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Peri-operative Rectus Sheath Fentanyl-levobupivacaine Infusion *vs.* Thoracic Epidural Fentanyl Levobupvacaine Infusion in Patients Undergoing Major Abdominal Cancer Surgeries with Medline Incision

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Abstract

Background and Objectives: The gold standard for acute postoperative pain management in major abdominal surgeries is thoracic epidural analgesia (TEA) and this was proved by a lot of studies, systematic reviews and meta-analyses. However, TEA is sometimes contraindicated and may cause serious risks. Rectus Sheath Block (RSB) is effective for the abdominal surgeries with midline abdominal incisions as local anesthetics will be injected within the posterior rectus sheath bilaterally leading to intense pain relief for the middle anterior wall extending from the xiphoid process to the symphysis pubis. The aim of the study was to assess intra and post-operative RSB versus intra and post-operative TEA, in patients undergoing elective major abdominal cancer surgery with midline incisions.

Methods: This randomized, blinded, was registered at www.clinicaltrials.gov at no.: "NCT03460561" and was approved by local ethics committee of South Egypt Cancer Institute, Assiut University, Egypt. One hundred adult patients, (ASA grade II and III), scheduled for major elective abdominal cancer surgery with Medline incision, were randomly divided into two groups, (50 patients each); **TEA group:** patients in this group received TEA with standard GA and intra-operative analgesia was started before skin incision by injecting epidural bolus dose of 0.1 ml/kg of (0.125% levo-bupivacaine+fentanyl 2 µg/ml). Postoperative analgesia was provided through PCEA by injecting a bolus dose of 3 ml then continuous infusion of 0.1 ml/kg of mixture of (0.0625% levo-bupivacaine+fentanyl 2 µg/ml) for 48 hours postoperative. **RSB group:** patients in this group received standard GA plus ultrasound (U/S) guided rectus sheath block by a volume of 20 mL of (0.25% levo-bupivacaine+fentanyl 30 µg) in saline on either side. Before end of surgery and before closure of abdominal wall, bilateral surgically placed catheters in rectus sheath plane aiming to provide post-operative analgesia using the following; 20 mL of (0.125% levo-bupivicaine+Fentanyl 30 µg) every 12 hours in to each catheter for 48 hours. Perioperative hemodynamics (MAP and HR) were recorded. Postoperative pain was assessed over 48 hour post operatively using (VAS). Total fentanyl consumption, Peak expiratory flow rate (PEFR), postoperative and side effects of the drugs and duration of ICU and hospital stay were recorded.

Results: We found a significant reduction in VAS pain scores (at rest and during cough) in both group at all post-operative period but fentanyl consumption was significantly lower in TEA group. Also we found a significant reduction in intra-operative hemodynamics (mean arterial pressure and heart rate) in TEA group in comparison to RSB group while there was minimal statistically significant reduction in postoperative MAP and heart rate. The incidence of other postoperative complications such as decreasing PEFR, sedation, nausea and vomiting were comparable in both groups.

Conclusion: Rectus sheath block was not inferior to thoracic epidural analgesia in reduction of pain intensity after major abdominal cancer surgeries, and associated with hemodynamic stability along the 48 hours postoperative without procedure related adverse events or decreasing PEFR.

Introduction

Major upper abdominal cancer surgeries with midline incisions usually cause intense postoperative pain, and a significant component of this experienced severe pain is due to abdominal wall incision [1]. Treating of this pain lead to reduction of stress response, post-operative insulin resistance and allows early patients mobility, which itself is very important to decrease secondary complications such as chest infection and Deep Venous Thrombosis. This is an important goal of Enhanced Recovery Programmes (ERP) which aimed at reducing complications [2]. Thoracic epidural analgesia (TEA) is considered the gold standard method in major upper abdominal surgeries for postoperative analgesia, and this was proved by many studies, systematic reviews and meta-analyses which have concluded that TEA was associated with effective postoperative analgesia with

better patients' outcomes and reduction of (ileus, systemic opiate requirements and pulmonary complications) [3-7].

