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Original Research Article

Comparison between Ultrasound-Guided Rectus Sheath Block and Local Anesthetic Infiltration of the Surgical Site for Post-Operative Analgesia in Adult Cancer Patients Undergoing Palliative Abdominal Surgery

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Abstract:

Introduction: Minimally invasive palliative surgeries in oncology like diversion colostomy and feeding jejunostomy can cause moderate to severe pain in the postoperative period. Local anesthetic infiltration of the surgical wound is useful for providing post-operative analgesia but has a short duration of action. Rectus sheath block provides somatic analgesia for abdominal wall vertical midline surgical incisions. The ultrasound-guided rectus sheath block is a good modality for pain relief due to the reduced complications and relatively high success rate. This study aimed to compare the analgesic efficacy, duration of analgesia, rescue analgesia, adverse effects and patient satisfaction between bilateral ultrasound guided rectus sheath block and local anesthetic infiltration on adult cancer patients undergoing palliative abdominal surgery.

Methodology: Following approval by the Institutional Ethical Committee, a prospective randomized controlled study was conducted in a tertiary cancer centre between September 2021 to August 2022. 60 adult patients of either sex and ASA I or II classification, who underwent colostomy or feeding jejunostomy with midline incisions were divided into two groups. Group A (RSB group) received bilateral ultrasound-guided rectus sheath block with 0.2ml/kg of 0.25% ropivacaine following the administration of general anaesthesia and group B received local anaesthetic infiltration with 0.25% ropivacaine, 0.2ml/kg towards the end of surgery. Pain was assessed by VAS score at 0, 2, 4, 6, 8 and 24 hours. Time to initial rescue analgesia following block (hours), frequency of side effects and patient satisfaction as determined by the Quality of Recovery-15 questionnaire were the secondary outcomes studied.

Results: In both the groups, patient characteristics, diagnosis, ASA status, intraoperative vitals and the type and duration of surgery were comparable. Compared to the LA group, the VAS score of RSB group was significantly lower in the immediate post operative period from 2h post operative to 8h post operative (p<0.001). RSB group had a longer time to first rescue after block compared to the LA group (p=0.0098). In a 24-hour period, the RSB group required fewer rescue doses than the LA group (p<0.001). Three patients in each group developed adverse effects. Patients were more satisfied in RSB than the LA group (p<0.001) as measured by QoR 15 score.

Conclusion: Ultrasound guided rectus sheath block is an efficient, simple and secure method of providing analgesia to cancer patients undergoing lower abdominal surgeries.

Keywords: Palliative Medicine, Analgesia, Postoperative Period, Abdominal Wall, Ultrasonography, Anesthesia Local, Surgical Wound.

Introduction

Cancer surgeries are associated with significant postoperative pain and morbidity [1]. Colostomy is one of the most frequently performed life-saving surgical procedures for any acute bowel obstruction most significantly due to colo-rectal malignancy [2]. Colostomy surgeries are associated with significant post-operative pain and discomfort. NSAIDS, acetaminophen and opioids are traditionally used for post-operative pain control [3]. Regional anesthesia techniques using local anesthetics have been shown to provide good analgesia [4]. Surgical jejunostomy is a life-saving procedure done in

patients unable to attain their nutritional needs orally especially in patients with cancer of upper gastrointestinal tract or oropharynx carcinoma [5]. It is an upper abdominal surgery with intraperitoneal approach usually done under general anaesthesia and controlled mechanical ventilation [6].

Feeding jejunostomy can also be done under local anaesthesia in some cases. However, patient's discomfort is common due to peritoneal traction during the procedure especially in cases with long standing disease with adhesions or obstruction. [8] Open jejunostomy cases are associated with significant postoperative pain. [7]

Local anesthetic infiltration of the surgical wound is one of the most frequently used techniques for providing post-operative analgesia in abdominal surgeries [4].

