Original Research Article

Comparison of preoperative versus postoperative bilateral rectus sheath block (RSB) for effective perioperative analgesia in patients undergoing emergency midline incision peptic perforation repair

Sayeeda K Mujpurwala[1], Bhumika A Munshi[2], Divyang V Shah[3*]

[1]Post Graduate Third Year Resident, [2]Assistant Professor, [3]Professor & HOD, Department of Anaesthesiology, Surat Municipal Institute of Medical Education and Research (SMIMER), Surat, Gujarat, 395010, INDIA.
Email: sayeedam47@yahoo.com

Abstract

Background: Incision, intraoperative trauma, and postoperative inflammatory inputs are trigger for Surgery-induced central sensitization of pain pathway. Any abdominal surgery, with a large incision, have a high intraoperative and postoperative analgesic requirement; for which regional anesthetic techniques can be useful. Preoperative Rectus Sheath block (RSB) has been shown to be effective for perioperative analgesia, but it has not been compared with postoperative Rectus Sheath block (RSB) **Aim:** Evaluate the efficacy of preoperative versus postoperative bilateral rectus sheath (RS) block for better perioperative analgesia, by comparing the intraoperative analgesic consumption, postoperative pain score and rescue analgesic consumption by 24 hours postoperatively. **Methodology:** 40 eligible patients, ASA grade 1 and 2, devided in 2 equal groups, undergoing emergency, midline incision, gastric perforation repair were included who received a standardized general anesthesia. Using LOR technique for rectus sheath block, Group 1(n = 20) received preincisional bilateral RS blocks using 20ml volume of bupivacaine 0.25% for each side, and group 2(n = 20) received postoperative bilateral RS blocks using 20 ml volume of bupivacaine 0.25% for each. Intraoperatively hemodynamic response and supplemental fentanyl consumption (1 mcg/kg bolus) were noted. **Result**: Preoperative RSB group resulted in significantly lower intraoperative as well as postoperative analgesic consumption during 24 h post-surgery, compared with postoperative RSB group. There was no significant difference in postoperative pain score (NRS) between the two groups except, NRS was significantly lower immediate postoperatively in preoperative RSB group than in postoperative RSB group. **Conclusion:** Preoperative rectus sheath block provide better intraoperative as well as postoperative (perioperative) analgesia when compared to postoperative rectus sheath block, in patients undergoing midline incision gastric perforation repair.

Keywords: Abdominal surgery, midline incision, perioperative analgesia, rectus sheath block.

[*]**Address for Correspondence:**
Dr Divyang V Shah, Professor & HOD, Department of Anaesthesiology, Surat Municipal Institute of Medical Education And Research (SMIMER), Surat, Gujarat, 395010, INDIA.
Email: sayeedam47@yahoo.com

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INTRODUCTION

The Rectus Sheath Block (RSB) was first described by Schleich in 1899 to provide perioperative relaxation of the anterior abdominal wall for intra abdominal surgery. RSB conducted with general anesthesia, can reduce opioid use and postoperative pain. Local anaesthetic drug injected via a RSB, blocks the ventral rami of the 7th to 12th intercostal nerves thus anesthetizing the middle portion of the anterior abdominal wall from the xiphoid process to the symphysis pubis in adults and providing an analgesic effect in the area. 'Pre-emptive-protective' analgesia is a treatment that

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is initiated before the surgical procedure in order to reduce the sensitization of peripheral and central pain pathways evoked by tissue damages. It is an antinociceptive treatment that prevents the establishment of central sensitization caused by incisional and inflammatory injuries, which amplifies postoperative pain. Suffcient blockade of perioperative nociceptive input may reduce pathologic hypersensitivity, thereby improving the pain after surgery.

What are the available methods?

- ✓ Parenteral and oral NSAIDs
- ✓ Sublingual and intravenous (IV) opioids
- ✓ Parenteral NMDA receptor antagonists
- ✓ Local anesthetics (LA) for neuraxial administration, peripheral blocks, wound infiltrations, and intraperitoneal instillations.
- ✓ Systemic antiepileptics (GABA analogues).

In the present study, we hypothesized that preoperative RSB (pre-RSB) may decrease intraoperative analgesic recquirement and also lessen the deleterious impact of intraoperative and early postoperative noxious input, thus provide adequate 'Pre-emptive analgesia'.