However, TEA is sometimes contraindicated and leads to many serious risks as; motor block involving lower limbs preventing early mobilization of patient, high incidence of failure rate, premature catheter dislodgement and hypotension with risk of prolonged use of vasopressors [8]. Also TEA may cause rare but dangerous and critical neurologic complications such as; (hematoma, abscess and paraplegia) [9,10]. Several investigators explored other alternatives to reach the best choice for post-laparotomy analgesia avoid adverse effects related to TEA, decrease opioid requirements and allow patients to breathe and cough more comfortably [11,12]. The rectus sheath block (RSB) was performed first time in 1899 as an analgesic technique. Then, the block appears to decrease opioid requirements after laparotomy, by blocking ventral rami of the seventh to twelfth intercostal nerves, which supply the rectus abdominis muscle and overlying skin, are blocked [13,14].

RSB was used effectively for the abdominal surgeries with midline incisions as local anesthetics injected within the posterior rectus sheath bilaterally providing good analgesia for the middle anterior abdominal wall from the xiphoid process to the symphysis pubis [15,16]. But, RSB has no effects on visceral pain control, which may be experienced in the early postoperative 12-36 hours [15]. To improve the block duration or quality or both, many studies have shown that adjuvant like opioids (Fentanyl), has been used for regional nerve plexus blocks [17,18]. The value of u/s image guiding for rectus sheath block helps to reduce incidence of peritoneal or vital structures injury, and to facilitate correct needle position [19]. The aim of the study was to answer the question; does analgesic efficacy of intra and post-operative RSB-as safe alternative-comparable to intra and post-operative TEA in patients undergoing elective major abdominal cancer surgery with midline incisions?

Patients and Methods

This randomized, blinded, was registered at www.clinicaltrials.gov at no.: "NCT03460561" and was approved by local ethics committee of South Egypt Cancer Institute, Assiut University, Egypt. One hundred adult patients, (ASA grade II and III), scheduled for major elective abdominal cancer surgery with Medline incision, were consecutively enrolled. Patients who excluded from the study; who refused the study, Patients with active neurological disease, Patients with coagulopathy, cutaneous disorders at the epidural insertion site, and Patients allergic to the studied medications. All patients were evaluated by cardiologist and anesthesiologist for medical history, and physical fitness.

Oral ranitidine tablet, 50 mg and lorazepam tablet, 3 mg on the night of surgery were given to all patients as pre-operative medications. The day before surgery, patients of both group were taught how to evaluate their own pain intensity using the visual analog scale (VAS), scored from 0 to 10 (where 0=no pain and 10=worst pain imaginable) [20], and how to use the patient controlled analgesia (PCA) device (Abbott Laboratories, North Chicago, IL, USA). Patients were randomly assigned into two groups, (50 patients in each group), and method of randomization was as following; opaque sealed envelopes containing a computer generated randomization schedule; the opaque envelopes were sequentially numbered and were opened immediately before application of anesthetic plan.

TEA group (No.=50): Patients in this group received TEA with standard GA and intra-operative analgesia was started before skin incision by injecting epidural bolus dose of 0.1 ml/kg of (0.125% levo-bupivacaine+fentanyl 2 µg/ml). Postoperative analgesia was provided by bolus dose of 3 ml then continuous infusion of 0.1 ml/kg of mixture of (0.0625% levo-bupivacaine+fentanyl 2 µg/ml) for 48 hours postoperative.

RSB group (No.=50): Patients in this group received standard GA plus ultrasound (U/S) guided rectus sheath block by a volume of 20 mL of (0.25% levo-bupivacaine+fentanyl 30 µg) on either side. Before end of surgery and before closure of abdominal wall, bilateral surgically placed catheters in rectus sheath plane aiming to provide post-operative analgesia using the following; 20 mL of (0.125% levo-bupivicaine +Fentanyl 30 µg) every 12 hours in to each catheter for 48 hours. Also we gave postoperative intravenous rescue analgesic Fentanyl (30 µg) that could be repeated every 10 minute) if visual analog pain scale (VAS) ≥ 4.