Local anaesthetic administration blocks the noxious stimuli that result from surgical insult at the site of origin. It is easy to perform, safe and inexpensive. It has been shown to provide effective post-operative analgesia with decreased pain scores and decreased opioid consumption in all surgeries especially in abdominal surgeries. Its major disadvantage is its short duration of action. It has been compared extensively with other pain relieving modalities like epidural, spinal, tap block etc. However, there have been limited studies comparing it to rectus sheath block.

The rectus sheath block, first described by Schleich [8] in 1899, provides abdominal wall muscle relaxation and analgesia by blocking the terminal branches of the thoracolumbar nerves [9]. This technique involves injection of local anesthetic into the space between the rectus muscle and posterior rectus sheath which blocks the ventral rami of the 7th to 12th thoracolumbar nerves which results in anesthesia of the periumbilical area (spinal dermatomes 9, 10, and 11) [9,10].

Rectus sheath block provides somatic analgesia for abdominal wall vertical midline (or paramedian) surgical incisions from the xiphoid process superiorly to the symphysis pubis inferiorly. [9] Rectus sheath block is however, not useful for analgesia of the abdominal viscera [11,12]. Both anatomical landmark based technique and ultrasound guided technique have been described for rectus sheath block [13].

The ultrasound-guided rectus sheath block is a good modality for pain relief due to the reduced complications and relatively high success rate [14,15].

Recent studies show that ultrasound guided regional anesthesia techniques for abdominal wall can be an effective component of multimodal analgesic regimen with limited side-effects, hemodynamic instability and perioperative reduction in the use of opioids and NSAIDS [16,17].

With the help of high-resolution ultrasound guidance, direct visualization of the relevant structures aids in successful execution of nerve blocks and avoids complications [13,14].

This study aimed to compare the analgesic effects of bilateral ultrasound guided rectus sheath block and local anesthetic infiltration on adult cancer patients undergoing palliative abdominal surgery. The primary objective was to compare the analgesic efficacy of ultrasound guided bilateral rectus sheath block and local anaesthetic infiltration in patients undergoing colostomy and feeding jejunostomy. Secondary objectives were to compare the duration of analgesia in both groups based on time to first rescue analgesic, the incidence of adverse effects and patient satisfaction in the postoperative period.

Materials and Methods:

A prospective randomized controlled study was carried out in a tertiary cancer care institute between September 2020 and August 2021 after approval of the Institute's Ethical Committee (BBCI-TMC/Misc-01/MEC/256/2021). A total of 60 adult cancer patients undergoing palliative surgeries of abdomen were enrolled in the study. Patients of either sex, between 18 to 70 years, scheduled for colostomy or feeding jejunostomy with midline incisions and belonging to ASA I or II were included. Patients who refused, who had history of previous allergy to local anaesthetics, coagulopathy, sepsis and localised skin infection were excluded.

Patients were randomly divided by a computer-generated program into 2 groups of 30 each. Group A patients (RSB group) received bilateral ultrasound-guided rectus sheath block and Group B patients (LA group) received local anaesthetic infiltration at the incision site.

In the operating room (OR), patients were premedicated with inj palonosetron 0.075 mg i.v, inj tramadol 1 mg/kg iv and induced with inj propofol (1%) 2 mg/kg iv and inj succinylcholine 1.5 mg/kg iv. After intubating with an adequate sized endotracheal tube, patients were maintained with oxygen, nitrous oxide and isoflurane. Inj paracetamol 20 mg/kg iv infusion was given intraoperatively.

The rectus sheath block was performed by one of the authors who was not involved in the collection of data. Surgeon and OR staff were not blinded to the study but patients, family members, recovery room nurses and study coordinators collecting the data were blinded by sealed envelopes.