AIM AND OBJECTIVE

Evaluate the efficacy of preoperative versus postoperative bilateral rectus sheath (RS) block for better perioperative analgesia.

Objective:

Intraoperative analgesic consumption.

1. Postoperative pain assessment by Numerical Rating Scale (NRS).
2. Total and cumulative rescue analgesic consumption by 24 hours postoperatively.

MATERIAL AND METHOD

This study had been conducted over 40 patients belonging to the age group of 18 to 65 years, of either sex and of American Society of Anaesthesiologists grade I or II, admitted to our tertiary care hospital, undergoing, midline incision, peptic perforation repair who received a standardized general anesthesia. Sample size was calculated by using Open EPI software with confidence limit of 95% from the mean number of intraoperative analgesia doses required as suggested by Seongwook Hong. Study design was Prospective observational study and duration of study was 6 months. The exclusion criteria for the study were as follows: Unwilling patients and patients with body mass index >30 kg/m2, compromised renal and liver function, uncontrolled diabetes, severe cardiovascular, respiratory disease, coagulation disorders, signs of sepsis, history of allergy to local anaesthetic drug and infection at local site of puncture. All the patients enrolled in this study underwent thorough pre-anesthetic checkup before the surgery. NBM status of all patients were assessed prior to surgery. In the recovery room, baseline vitals like pulse, systolic and diastolic blood pressure, respiratory rate and SpO2 were recorded as well as written and informed consent was taken after explaining the patient about the procedure.

The patients were randomly divided into two groups.

- ✓ Group 1(n = 20) = pre(RSB)
- ✓ Group 2(n = 20) = post(RSB)

Pre(RSB) group 1 received preincisional bilateral Rectus Sheath Block by LOR (Loss Of Resistance) technique. Post(RSB) group 2 received post skin closure and before extubation bilateral Rectus Sheath Block by LOR technique. Local anaesthetic drug used was 20 ml volume of bupivacaine 0.25% for each side.

Rectus sheath block via LOR technique

Bilateral RSB was given by two injections one on each side of the abdomen, after induction, before start of the surgery in Group 1 and before extubtion, after completion of surgery in Group 2. A (22 G) short bevel needle (B-DLtd) was inserted at a point 3–5 cm above the umbilicus medial to lateral border of the rectus abdominis. The anterior rectus sheath was identified by moving the needle from side to side with a back and forth motion while advancing the needle until it was felt to scratch the sheath. The needle was then advanced until the resistance of the posterior layer of the rectus sheath was felt and the drug was injected after negative aspiration test. Time of RSB was noted.

General anaesthesia technique and analgesia.

In the operation theater, i.v. line was accessed with an 18 G cannula and dextrose normal saline infusion was started. Basic monitorings (NIBP, SpO2 and ECG) were applied. Patients were pre-medicated using inj. glycopyrrolate 0.01 mg/kg, inj ondensetron 0.2mg/kg and inj. Fentanyl 2 mcg/kg i.v. After preoxygenation for 3 minutes, patients were induced with inj. propofol 1.5-3.0 mg/kg and 100 mg succinylcholine. Endotracheal intubation was done by direct laryngoscopy. Anaesthesia was maintained with nitrous oxide, oxygen, isoflurane and inj. Atracuronium (loading dose 0.5mg/kg followed by maintainance dose of 0.1mg/kg as and when required for intra operative muscle relaxation). Intraoperative analgesic supplementation in the form of inj. Fentanyl 1mcg/kg was administered to maintain mean arterial blood pressure within 20% of baseline values. After completion of surgery, patients were reversed with inj. neostigmine (0.5mg/ kg) and inj. glycopyrrolate (0.1mg/kg). This time was noted as 0 hour (post extubation) for post-operative data collection.