Standard general anesthesia

Preoxygenation for 3 min, then induction of anesthesia was done with IV propofol (2.5 mg/kg) plus 0.15 mg/kg Cisatracurium to facilitate Tracheal intubation and fentanyl 2 µg/kg. Anesthesia maintainance was done by; sevoflurane 1-1.5 minimum alveolar concentration (MAC) and cisatracurium 0.03 mg/kg when indicated. Patients were mechanically ventilated to maintain end tidal CO_2 between 35 and 40 mmHg. The oxygen-air mixtures was used to keep inspired oxygen fraction (FIO_2) 50% At the end of surgery, neuromuscular block was antagonized in all patients using neostigmine 0.05 mg/kg and atropine 0.02 mg/kg and the patients were extubated in the operating room. Hypotension was defined as systolic blood pressure <85 mmHg and was treated with IV fluid plus IV ephedrine 0.1 mg/kg. Bradycardia was defined as HR slower than 50 beats/min and was treated by atropine 0.01 mg/kg.

The technique of thoracic epidural

Thoracic epidural catheter was inserted, under complete aseptic precautions and before induction of GA, using a 17 gauge, Tuohy epidural needle by a midline approach. T9-T10 interspace was targeted for the injection after skin infiltration by 5 mL of lidocaine 1%. Using loss of resistance technique, the epidural space was identified then the catheter was introduced 2 cm into the epidural space, then epidural test dose of 3 mL of lidocaine 2% with 1:200,000 adrenaline was injected to exclude accidental vascular or subarachnoid position. Loading dose of 0.1 mL/kg of 0.125% bupivacaine+fentanyl 2 µg/mL to obtain T4 sensory level but if the injected dose was not enough to achieve T4 sensory level, another dose of 0.05 mL/kg was injected after 20 minutes.

Rectus sheath block technique

Just after induction of GA and before surgical incision, rectus sheath blocks (RSB) were performed (by one investigator to all patients) in the operative room. Emergency equipments to treat local anesthetic toxicity were available and under complete aseptic sterilization, the rectus muscle was imaged with the ultrasound probe, A broadband (5-12 MHz) linear array probe of Sonosite™ 3000 ultrasound (FUJIFILM, Sonosite EDGE II-UAS) in a transverse orientation immediately above the level of the umbilicus, with an imaging depth of 4-6 cm.

Then an 18G Tuohy needle was introduced few millimeters depth using an in plane technique in an angle of 45 degrees to the skin. The

ultrasound images identify the rectus muscle and posterior rectus sheath with fascia transversalis as two hyperechoic railway-like lines. Then under direct vision, the needle was advanced to the desired position where 20 mL of (levo-bupivacaine 0.25% Fentanyl 30 μg) were injected causing hydro dissection of the rectus muscle away from the posterior rectus sheath. And the same technique was repeated on the opposite side.

Before closure of abdominal wall, an epidural catheter (Smiths-medical 16G epidural mini-pack) with multiple opening at the end of the tubing were inserted by surgeon as following; two catheters were placed at the superior end of the laparotomy wound. And the surgeon placed one hand inside the abdomen and the other hand used for insertion of the introducer needle. The surgeon felt when needle was in the interface between the peritoneum and muscle layer, and palpated the inferior epigastric artery to prevent its injury then he removed the stylet and the epidural catheter was advanced until a 5 cm length is in the peritoneum-muscle interface. The surgeon fixed the catheter and secured it at this point, to prevent accidentally pulled out.

Then a bacterial filter was connected and the catheter was flushed as to avoid its occlusion. The procedure was repeated on the contra lateral side. In PACU, we injected above mentioned local anesthetic mixture every 12 hours in to each catheter, and the catheters were examined every day for signs of infection or occlusion. All patients were followed up for 48 hours in PACU by the following parameters:

- Vital signs (MAP, HR) were recorded intra and post-operative 48 hours.
- VAS score (at rest and with cough) was recorded at 0,2,6,12,24,36 and 48 hours.
- Total intra and post-operative Fentanyl consumption.
- The Peak expiratory flow rate (PEFR) preoperatively, 12 and 24 hours postoperative.
- Any side effects as; nausea, vomiting, itching, respiratory depression (diagnosed as SPO2 less than 90%) or sedation by (sedation score).
- Interventional complications (dural puncture, hematoma, abscess or vital structure injury) were recorded.
- Duration of ICU and hospital stay.