In group A, before skin incision, and after proper aseptic and antiseptic skin precautions the rectus sheath block was performed. After cleaning with 2% chlorhexidine and 70% isopropyl alcohol, the ultrasound linear array transducer probe 6-13MHz was covered with a sterile sheet and placed transversely just lateral to the umbilicus. A 22G 100mm insulated needle was inserted in an in-plane approach from lateral to medial direction until its tip lay between the rectus muscle and the posterior rectus sheath. After negative aspiration, 2ml saline was injected to see the spread and 0.2ml/kg of 0.25% Ropivacaine was then injected. The same procedure was repeated on the other side.

In group B, at the end of surgery and before closure of the skin incision, local anaesthetic infiltration was done by the surgeon with 0.25% Ropivacaine 0.2ml/kg at the surgical site incision.

After the surgical procedure, muscle paralysis was reversed with inj. glycopyrrolate 0.02mg per kg iv and inj. neostigmine 0.05 mg per kg iv and patients were extubated and shifted to the post anaesthesia care unit (PACU).

In the PACU, patients received inj diclofenac 1mg/kg iv twice daily and inj paracetamol 1g iv infusion 6 hourly as part of multimodal analgesia.

Rescue analgesia was given with inj tramadol 1mg/kg iv whenever VAS score was 4 or more.

Primary outcome was to assess pain by VAS score at 0, 2, 4, 6, 8 and 24 hours. Secondary outcomes were to estimate the time to first rescue analgesia after block (in hours),incidence of adverse effects and patient satisfaction assessed by Quality of recovery-15 (QoR-15) questionnaire, which is based on patient-reported outcome measure of recovery after surgery and anaesthesia.

Statistical Methods:

Descriptive and inferential statistical analysis was carried out. Results were presented by mean ± SD (min-max) and number (%). Significance was assessed at 5% level of significance. Student T test (two tailed, independent) was used to find the significance of study parameters on continuous scale between two groups on metric parameters. Leven's test was used to assess the homogeneity of variance. Chi-square test was used to find the significance of study parameters on categorical scale between two groups, non-parametric setting for qualitative data analysis. Fisher Exact test was used when cell samples are very small. A P value of <0.01 was taken as strongly significant. All data was analysed by Statistical Package for the Social Sciences (SPSS) version 22.0.

Results:

Demographic variables were similar between the two groups. Most of the patients were men more than 50 years old (Figure 1). The most common diagnosis was carcinoma esophagus followed by carcinoma rectum and stomach with similar distribution in both the two groups. Most patients of both groups belonged to ASA I class (Table 1). Distribution of type of surgery, duration of surgery and intraoperative vitals were similar in both groups (Figure 2, Table 2). VAS score in RSB group was significantly lower than the LA group in the immediate post-operative period from 2h post-operative to 8h post-operative. (Table 3, Figure 4) Time to first rescue after block was longer in RSB than the LA group.

Group RSB required less number of rescue doses than group LA within 24 h (Table 3). The incidence of adverse effects was also similar and not significant in the two groups. A total of six that is three patients in each group developed adverse effects. (Table 3) Patient satisfaction as measured by QoR 15 score was significantly higher in RSB than the LA group. (Table 3).

Table 1: Demographic variables and clinical data

Variables	Group LA	Group RSB	Total	P Value
Age (years)	53.1±12.54	50±12.65	51.55±12.59	0.345
Weight (kg)	46.2±5.15	44.53±5.62	45.37±5.41	0.236
Height (cm)	158.1±7.71	158.27±6.22	158.18±6.95	0.927
ASA status				
I n(%)	20(66.7%)	20(66.7%)	40(66.7%)	P=0.777
II n(%)	10(33.3%)	10(33.3%)	20(33.3%)	
Diagnosis				
Cancer esophagus	17(56.7%)	17(56.7%)	34(56.7%)	0.791
Cancer hypopharynx	1(3.3%)	0(0%)	1(1.7%)	1.000
Cancer pyriform sinus	0(0%)	1(3.3%)	1(1.7%)	1.000
Cancer rectum	7(23.3%)	7(23.3%)	14(23.3%)	0.764
Cancer stomach	5(16.7%)	5(16.7%)	10(16.7%)	0.729

