	3.0 (3.0–4.0)	0.160^

Data presented as Median (1st–3rd IQR)
NRS numerical rate scale, *TB* transversus abdominis plane block, *RB* rectus sheath block
^Mann-Whitney test
*P value < 0.001 is highly significant

Discussion

This prospective, randomized study shows that surgical RS block was better than surgical TAP block for postoperative pain control in morbid obese patients undergoing major gynaecological surgery as evident by lower total morphine consumption and NRS scores postoperatively. In addition, postoperative respiratory function and patient satisfaction were higher in the RS block group. There were no differences between both groups regarding postoperative complications and hospital stay.

The aim of postoperative pain management in morbid obese patients is to provide comfort, early mobilization and improving respiratory functions without causing excessive sedation. However, the pathophysiology of obesity, its associated co-morbidities and the higher incidence of obstructive sleep apnoea make safe postoperative analgesia a difficult issue in these patients (Schug and Raymann, 2011).

Moreover, major abdominal surgeries, especially with midline incisions, can add extra challenges in obese patients. These operations usually lead to severe postoperative pain that may contribute, if poorly managed, to impaired breathing, inadequate clearance of secretions, atelectasis and reduced cooperation during physiotherapy (Ahmed et al., 2013).

While intravenous opioids are considered the conventional modality to provide postoperative analgesia for these surgeries, several adverse effects may result such as nausea, vomiting, pruritus, urinary retention, ileus and respiratory depression (Oderda et al., 2003). In a retrospective study by Taylor and colleagues, opioids were a leading cause of morbidity in 77% of patients in the first 24 h after surgery, where obese patients were among the most vulnerable group (Taylor et al., 2005).

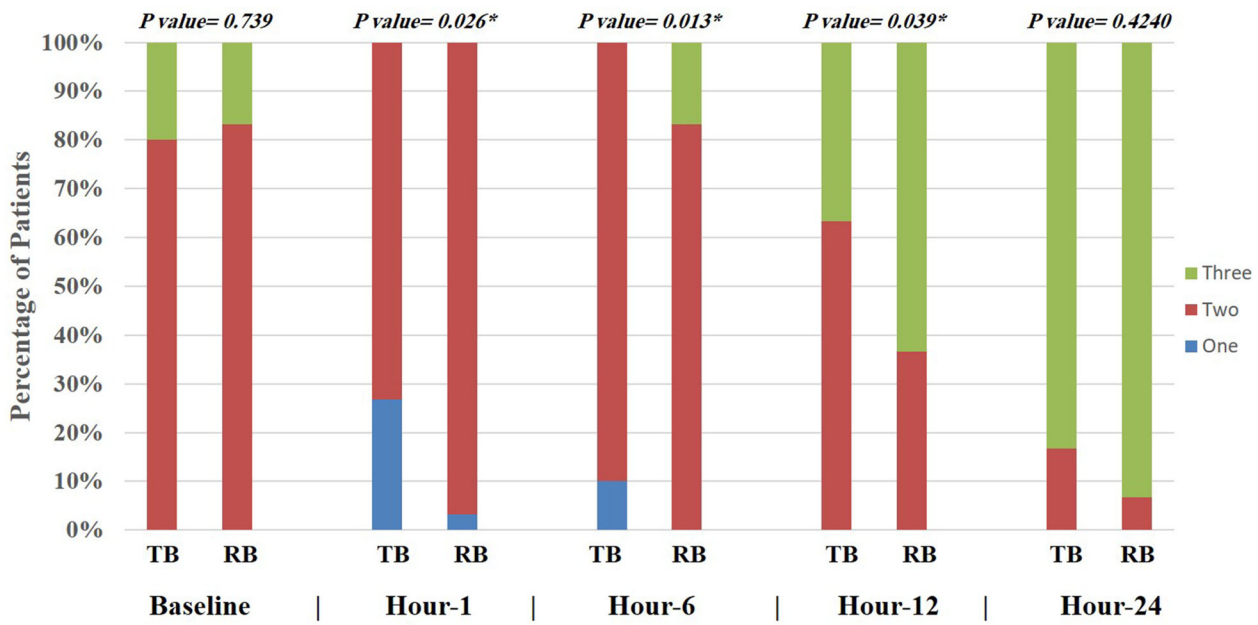

Fig. 2 Postoperative Respiratory functions as measured by the flow-oriented incentive spirometer among the study groups. * Significant. One, two, and three refers to the number of balls that patients were able to elevate by the incentive spirometer during inspiration which represents the maximal inspiratory effort done by the patient. *TB* Transversus abdominis plane Block, *RB* Rectus sheath Block

Thus, a multimodal approach for postoperative pain control that consists of regional anaesthesia techniques, opioids, acetaminophen and non-steroidal anti-inflammatory agents is a highly recommended modality in morbid obese patients as it can decrease the opioids-related side effects (Schumann et al., 2009).

