ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 13, Issue 7, 2020

Online - 2455-3891
Print - 0974-2441

Research Article

ULTRASOUND-GUIDED RECTUS SHEATH BLOCK ALONG WITH RIGHT SIDE SUBCOSTAL TRANSVERSE ABDOMINIS PLANE BLOCK VERSUS PORTSITE INFILTRATION WITH LOCAL ANESTHETICS IN LAPAROSCOPIC CHOLECYSTECTOMY FOR POST-OPERATIVE PAIN RELIEF: A COMPARATIVE STUDY

RAJIV D MISHRA, MADHUSMITA PARIDA, SWASTIKA SWARO, SOUMYA SAMAL*

Department of Anaesthesiology, IMS and SUM Hospital, Bhubaneswar, Odisha, India. Email: samalsoumya11@gmail.com

Received: 14 March 2020, Revised and Accepted: 30 April 2020

ABSTRACT

Objectives: The objective of the study was to compare the efficacy between ultrasound guided rectus sheath block and the right side subcostal transverse abdominis plane with portsite infiltration with local anesthetics in laparoscopic cholecystectomy for post operative pain relief.

Methods: Sixty patients posted for laparoscopic cholecystectomy were divided into two groups of 30 each. Group A received total dose of 80 mg (16 ml) of 0.5% ropivacaine 4 ml in each port and Group B received bilateral rectus sheath block with right-sided subcostal TAP block postoperatively, 80 mg (40 ml) of 0.2% ropivacaine was divided into two parts 20 ml in right-sided subcostal TAP and 20 ml in rectus sheath block, 10 ml in each side. **Results:** The first request of analgesia was significantly longer in combined block group than in the port site infiltration group (p=0.000). The numeric rating scale was reduced in patients given with abdominal field blocks when compared to patients obtaining port site infiltration. Mean NRS score was peak in pain score at the 6th h postoperatively in Group A and remained higher till 24 h in comparison Group B and was statistically significant. The overall tramadol consumption in Group A was approximately twice (215±51 mg) as compared to Group B (105±28 mg). Three cases of PONV were seen in Group A that is not statistically significant. The patient satisfaction score after 24 h was much higher with Group B in comparison to Group A (*P* 0.000).

Conclusion: It is concluded that ultrasound-guided right-sided subcostal TAP and rectus sheath block produce effective post-operative analgesia for the incisional pain in laparoscopic cholecystectomy surgeries and act as a supplementary method in multimodal analgesia.

Keywords: Post-operative pain, Laparoscopic cholecystectomy, Ultrasound-guided rectus sheath block, Subcostal transverse abdominis block, Port site infiltration.

 DOI: http://dx.doi.org/10.22159/ajpcr.2020.v13i7.37741

INTRODUCTION

Pain is defined as an unpleasant emotional experience usually initiated by noxious stimulus and transmitted over a specialized neural network to the central nervous system where it is interpreted as such [1]. Post-operative pain is a hindrance in the recovery of the patient. It is a limiting factor and may lead to following effects such as hemodynamic instability, decreased functional residual capacity and increased work of breathing, atelectasis, hypoxemia, sepsis, poor wound healing and wound gaping, opioid consumption and its adverse effects, post-operative paralytic ileus, poor healing of anastomosis site, prolonged hospital stay, and increased morbidity.

Hence, an effective analgesia is a must in post-operative management. The requirement of analgesia post-laparoscopic surgeries could not be achieved by a single technique as the pain could be incisional, visceral, or referred; hence, a multimodal approach to analgesia would be apt [2]. Each method has its own advantage and disadvantage, but their goal is to attenuate pain and reduce side effects. The use of only intravenous opioids has been discouraged because of their potency to cause post-operative respiratory depression, sedation, and post-operative nausea and vomiting. This limits the functional capacity of the patient and hence the wound healing is impaired. It also increases the morbidity of patient and prolongs the hospital stay. For above-mentioned shortcomings, regional anesthetic techniques were popularized. Although epidural analgesia is most widely used method of analgesia, recently, regional blocks of nerves innervating the incision site in abdominal surgeries are getting popular.