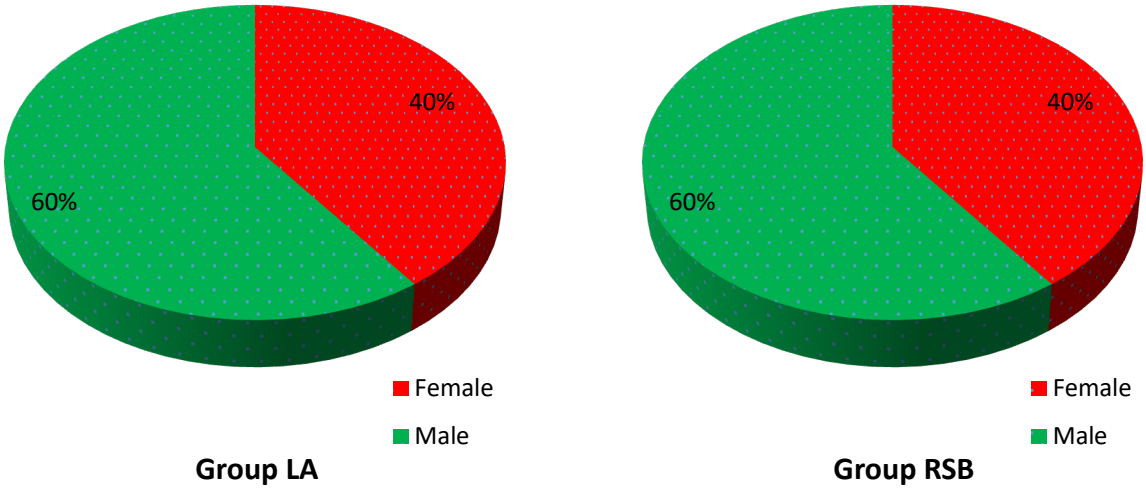

Figure 1: Showing the distribution of sex between the two groups

Figure 2: Showing the distribution of surgery between the two groups

Table 2: Intraop variables:

Variables	Group LA	Group RSB	Total	P value
Duration of surgery (min)				
40-50, n (%)	7(23.3%)	4(13.3%)	11(18.3%)	P=0.857
50-60, n (%)	9(30%)	9(30%)	18(30%)	
>60, n (%)	14(46.7%)	17(56.7%)	31(51.7%)	
Mean ± SD	72.17±22.88	73.17±19.72	72.67±21.18	
Intraop vitals				
Pulse (/min) Mean ± SD	79.43±12.18	76.37±18.91	77.9±15.84	0.458
SBP (mmHg) Mean ± SD	111.1±14.34	109.23±16.07	110.17±15.13	0.637
DBP (mmHg) Mean ± SD	69.3±10.46	67.8±10.62	68.55±10.48	0.584