Thoracic epidural analgesia (TEA) has become one of best approaches to provide postoperative analgesia in major abdominal surgeries in several trials and meta-analysis (Wheatley et al., 2001; Block et al., 2003). However, TEA is not free of complications such as motor blockade which can hinder early mobilization, haematoma formation, haemodynamic instability, neural injury and the higher incidence of failure and catheter dislodgement (Bonnet and Marret, 2005). As a result, numerous studies have explored anterior abdominal blocks like TAP block and RS block as alternatives to minimise risks associated with TEA techniques (Chin et al., 2017; Desai et al., 2021; Godden et al., 2013).

Table 3 Postoperative complications among the study groups

Variable	TB (n = 30)	RB (n = 30)	P value
Nausea	3 (10.0%)	2 (6.7%)	1.000^
Hypotension	2 (6.7%)	1 (3.3%)	1.000^
Pruritus	2 (6.7%)	1 (3.3%)	1.000^
Sedation	0 (0.0%)	1 (3.3%)	1.000^

Data are presented as number (%)
TB transversus abdominis plane block, *RB* rectus sheath Block
^Fisher's exact test

Traditionally, TAP block and RS block have been performed percutaneously guided by anatomical landmarks and pop sensation (Azemati and Khosravi, 2005; Rafi, 2001; Bjerregaard et al., 2012). However, false needle passage and visceral organ damage may complicate this blind approach (Dolan et al., 2009; Sandeman and Dilley, 2008). Ultrasound (US) guidance may avoid such potential risks by enhancing visualization of anatomical structures and the precise location of the needle (Belavy et al., 2009; Willschke et al., 2006). But US guidance is not without difficulties, particularly in obese patients, due to difficult positioning, redundant abdomen, inability to recognize anatomical landmarks and the need for an experienced operator (Brodsky and Lemmens, 2007; Ruiz-Tovar et al., 2019).

Surgical blocks during abdominal operations may be a safer choice to overcome these difficulties, as surgeons or anaesthesiologists can perform the procedure under direct vision (Owen et al., 2011; Crosbie et al., 2012). Urfalıoğlu and colleagues have compared both surgical and US-guided TAP blocks in obese pregnant women undergoing caesarean section under general anaesthesia and found similar results regarding postoperative analgesia (Urfalıoğlu et al., 2017). In addition, Narasimhulu and colleagues compared time taken to perform either the surgical TAP block or the US-guided TAP block after caesarean section and found significantly shorter time for the surgical approach (2.4 vs. 12.1 min, P < 0.001) (Narasimhulu et al., 2018).

Despite all previous studies, there is scarce literature about the comparison of the effects of surgical TAP block and surgical RS block in obese patients in major abdominal gynaecological surgeries.

In the current study, the total dose of morphine consumption in the first 24 h was significantly lower among patients in the surgical RS block group. Additionally, pain scores were significantly lower at 6 h postoperatively at both rest and cough among patients in the RS block group compared to patients in the TAP block group. However, there was no significant difference between the two groups at other times.

The anterior abdominal wall is supplied by the anterior rami of thoracolumbar spinal nerves from T7 to L1. T7–T12 forms a neural plexus that lies in the TAP between the transversus abdominal and the internal oblique muscles. Nerves from this plexus travel medially to pierce the rectus abdominis muscle from behind and move anteriorly to supply the overlying skin (Ellis, 2009). As the site of the TAP sensory block is predominantly present lateral to a line that passes through the anterior iliac spine, an RS block may be a better option for providing analgesia to midline incisions (Stoving et al., 2015).

Regarding the effectiveness of surgical RS block and surgical TAP block, first, Crosbie et al. revised the data of 98 patients who underwent major gynaecological surgeries and found that patients who received surgical RS had lower pain scores and consumed less morphine than patients receiving standard wound infiltration with a local anaesthetic (Crosbie et al., 2012). While Baharti et al. investigated the efficacy of surgical TAP block in colorectal surgeries and found that patients experienced lower pain scores, and there was a 64% reduction in the 24-total morphine consumption (Bharti et al., 2011).