Results

The study involved two groups of patients who underwent major abdominal cancer surgeries using midline incisions; the RSB Group (n=50) and the TEA Group (n=50) (Figure 1) illustrates the flow of the patients through the study. The demographic data and the patient's characteristics were similar between groups (Tables 1-4). We found a significant reduction in VAS pain scores (at rest and with cough) in both group at all measured time points (Tables 5-7) however, intra and post-operative fentanyl consumption were significantly decreased in TEA group (P-value 0.000**) (Table 8). Also there was a significant reduction in early intra and post-operative mean arterial pressure (MAP); and heart rate in TEA group in comparison to RSB group patients (Table 2 and 3) who had clinically important but not statistically significant reduction in postoperative PEFR (192.0 ± 28.0 versus 181.6 ± 31.7 L/min) (Table 4). The incidence of postoperative complications (nausea, itching and vomiting) was comparable in both groups (Figure 2) except sedation which was significantly increased in early post-operative RSB group (P-value 0.046*) (Table 7).
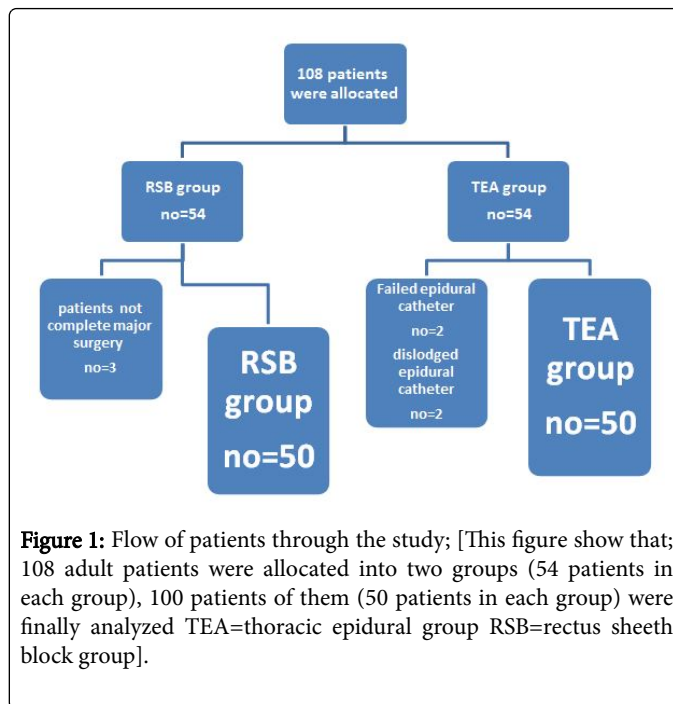
Figure 1: Flow of patients through the study; [This figure show that; 108 adult patients were allocated into two groups (54 patients in each group), 100 patients of them (50 patients in each group) were finally analyzed TEA=thoracic epidural group RSB=rectus sheath block group].
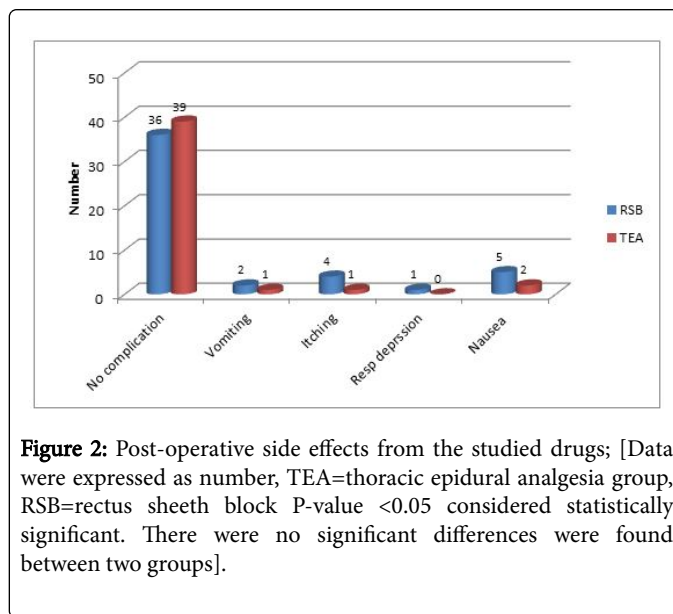
Figure 2: Post-operative side effects from the studied drugs; [Data were expressed as number, TEA=thoracic epidural analgesia group, RSB=rectus sheath block P-value <0.05 considered statistically significant. There were no significant differences were found between two groups].