The ultrasound-guided subcostal transverse abdominis (SCTAP) block is a variation of transverse abdominis plane (TAP) block which produces effective analgesia for supraumbilical incisional pain limited to lateral border of rectus sheath [3,4]. Rectus sheath block (RSB) is targeted to block the terminal branches of the intercostal nerves that are present in the plane linking the rectus abdominis muscle with its posterior rectus sheath resulting in anesthesia about the midline, leading to an effective analgesia in post-laparoscopic cholecystectomy surgery. The incisional pain contributes more in post-laparoscopic surgery pain than visceral pain. The aim of our study is to compare rectus sheath and right-sided subcostal TAP block with port infiltration with local anesthetics for better post-operative pain relief in laparoscopic cholecystectomy patient.

MATERIALS AND METHODS

After approval from the Institutional Ethical Committee and receiving written informed consent, 60 patients of 18–70 years of both sexes, ASA I/II posted for elective laparoscopic cholecystectomy, were included in this prospective randomized double-blinded experimental study. Exclusion criteria were allergies to local anesthetic agents, surgical or block site infection, pre-operative chronic opioid dependence, surgeries converted to open cholecystectomy, surgery with excessive adhesions, pregnancy, coagulation disorders, and refusal by patient. Patients were randomized using computer generate sampling technique into two groups: Group A received port site infiltration (n=30), post-operative port site infiltration was performed by the same surgeon every time after the surgery was performed and local anesthetic was divided equally between four port sites. 4ml of 0.5% ropivacaine was infiltrated in each port making total dose to 80mg (16ml). Group B received bilateral RSB with right-sided subcostal TAP block (n=30), postoperatively, 80 mg (40 ml) of 0.2% ropivacaine

was divided into two parts 20 ml in right-sided subcostal TAP and 20 ml in rectus sheath block, 10 ml in each side.

Patients posted for laparoscopic cholecystectomy were brought to the operation theater (OT) after getting fitness for surgery and nil per oral status of at least 8 h. Tablet alprazolam 0.5 mg was given to all the patients on the night before the surgery to allay anxiety. After receiving the patient in the OT, a wide bore cannula was secured (18G) and Ringer's lactate was started. All the basic monitors were attached that are pulse oximetry, NIBP, and ECG and baseline vital parameters were recorded. Premedication was done with inj. glycopyrrolate 0.2 mg IV and inj. midazolam 0.03 mg/kg IV. A standard balanced general anesthetic regime was employed which consisting of fentanyl (2 mcg/kg IV), propofol (2 mg/kg IV), and vecuronium (0.1 mg/kg IV). Top up of fentanyl 0.5 mcg/kg was administered as and when required depending on the variability in heart rate and blood pressure if it was more than 20% from baseline. Intraoperative non-opioid analgesia includes diclofenac (75 mg intravenous infusion) for all the patients. Maintenance of anesthesia was done with oxygen, nitrous oxide, and isoflurane. Vecuronium was repeated at a dose of 0.01 mg/kg IV for muscle relaxation as and when required. Before extubation, the following interventions were performed.

Group A

In Group A, post-incisional port site infiltration was executed by the same surgeon every time, after the surgery is performed and local anesthetic was divided equally between port sites. Total dose of 80 mg 0.5% ropivacaine (16 ml) was given. Infiltration of local anesthetics from skin to parietal peritoneum was given by same surgeon every time just before closure. A total of four ports – supraumbilical, subxiphoid, and two ports in the right subcostal area at mid-clavicular and anterior axillary line be made.