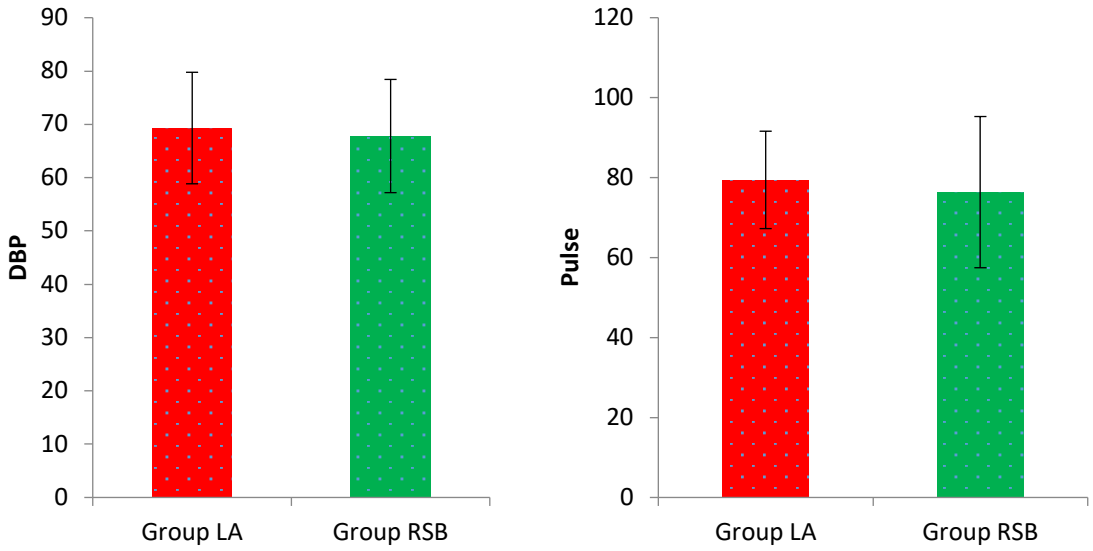

Figure 3: Intraop vitals

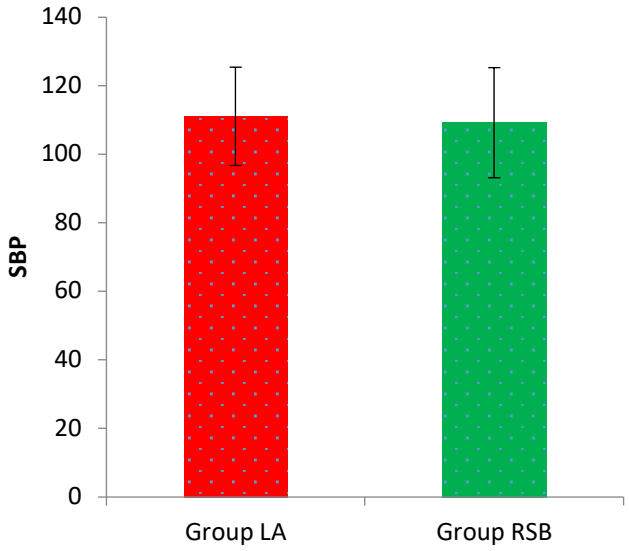

Figure 3: Intraop vitals

Table 3: VAS score, rescue analgesia, adverse effects and QoR-15 score:

Variables	Group LA	Group RSB	Total	P Value
VAS score				
VAS 0	0.3±0.53	0.27±0.45	0.28±0.49	0.795
VAS 2	1.77±0.68	0.8±0.66	1.28±0.83	<0.001**
VAS 4	2.67±1.03	1.5±0.73	2.08±1.06	<0.001**
VAS 6	3.67±1.03	2.33±0.92	3±1.18	<0.001**
VAS 8	4.07±0.87	2.8±0.76	3.43±1.03	<0.001**
VAS 24	3.7±0.99	3.5±0.51	3.6±0.79	0.328
Time to first rescue after block (hours), mean ± SD	6.93±5.14	9.6±7.97	7.77±7.91	0.0098
Total rescue doses in 24 hours, mean±SD	2.23±1.04	0.8±0.81	1.52±1.17	<0.001**
Adverse effects				
No, n(%)	27(90%)	27(90%)	54(90%)	P=1.000
Yes, n(%)	3(10%)	3(10%)	6(10%)	
QoR-15				
<100, n(%)	6(20%)	0(0%)	6(10%)	P≤0.001**
>100, n(%)	24(80%)	30(100%)	54(90%)	
Mean ± SD	114.43±12.59	130.6±8.92	122.52±13.54	