	RSB Group (n=50)	TEA Group (n=50)	p value
Age (kg)	56.6 ± 8.6	53.7 ± 11.6	0.322
Sex (male/female)	44/6	46/4	1
Body Mass Index (kg/m^2)	27.8 ± 4.4	26.7 ± 5.0	0.439
Duration of operation (min)	162.4 ± 24.9	156.0 ± 27.1	0.389
Type of Operation			
Cystectomy	24 (48.0%)	32 (64.0%)	0.634
Colectomy	18 (36.0%)	14 (28.0%)	

Hysterectomy	6 (12.0%)	4 (8.0%)	
Anterior pelvic resection	2 (4.0%)	0 (0.0%)	

Table 1: Demographic and baseline clinical characteristics of the two studied groups; [Data are expressed as (mean ± standard deviation, ratio and frequency (percentage) TEA=thoracic epidural group RSB=rectus sheath block. P-value <0.05 considered statistically significant].

MAP (mmhg)	RSB group (n=50)	TEA group (n=50)	P-value
Baseline reading	77.9+10.6 (58-94)	78.5+9.3 (68-95)	0.117
1 hour	82.47+10.04 (62-100)	64.53+10.02 (56-90)	0.002*
2 hour	79.67+12.12 (62-98)	65.07+7 (52-77)	0.001*
3 hour	73.73+11.79 (60-100)	69.67+7.32 (60-82)	0.12
4 hour	77.2+13.43 (62-108)	73.2+8.35 (59-86)	0.218
5 hour	73.13+8.86 (62-98)	72.93+4.95 (65-82)	0.914
HR (bpm)			
0 hour	74.8+11.0 (56-94)	77.9+14.0 (57-97)	0.326
1 hour	84.13+10.37 (65-98)	62.4+7.16 (65-89)	0.001*
2 hour	81.93+18.02 (56-120)	66.47+14.43 (57-110)	0.016*
3 hour	83.27+13.96 (58-110)	70.67+11.81 (56-108)	0.012*
4 hour	79.07+14.14 (59-108)	75.33+11.57 (50-98)	0.161
5 hour	73.93+12.34 (55-100)	72.73+13.05 (55-100)	0.952

Table 2: Intra-operative MAP and HR.

Data are expressed as mean ± SD. At base line reading and 1, 2, 3, 4 and 5 hours MAP= mean arterial pressure (mmhg), HR=heart rate (beat per minutes), h=hour interval 0h=Baseline reading TEA=thoracic epidural group RSB=rectus sheath block P-value <0.05 considered statistically significant. There was significant difference in early post-operative periods being decreased in TEA group in comparison to control group.

	RSB group (n=50)		TEA group (n=50)		P-value
	Range	Mean+SD	Range	Mean+SD	
Postoperative HR (bpm)					
Day 1	64.8-121.4	92.91+19.07	55-116.6	84.59+21.78	0.003*
Day 2	67.4-125.4	88.53+15.1	61.6-112	80.6+15.14	0.147
Postoperative MAP (mmhg)					
Day 1	68.8-84.6	77.21+4.63	61.4-80.8	73.69+7.14	0.031*
Day 2	64.8-83.2	76.15+7.94	62.6-79.2	73.75+7.96	0.154

Table 3: Post-operative haemodynamic variables (mean of readings/day).

Data are expressed as mean ± SD, HR=heart rate (beat per minutes), TEA=thoracic epidural group. MAP=mean arterial pressure (mmhg), TEA=thoracic epidural group RSB=rectus sheath block between two groups there was only significant difference in early post-operative day regarding patient's H.R and MAP. P-value <0.05 considered statistically significant.

	RSB Group (n=50)	TEA Group (n=50)	P value
Preoperative	210.0 ± 29.6	196.4 ± 33.4	
12 hour Postoperative	192.0 ± 28.0	181.6 ± 31.7	
24 hour Postoperative	196.0 ± 28.0	184.6 ± 31.7	0.031

Table 4: The Peak expiratory flow rate preoperatively and 12 hours postoperative period in the two studied groups.