In postoperative care unit, all the study subjects received i.v. paracetamol (1g) as analgesic postoperatively. This was followed by postoperative analgesic regimen composed of six hourly i.v. paracetamol (1g) in general ward. As rescue analgesic, i.v. Tramadol (1mg/kg) was administered when NRS ≥4 cm or on patient demand, not

exceeding 600mg/day. Administration of tramadol was repeated until NRS <4 or the patient did not request further pain relief. Pain score assessment using NRS scale and total and cumulative analgesic consumption were assessed postoperatively from 0 to 24 h after surgery. The side effects of analgesics, such as dizziness, sedation, respiratory depression, nausea, and vomiting were all checked. In addition, the complications associated with RSB were evaluated, including pneumothorax and hematoma.

Data recording

Demographic profile like age, sex, and weight of the patients; duration of surgery (from skin incision to last suture), duration of anaesthesia and intraoperative supplemental analgesic recquirement were recorded. Vital parameters [heart rate(HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP)] were recorded as baseline (before induction), after induction every 15 min, after extubation (0 hour post extubation) and then 1,2,4,8,16 and 24 hours postoperatively.

Pain score: Numeric Rating Scale (NRS)

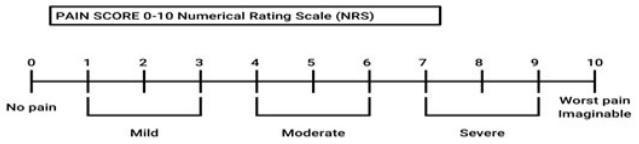

Figure 1:

The degree of spontaneous postoperative abdominal pain was assessed using an 11-point Numeric Rating Scale (NRS) at 1,2,4,8,16 and 24 hours after surgery, in which 0 = no pain and10 = worst pain imaginable. Numeric Rating Scale (NRS) 0-10 cm: was graded as 0=no pain, 1-3=mild pain,4-6=moderate pain7-9=severe pain and 10=worst imaginable pain.

Statistical analysis

Data was entered and analyzed with the help of MS Excel, open EPI and SPSS version 16. Categorical data was presented as frequencies and percentage. Continuous data was presented as mean(SD). Mean comparison of analgesic consumption of Pre(RSB) and Post(RSB) groups was done using student 't' test for independent samples. Differences were considered statistically significant at $p<0.05$.

OBSERVATION AND RESULTS

Table 1: Patient characteristics

PARAMETERS	GROUP 1	GROUP 2	p VALUE	INFERENCE
Age(yr)	46.95(7.5)	48.25(10.7)	>0.05	Not Significant
Sex(M/F)	13/7	12/8		
Weight(kg)	66(9.9)	63.7(7.28)	>0.05	Not Significant
ASA (1/2)	9/11	8/12		
MAP(mmHg)	93.8	94.2(3.4)	>0.05	Not Significant
HR(per min)	81.15(9.0)	84(6.0)	>0.05	Not Significant

Patient demographic data like age, weight, preoperative vitals(HR,MAP) were comparable in both the groups 1 and 2. The duration of surgery and anesthesia were not significantly different between the two groups. (p>0.05) (Table 1)

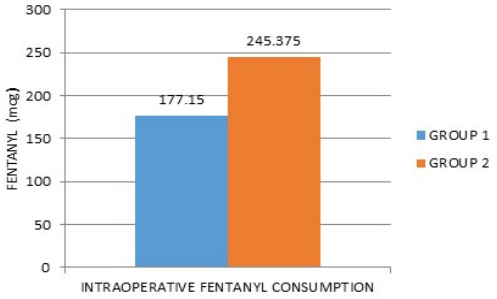

Figure 1: Intraoperative analgesic consumption. Data expressed as mean. p value <0.0000001 (significant)

Table 2: Intraoperative data

	GROUP 1	GROUP 2	p VALUE	INFERENCE
MBP change after incision(%)	0.0(.9-2.6)	13.2(3.6-19.2)	<0.05	Significant
HR changes after incision(%)	0.00(-1.1-1.3)	7.5(1.2-10.7)	<0.05	Significant
Duration of surgery(min)	106.75(13.9)	108.25(13.7)	>0.05	Not Significant
Duration of anaesthesia(min)	131.75(13.7)	134.75(14.5)	>0.05	Not Significant
Intraop fentanyl consumption (mcg)	177.15(26.36)	245.37(37.82)	<0.0000001	Significant

The pre-RSB Group1 had significantly lower intraoperative fentanyl consumption 177.15(26.36) mcg than the post-RSB Group2, 245.37(37.82)(p = 0.0000001) (Figure 1). Compared with the post-RSB Group2, the pre-RSB Group1 had no significant changes in the vital signs related to the skin incision.