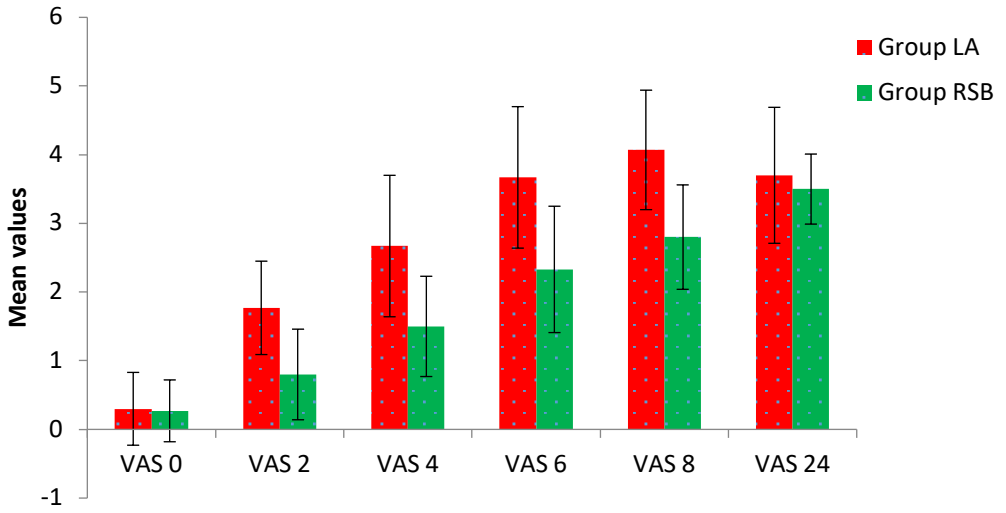

Figure 4: VAS scores

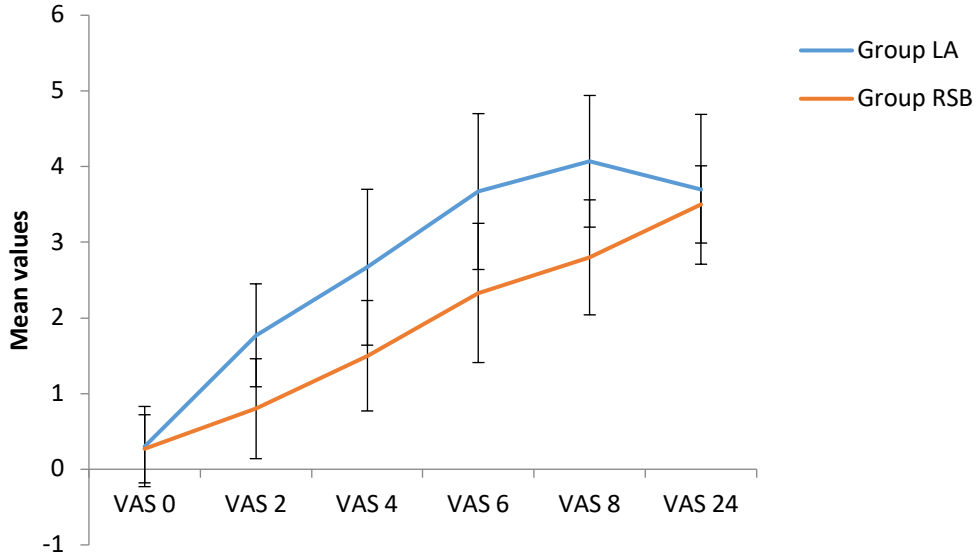

Figure 5 showing VAS scores in both groups

Discussion

Minimally invasive palliative surgeries in oncology like diversion colostomy and feeding jejunostomy can cause moderate to severe pain in the postoperative period. Despite the best analgesic treatment being given, every individual's pain threshold is different and difficult to predict and thus, treatment should be individualised.

Local anesthetic infiltration (LAI) around the surgical incision site is one of the traditional methods, especially used when neuraxial techniques are contraindicated. It has been a part of multimodal analgesia and can decrease opioid requirement and side effects as depicted by several studies [18]. LAI can be used as single or continuous infiltration via catheters placed in the surgical wound. However, due to its antimicrobial and anti-inflammatory property, it can affect wound healing. Complications include local anesthetic toxicity, wound infection, hematoma and bruising.