Data are expressed as mean ± standard deviation TEA=thoracic epidural group RSB=rectus sheath block Peak expiratory flow rate (PEFR) was assessed preoperatively and then 12 and 24 hours postoperatively. Using ANOVA for repeated measures, (p <0.001). The two groups had the almost same effect on PEFR, however, it was clinically but not significantly higher in RSB Group (p=0.031).

VAS scores at rest	RSB Group (n=50)	TEA Group (n=50)	p value
1 hour	3 (1-4)	2 (2-4)	0.822
2 hour	2 (1-3)	2 (1-4)	0.512
6 hour	2 (1-3)	1.5 (1-3)	0.946
12 hour	1 (1-2)	1.5 (1-2)	0.354
24 hour	1 (1-2)	1 (1-2)	0.734
36 hour	2.5 (2-3)	2.2 (2:3)	0.126
48 hour	2 (2-3)	2 (1:3)	0.302

Table 5: Pain VAS scores at rest during the postoperative 2 days.

Data are expressed as median (range) TEA =thoracic epidural group RSB=rectus sheath block VAS=visual analogue scale, h=hour. P-value <0.05 considered statistically significant.

VAS score with coughing	RSB Group (n=50)	TEA Group (n=50)	p value
1 hour	3 (2-5)	3 (2-4)	0.854
2 hours	3 (2-4)	2.5 (1-4)	0.251
6 hours	3 (2-4)	2.5 (1-4)	0.465
12 hours	2.5 (1-4)	2 (1-4)	0. 735
24 hours	2.4 (1-4)	2 (1-4)	0.693
36 hours	2 (1:3)	1 (1:1)	0.194
48 hours	2 (2:2)	2(1:3)	0.157

Table 6: Pain VAS score with coughing during the postoperative 2 days.

Data are expressed as median (range) TEA=thoracic epidural group RSB=rectus sheath block, VAS=visual analogue scale, h=hour, P-value <0.05 considered statistically significant. Data are expressed as mean ± SD TEA =thoracic epidural analgesia group. RSB=rectus sheath block, h=hour 0h=immediately after recovery. In RSB group sedation was significant in early post-operative hours P-value <0.05 considered statistically significant.

Data are expressed as mean ± SD, TEA=thoracic epidural analgesia group, RSB=rectus sheath block, P-value <0.05 considered statistically significant. There was a difference between two groups. Patients of TEA group stay less period in ICU and hospital and consumed less fentanyl.

Post-op. sedation score	RSB group(n=50)		TEA group (n=50)		P-value
	Range	Mean+SD	Range	Mean+SD	
0 hour	01-02	2	01-01	1	0.01*
4 hour	01-03	2	01-01	1	0.01*
8 hour	01-03	2	01-01	1	0.046*
12 hour	01-02	1	01-01	1	0.943
16 hour	01-01	1	01-01	1	0.948
20 hour	01-01	1	01-01	1	0.943
24 hour	01-01	1	01-01	1	0.956

Table 7: Post-operative sedation score.

	RSB group (n=50)		TEA group (n=50)		P-value
	Range	Mean+SD	Range	Mean+SD	
ICU stay (day)	2-7	4.47 ± 2.16	02-06	3.8 ± 1.57	0.115
Hospital stay (day)	3-12	8.13 ± 7.62	04-11	7.13 ± 4.12	0.209
Fentanyl (mic/24 hour) consumption	600-900	725.6 ± 234.5	200-320	225.3 ± 122.43	0.000**

Table 8: ICU, Hospital stay and total (intra and post-operative) fentanyl consumption.

Discussion

This study showed that both TEA and RSA provided effective of postoperative pain control during the 48 hours with insignificant effects on PEFR and hemodynamics. However, TEA had a better opioid sparing effect than RSA, as proved by much lesser postoperative fentanyl consumption, less ICU stay and hospital stay. With exception of sedation scores which were high in the (RSA) group at the first 12 hours postoperatively in comparison to the TEA group, reflecting the increased fentanyl consumption, there were no interventional complications recorded during the study period. Anesthesia has evolved as an essential three element (pre, intra and postoperative) patient care, and pain management, has become a major quality of life issue [21]. Since the pain inhibitory system was discovered and modulated by neurotransmitters like endorphins, serotonin and others, there were possibilities of using substances that imitate the action of these inhibitory neurotransmitters in the epidural or subarachnoid spaces as means for decreasing acute postoperative pain [22].