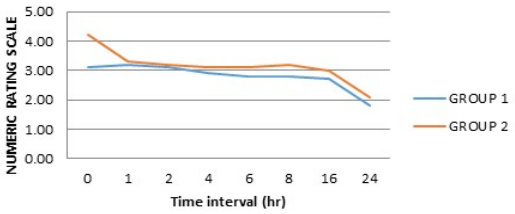

Figure 2: Postoperative pain scores (numerical rating scale 0 to 10) during 24 h after surgery. Data are expressed as mean (standard deviation). GROUP 1,Pre-RSB (preoperative rectus sheath block); GROUP 2, Post-RSB (postoperative rectus sheath block)

Table 3: Postoperative NRS Score

TIME INTERVAL	GROUP 1 NRS SCORE	GROUP 2 NRS SCORE	p VALUE	SIGNIFICANCE
0 hr	3.1(1.2)	4.2(2.1)	<0.05	Significant
1 hr	3.2(1.2)	3.3(1.7)	>0.05	Not significant
2 hr	3.1(1.4)	3.2(1.4)	>0.05	Not significant
4 hr	2.9(1.2)	3.1(1.3)	>0.05	Not significant
6 hr	2.8(1.2)	3.1(1.2)	>0.05	Not significant
8 hr	2.8(1.1)	3.2(1.2)	>0.05	Not significant
16 hr	2.7(1.1)	3(1.1)	>0.05	Not significant
24 hr	1.8(1.2)	2.1(1.2)	>0.05	Not significant

NRS was significantly lower in the pre-RSB group than in the post-RSB group at 0 h after surgery (3.1(1.2) vs. 4.2(2.1), p <0.05) (Figure 2, table 3). Except at 0 h, the NRS was not significantly different between the two groups throughout the 24 h after surgery.

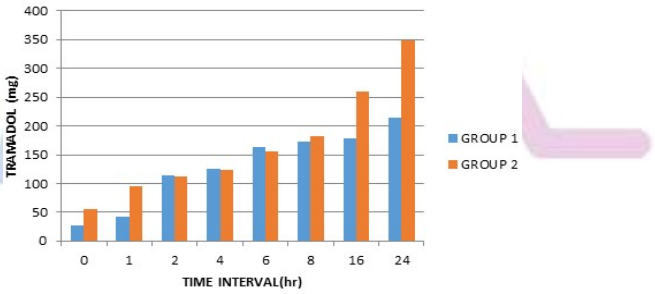

Figure 4: Cumulated rescue analgesic consumption during 24 h after surgery. Data are expressed as mean

Table 5: Cumulative rescue analgesic (Tramadol) consumption in 24 hrs postoperatively

TIME (h)	GROUP 1 CUMULATIVE ANALGESIC TRAMADOL (mg)	GROUP 2 CUMULATIVE ANALGESIC TRAMADOL (mg)	p VALUE	INFERENCE
0	27.75(31.94)	55(20.19)	<0.05	Significant
1	42.55(29.30)	94.45(30.86)	<0.05	Significant
2	115(20.32)	113.1(23.99)	>0.05	Not Significant
4	125(21.32)	124.1(24.00)	>0.05	Not Significant
6	164.15(35.16)	155.8(38.62)	>0.05	Not Significant
8	172.05(31.96)	182.25(34.44)	>0.05	Not Significant
16	178.3(37.47)	259.95(55.44)	<0.05	Significant
24	214.65(49.03)	348.45(57.68)	<0.05	Significant

Total postoperative rescue analgesic consumption in 24 h after surgery was significant decreased in the pre-RSB Group1 as compared to the post-RSB Group2 (214.65(49.03) vs 348.45(57.68)), p value <0.05. Also, the postoperative cumulated rescue analgesic consumption was significantly decreased in the pre-RSB group as compared to the post-RSB group at; 0,1,16 and 24 hours after surgery, p value <0.05.(Figure 4, table 5);(27.75(31.94) vs 55(20.19);42.55(29.30) vs 94.45(30.86); 178.3(37.47) vs 259.95(55.44); 214.65(49.03) vs 348.45(57.68)). No patient complained of any significant side effects related to the analgesics or complications associated with RSB.