Currently anterior abdominal wall blocks are being regularly utilized as part of multimodal analgesia. One such block is the rectus sheath block that has gained popularity because it decreases the somatic pain from the xiphisternum to the symphysis pubis, innervated by the anterior cutaneous branches of the T7-T12 nerves [19].

Earlier, rectus sheath blocks were given blindly with loss-of resistance technique. However, due to the correct placement of needle tip being not confirmed, there were risk of injury to various vascular structures organs and peritoneum. The popularity and safety of RSB increased with the use of ultrasound guidance due to accurate identification of the layers of the rectus sheath and important vascular structures. A review of the use

of ultrasound to facilitate the use of regional anesthesia showed that ultrasound imaging allowed the operator to see neural structures, guide the needle under real-time visualization, navigate away from sensitive anatomy and monitor spread of local anesthetic [18].

A study of 81 patients undergoing laparoscopic surgery received RSB performed by trainee anesthetists with either loss of resistance (LOR) technique or ultrasound guided. The LOR technique was accurate in 45% of attempts but was superficial and deep to the rectus sheath in 34% and 21% of punctures, respectively. Ultrasound guidance significantly improved the accuracy of needle placement, with 89% of abdominal punctures being correctly placed at the first attempt [13].

One of the primary indications for RSB with or without catheters is to provide postoperative abdominal wall analgesia when thoracic epidural analgesia (TEA) is contraindicated. One potential advantage is the lack of sympathectomy (and hypotension) that is commonly associated with epidural.

Rectus sheath catheters can be used as an alternative to epidural analgesia or opioid based IV-PCA (intravenous patient controlled analgesia) by targeting the anterior branches of the intercostal, segmental nerves which supply the abdomen. RSB performed prior to the surgical incision facilitates analgesia immediately after initiation of surgery and decreases intraoperative analgesic (opioid) requirements. Alternatively, RSB may be performed in the immediate postoperative setting as a “rescue block technique” in the event of either unexpected severe postoperative pain after an abdominal surgical procedure or unanticipated failed epidural analgesic technique.

This study was done to compare the analgesic effect of rectus sheath block and local anesthetic infiltration. Secondly, the duration of analgesia based on time to first rescue analgesic, the quality of analgesia based on the VAS pain scale, and the incidence of side-effects were compared in the two groups.

In this study, majority of the patients were men in the age group of more than 50 years and the distribution of age, sex, weight and height were similar between the two groups. The diagnosis, surgery, ASA status, duration of surgery and intraoperative hemodynamics between the two groups were similar. Pain as assessed by VAS score was significantly lower in RSB group than the LA group in the immediate post-operative period between 2 and 8 hours post operatively. The time to first rescue dose after the block was longer in RSB than the LA group but that was not statistically significant.

Group RSB required less number of rescue doses in 24 hours as compared to group LA. The incidence of adverse effects between the two groups was also similar.

In a comparative study of 52 patients undergoing umbilical hernia repair who received ultrasound-guided rectus sheath block or local anaesthetic infiltration, the rectus sheath group showed less opioid consumption in the perioperative period than the LA group. [16]. However, the pain scores at rest and with movement the two groups was not statistically significant (P=0.30) . However, in our study we found a statistically significant difference in the pain scores with rectus sheath block showing decreased pain than the LA group 2 hrs after surgery($p<0.001$). The difference in time to rescue analgesic administration between the RSB group [49.7 (36.9) min] and the LAI group [32.4 (29.4) min] was not statistically significant (P=0.11).However,in our study it was 6.93±5.14 hrs(LA) and 9.6±7.97 hrs in RSB block.($p<0.0098$).