The main analgesic regimens used for major abdominal surgery are patient-controlled epidural analgesia (PCEA) or intravenous patient controlled analgesia (IVPCA) with a combination of opioids and local anesthetic drugs with or without intravenous non-steroidal anti-inflammatory drugs (NSAID) or paracetamol [23]. TEA is in routine use in the Egyptian Cancer Institutes in anesthetic management of cancer patients [24] and their risks and benefits are well described and proved and as mentioned above; and many studies concluded that TEA is the gold standard method of post-operative pain control [25,26], therefore this study does not confer any additional risk to trial patients but to investigate if RSB is as effective and safe as TEA or inferior to it. But important limitation of analgesic choice in these cases is contraindications to neuroaxial block as risk of sepsis, immune suppression or coagulopathy that may necessitate avoiding an epidural block for analgesia. These problems are especially common in developing countries [27].

And IV opioids may not be particularly effective in controlling postoperative pain as they provide an initial analgesic effect but subsequently because rapid development of tolerance [21] and it prolongs duration of hospital stay due to dose-related side effects such as postoperative nausea and vomiting (PONV), respiratory depression, over sedation, urinary retention, and ileus [28]. For these reasons, we are concerned with the search for the best analgesic modality to be used in vulnerable cancer patients requiring major surgery associated with hemodynamic instability, excessive blood loss with the least possible side effects that encourage early postoperative mobility. Enhanced recovery after cancer surgery should be the main goal in such vulnerable group.

The regional blocks (as RSB) have been proved to provide effective postoperative analgesia. Furthermore, they were safe and avoid the risk for potentially devastating complications of EA and to decrease systemic analgesic side effects [29,30]. An effective epidural provide effective analgesia after abdominal surgery, while rectus sheath block may spare some visceral pain which is usually minimal by 24 hours post-operative [31]. This fact was proved by the study of Smith and their colleagues who concluded that the RSB was more effective in diagnostic laparoscopy than laparoscopic sterilization because women who performed sterilization experienced a pelvic visceral pain [32].

Visceral pain in this study was almost controlled, we can explain this control because of fentanyl which used with levo-bupivacaine in our study aiming to prolong the duration of sensory and motor blockade as proved by many studies [33,34]. the mechanism of this decrease probably by directly binding with opioid binding sites on the dorsal nerve roots aided with these axonal transport or by diffusing into surrounding tissues and subsequently into the epidural and

subarachnoid spaces, it may also have been central opioid receptor mediated after systemic absorption of fentanyl [35,36]. Adding of Fentanyl as adjuvant opioid to levo-bupivacaine encouraged us to use the more diluted 0.125% concentrations.

RSB has been studied many surgeries, as umbilical and incisional hernia repair in children, cesarean section (when midline incision is used), and laparoscopy and proved to be effective [30,37]. The rectus sheath block aims to block the terminal branches of T6-L1 nerves by injecting local anaesthetics within the posterior rectus sheath bilaterally providing intense analgesia over the middle anterior wall from the xiphoid process to the symphysis pubis [38]. Confirming us Hamill et al. who investigated the effect of rectus sheath block on pain after laparoscopic appendectomy for acute appendicitis in children aged 8-14 years. In this group RSB reduced early post-operative pain. Authors recommended its use as a part of multimodal recovery program [39].

In the current study we used a single intraoperatve shot then continuous post-operative RSB via catheters infusion. As a single bolus of local anesthetic has a maximum duration of 12 hours. So, the comparison period between the two groups extended to the 48 postoperative hours [40]. Confirming us, more recent retrospective case review was done to report on the safety and efficacy of rectus sheath blocks, using bilateral rectus sheath catheters (RSCs), in 200 patients undergoing major open urological surgery. Operations included radical retropubic prostatectomy and radical cystectomy. All RSCs were successfully placed without complications. Low overall pain scores were reported [41].