DISCUSSION

Incision, intraoperative trauma, and postoperative inflammatory inputs are trigger for Surgery-induced central sensitization. The analgesic treatment which prevents the establishment of central sensitization caused by both intraoperative noxious inputs and postoperative inflammatory injuries is considered to be the ideal preemptive analgesia. The treatment starts before incision and covers both the intraoperative period and the initial postoperative period.

In midline incision upper abdominal surgery, for postoperative pain management; i.v. opiods, non-steroidal anti-inflammatory drugs, local anaesthetic infiltration to the surgical area and peripheral nerve blockades may be useful. Opiods are genera;;y safe for postoperative analgesia, though they have dose-dependent adverse effects like vomiting, nausea, constipation, headache and dizziness. The rectus sheath block provides excellent analgesia foe various abdominal surgery. Also it has been shown to provide better analgesia then the local site anaesthetic infiltration. Several randomized double-blinded studies have presented the preemptive analgesic effect of peripheral nerve blocks. To our knowledge, this is the first study aimed to evaluate the preemptive effect of RSB in the patients undergoing midline incision gastric perforation repair. The aim of this study was to evaluate the efficacy of preoperative vs postoperative bilateral RSB for providing better perioperative analgesia. In this study, pre-RSB resulted in significantly lower intraoperative analgesic consumption also there is significantly lower postoperative analgesic consumption during 24 h post-surgery, compared with post-RSB. Considering that the median duration of gastric perforation repair was 106.75 min in pre-RSB group, the effect of pre-RSB with 0.5% bupivacaine may have well extended into the postoperative period. There was no significant difference in postoperative pain score (NRS) between the two groups except, NRS was significantly lower immediate postoperatively (0 hr) in preoperative RSB group than in postoperative RSB group. In 2016, Abdelsalam *et al.* conducted a study on Ultrasound-guided rectus sheath and transversus abdominis plane blocks for perioperative analgesia in upper abdominal surgery and reported excellent perioperative analgesia for upper abdominal surgery using combination of bilateral US-guided RSB and TAPB (Treansverse Abdominis Plane Block). Similar to our study, the intraoperative as well as postoperative analgesic recquirement was significantly reduced in the group receiving block. In 2016, Kim *et al.* conducted a study on Effect of the bilateral ultrasound-guided split injection technique of rectus sheath block in female patients undergoing robotic cholecystectomy with lower abdominal ports, they reported that bilateral RSB decreased the intensity of superficial pain only during the first hour after robotic cholecystectomy, compared with a placebo group. In 2018, Jin *et al.* conducted a study on Preoperative versus postoperative ultrasound-guided rectus sheath block for improving pain, sleep quality and cytokine levels in patients with open midline incisions undergoing transabdominal gynecological surgery and they reported that there was no significant difference in the pain, analgesic requirements, or time to first rescue analgesic between the pre-RSB and post-RSB groups. However, only female patients were included, , RSB was performed in the lower abdomen below the arcuate line , and the incisional sites were limited in the lower abdomen which usually involves less postoperative pain than the upper abdomen. In 2019, Hye-Won Jeong *et al.* conducted a study on Preoperative versus Postoperative Rectus Sheath Block for Acute Postoperative Pain Relief after Laparoscopic Cholecystectomy and they reported a significant decrease in intraoperative analgesic consumption in preoperative RSB as compared to postoperative RSB with a significant decrease in total as well as cumulative postoperative analgesic consumption, which is similar to our study result. This study has limitations. First, we had no placebo group to compare. Including a placebo group may have been a more reasonable approach to demonstrate the preemptive effect of RSB in the patients undergoing midline incision gastric perforation repair. Second, use of real time USG for RSB block is increasing which may increase the efficacy of the block; we used a landmark based LOR technique. Though it does not affect the result of our study. Third, we could have used patient controlled analgesia in the postoperative period for accurate estimation of postoperative analgesic consumption.

CONCLUSION

Preoperative rectus sheath block provide better intraoperative as well as postoperative (perioperative) analgesia when compared to postoperative rectus sheath block, in patients undergoing midline incision gastric perforation repair.

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