In another study on 40 patients with mesenteric vascular occlusion scheduled for laparotomy, those who received rectus sheath block consumed statistically significant less opioid in comparison to control group who received LA. Mean pain scores were statistically significant less in RB Group than in the control group at 2, 4, and 6 h postoperatively. Sedation score, incidence of nausea and vomiting were statistically significant less in the RB Group in comparison to control group. More patients' satisfaction was reported in the RB Group. [11]. In our, the study too satisfaction score as assessed by QOR 15 score was higher in RSB group than LA group.

Another study where patient satisfaction was more in those who received rectus sheath block rather than wound infiltration was a randomised controlled trial done on 42 female patients who underwent hysterectomy or myomectomy. However, there were no significant differences in the amount of morphine consumption, VAS pain and rescue oral analgesics [17].

A three-year retrospective review of 120 patients who underwent open colorectal cancer surgery found a higher incidence of hypotension in epidural group than the rectus sheath catheter group on the first postoperative day (p=0.0001). There was no significant difference in pain score or opiate sparing properties between the groups [20]. In our study, both the groups had stable hemodynamic.

A recent study found that bilateral ultrasound-guided RSB had an excellent a postoperative analgesia at rest and cough for patients undergoing emergency laparotomy surgeries when compared with LA infiltration. Statistically significant differences in median VAS scores were noticed at

one hour (P<0.001), four hours (P=0.001), eight hours (P<0.001), and 12 hours (P=0.014) at rest, and at one hour (P<0.001), four hours (P<0.001) and eight hours (P<0.001) during cough. The median morphine consumption was less with RSB (P<0.001). The time to first rescue analgesia was prolonged with RSB3 (2-4) hours vs 2 (2-3) hours with LA infiltration, (P<0.001) [21]. These findings were consistent with the present study. VAS score was significantly lower and time to first rescue analgesic was longer in RSB compared to LA group in our study too.

Even in single port incision laparoscopic cholecystectomy, USG-guided rectus sheath block was as effective analgesic technique as local infiltration of the port sites, with longer duration of action and morphine-sparing effect and less sedation during the postoperative period. Patients in the RSB group had lower VAS scores in the period between six to eight hours and eight to 12 hours postoperatively [22]. In our study too, the findings were similar.

A retrospective study of 98 patients undergoing major gynecological surgery for benign or malignant disease found that patients who received the surgical rectus sheath block had lower pain scores, required less morphine post-operatively and was discharged home earlier than patients receiving standard subcutaneous local anesthetic into the wound [23]. A study conducted on 50 adult patients undergoing midline exploratory surgery found significantly lower pain scores at rest for 12 h and on mobilization for 6 h after operation with decreased total need of analgesic in first 24 h postoperative with rectus sheath block as compared to wound infiltration of local anesthetic [24].

Post-operative analgesia after laparotomy with rectus sheath block was superior in terms of VAS scores compared to that of subcutaneous bupivacaine infiltration. There was statistically significant decreased use of opioids as rescue analgesic [25]. In a study comparing postoperative analgesia after colorectal surgery through wound catheter continuous infusion and rectus sheath catheter, there was a significant decrease in VAS at rest and with movement in rectus group. Patients in rectus group required less number of rescue analgesia, lower total morphine consumption and had better patient satisfaction [26].

A randomised controlled trial on 60 patients who underwent laparotomy surgery comparing analgesic effects of wound catheter and rectus sheath catheter also had similar findings which was significantly lower VAS score in rectus sheath group [27].

In another comparative study done in patients undergoing midline laparotomies, a significant (p<0.05) reduction of pain was noted in patients receiving USG guided RSB at 2nd, 6th, 12th & 24th postoperative hours as assessed by VAS and time to first rescue analgesic was much higher in RSB group (10.70±3.50 hrs) compared to LA group (2.78±1.121 hrs).A finding similar to our study [28].

Conclusion

Ultrasound guided rectus sheath block is an effective mode of analgesia in cancer patients undergoing lower abdominal surgeries which is safe and easy to administer with few adverse effects.

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