In accordance with us, another study, which concluded that; RSB provide equivalent analgesia to EPB and avoid the recognized potential complications of EPB after colorectal surgery. RSB is associated with a shorter time to mobilization. This study involved 95 patients undergoing elective open or laparoscopic-converted-to-open colorectal resection for both benign and malignant disease [42]. But against us, an early study which studied the efficacy of intermittent injection of local anesthetics into rectus sheath space on postoperative opioid requirement, pain score and peak expiratory flow rate. In this study, patients who undergoing midline laparotomy received either bupivacaine 0.25% or normal saline using surgically placed catheters in the rectus sheath for 48 hours postoperative. And the results were, no statistically significant differences in postoperative opioid requirement, pain score or PEFR were noticed between two groups [30].

Of course, abdominal incisions is important reason that cause marked reduction in lung volume this is explained by spasm of the anterior abdominal wall muscles, splinting of the diaphragm and absence of deep breaths and sighs. The current study showed a reduction in PEFR in the first 12 h after surgery but the reduction was less pronounced using RSB compared to TEA. This is explained by less peritoneal irritation of the under-surface of the diaphragm and limitation of excursion in patients who receive RSB [43]. In addition, cancer patients constitute a vulnerable group. Elderly patients will increasingly make up the population of patients with cancer. Currently 60% of all malignancies, and 70% of all cancer deaths, occur in people over the age of 65. These patients may have problems in activities of daily living, COPD and medications for medical co-morbidities [44].

When compared with other regional block, a recent prospective, observer-blinded, randomized clinical study was done to evaluate the efficacy of US-guided RSB and transversus abdominis plane (TAP) blocks. The study involved 40 patients undergoing elective liver resection or Whipple procedure. RSB in combination with TAP block was associated with significantly decreased intraoperative fentanyl consumption, significantly lesser morphine boluses in PACU and significantly lower cumulative 24 hour postoperative morphine dosage [45]. Another subsequent study confirmed more effectiveness of administration of bupivacaine following midline laparotomy when placed in the rectus sheath compared with suprafascial delivery. Pain was less intense and morphine consumption decreases with intrafasical bupivacaine infusion [46].

A positive development is the advent of ultrasound use in anesthesia, which has made a variety of regional anesthesia blocks possible that may offer technically simple, safe and better alternative analgesic regimen or adjuncts [47]. It was noticed that the learning skills for the performing of RSCs are increasing in steep manner, particularly in those who previously experienced in ultrasonography-guided regional blocks and the rate of successful RSB is high with ultrasound guidance. The large size of the rectus muscle made RSB an easy technique to master [14]. This is confirmed by a RCT which compared the percentage of success and performance of inexperience trainees using ultrasound versus loss-of-resistance (LOR) technique, it was observed that the needle was placed in the correct targeted plane twice as often using ultrasound but in 21% of the LOR technique, the needle was placed intraperitoneal [48].

And surgical placement of RSCs, either blindly or with dissection, is a good alternative technique; but, some authors disagree with us and concluded that; the surgically placed RSCs were associated with more problems such as blockage or early removal. Also was also noted that patients required a greater amount of rescue analgesia [49]. We can conclude that rectus sheath block is almost effective as TEA in reduction of pain intensity at rest and with coughing following major abdominal operations in cancer patients without decrease of PEFR and addition of fentanyl to levo-bupivacaine as adjuvant may prolong the duration of sensory block. Also Rectus sheath block is associated with hemodynamic stability along the 48 hours postoperative with no drug- or procedure-related adverse events. So RSB could be used as an effective alternative to TEA in patients undergoing laparotomies with a midline incision especially when TEA is contraindicated.

Study Limitations

Our study has many limitations. First, a continuous infusion was not considered in the RSB group. Otherwise, intermittent 12 hours' interval injection was used, meanwhile an uninterrupted epidural infusion used for the TEA group. Second, the study was not double blind. Third, we did not appraise the level of the sensory block in RSA group patients after catheters insertion. Finally, we should include patients with ASA physical status classes >III.

Conflict of Interest

The authors declare that there is no conflict of interest.

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