On the contrary to our results, Abo-Zeid et al. found that bilateral surgical TAP block provided a prolonged duration of postoperative analgesia with a lower total dose of morphine consumption in the first 24 h compared to bilateral surgical RS block and subcutaneous infiltration of the wound. This controversy may be related to the type of operation since Abo-Zeid, and her colleagues investigated the previous three techniques in abdominoplasty operations (Abo-Zeid et al., 2018).

Cowlishaw et al. compared continuous subcostal TAP block and RS block in patients underwent midline laparotomy for gynaecologic oncologic surgery. Their study showed no difference between groups regarding postoperative pain and opioid consumption (Cowlishaw et al., 2017). Also, Shields et al. found that there was no significant difference in the total amount of postoperative morphine consumption in patients who underwent open retropubic prostatectomy with either surgical TAP block or surgical RS block (Shields et al., 2020). The use of catheters in Cowlishaw et al.'s study and the site of the operation in Shields et al. might be the result of this discrepancy.

Regarding postoperative respiratory functions, they were relatively better in the RS group than the TAP group using a simple flow-oriented incentive spirometer. This may be due to the relatively lower pain scores and reduced morphine consumption among patients in the surgical RS group.

Chouhan et al. found that patients who received RS block for midline laparotomy operations showed better improvement in peak expiratory flow rate than patients who received subcutaneous local anaesthetic infiltration (P value < 0.001) (Chouhan et al., 2020). Additionally, in a study by Basaran et al., they found that oblique subcostal TAP block can provide a substantial improvement in respiratory functions (Basaran et al., 2015).

On the other hand, Peterson et al. studied the impact of bilateral TAP block on abdominal muscles in healthy male volunteers, and found no clinically significant differences in the variables of respiratory functions as measured by spirometry (Petersen et al., 2011). Additionally, Carrie et al. found limited change in the restrictive pattern of the respiratory function in a patient undergoing splenectomy after bilateral subcostal TAP block (Carrie and Biais, 2014). Furthermore, Padmanabhan et al. reported that insertion of bilateral catheters into the rectus sheath space after midline laparotomy with intermittent bupivacaine infusion did not affect postoperative peak expiratory flow rate (Padmanabhan et al., 2007).

There was no statistical difference between the studied groups regarding postoperative complications, such as nausea and vomiting, hypotension, pruritus or sedation. Patient satisfaction was significantly higher in patients who received the surgical RS block group than patients who received the surgical TAP block. The relatively higher patient satisfaction may be attributed to the lower pain scores and better respiratory functions. However, both groups showed no significant difference regarding the duration of postoperative hospital stay.

Some studies revealed that RS block and TAP block were associated with lower incidence of adverse events such as nausea, vomiting and sedation. Also, they led to higher rates of patient satisfaction (Elbahrawy and El-Deeb, 2016; Karaarslan et al., 2018).

Limitations of our study were that we did not perform complete postoperative pulmonary function tests due to limited resources. In addition, we did not measure bupivacaine serum levels after each blockade.

Conclusions

Surgical RS blockade provided more favourable outcomes concerning postoperative analgesia than surgical

TAP blockade in morbid obese patients undergoing major gynaecological surgery with a nearly similar incidence of adverse events. Besides, there was more improvement in postoperative respiratory function and higher degrees of satisfaction among the patients in the surgical RS blockade group. More studies may be needed to compare both techniques regarding their effects on pulmonary function tests.

Abbreviations

BMI: Body mass index; ECG: Electrocardiogram; ICU: Intensive care unit; IV: Intravenous; LBW: Lean body weight; NIBP: Non-invasive blood pressure; NRS: Numerical Rate Scale; PCA: Patient-controlled analgesia; RS: Rectus sheath; TEA: Thoracic epidural analgesia; TAP: Transversus abdominis plane; US: Ultrasound

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Authors' contributions

MM, MA and ME participated in designing the study, revision of literature, following the patients, collecting the data, writing and critical revision of the manuscript. All authors approved the final version of the manuscript.

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Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

Approval of research ethical committee of Faculty of Medicine, Ain-Shams University was obtained (code number: FMASU R55/2018), registration in the ClinicalTrials.gov (registration no. NCT03732027), and informed consent was obtained from all patients.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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