Group B

The blocks were performed under ultrasound guidance by the same investigator every time. Linear array ultrasound probe with a 6–13 MHz frequency was used. Before extubation, the skin was disinfected with 2.5% chlorhexidine with 70% ethanol solution. Posterior rectus sheath block was administered by placing ultrasonography (USG) transducer 2 cm below the xiphisternum in transverse position. A 90 mm, 23-G Quincke Spinal Needle was introduced in plane and advanced until the tip is on the posterior rectus sheath. After negative aspiration, 2 mL of 5% dextrose was injected to verify the location of the needle tip. When the correct needle position is achieved, 10 ml of 0.2% ropivacaine was injected bilaterally on each side. Then, probe was advanced toward right subcostal margin laterally and obliquely, tracing the rectus abdominis muscle, transverse abdominis muscle appears just below the rectus abdominis and the probe was advanced further to locate linea semilunaris. Medial to linea semilunaris, the plane was identified between rectus and transverse abdominis and needle was inserted from the xiphoid process end laterally and inferiorly in-plane approach once the needle tip entered the plane, 2 ml of 5% dextrose was injected to verify needle tip location, when correct needle position was achieved, 20 ml of 0.2% ropivacaine was infiltrated by advancing the needle laterally and inferiorly in the pockets of the injectate that was given in graded aliquots.

Following adequate and complete recovery, patients were transferred to the post-anesthesia care unit and pain severity was assessed by 11-point numeric rating scale where 0 is considered as no pain and 10 being worst possible pain. NRS <3 was taken as satisfactory pain relief.

Injection tramadol 1 mg/kg IV was given if pain score is more than equal to 3 or on patient's demand. Patients were monitored for pain scores, tramadol consumption, and vital parameters including heart rate, NIBP, SPO2, and respiratory rate at 1, 2, 4, 6, 12, and 24 h in the ward. Patients were also monitored for adverse effect of the technique such as local site reaction, formation of hematoma, local anesthesia toxicity, and post-operative nausea and vomiting.

At the end of 24 h, patients were asked to rank the quality of pain relief on a 4-point patient satisfaction scale where 1 is excellent, 2 is very good, 3 is satisfactory, and 4 being poor.

Statistical analysis

The data were analyzed using software "Statistical Package for the Social Sciences, version 23, SPSS Inc., Chicago, Illinois, USA." The quantitative variables were expressed as mean and standard deviation and categorical variables are expressed in frequency percentage. All quantitative variables were analyzed through "Mann–Whitney U-test" as they were not present in a normal distribution. Categorical variables were analyzed by "Chi-square test/Fisher exact test." $p<0.05$ was statistically significant.

RESULTS

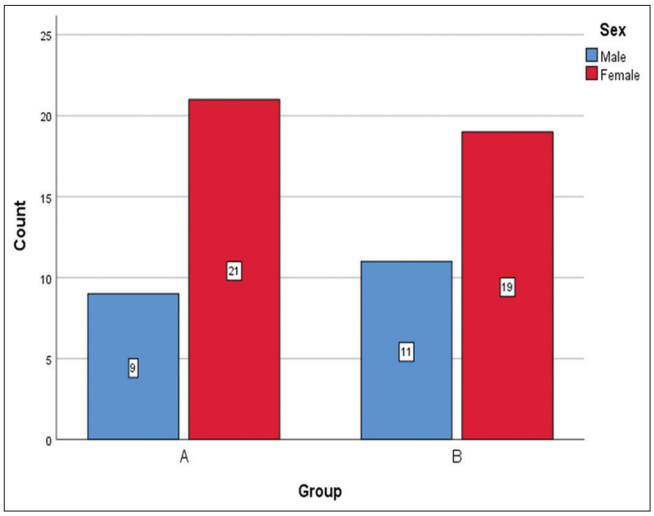
Sixty patients were included in study and were randomly assigned in two groups. In Group A, 30 patients (9 male and 21 female) underwent port site infiltration by 0.5% ropivacaine (80 mg) 16 ml, equally divided into four ports, and in Group B, 30 (11 male and 19 female) patients underwent right-sided subcostal TAP block with rectus sheath block by 0.2% ropivacaine (80 mg) 40 ml, 20 ml in each block for post-operative analgesia after laparoscopic cholecystectomy.

There was a female predominance seen in patients undergoing laparoscopic cholecystectomy, as shown in Graph 1. However, sex in both the groups was comparable and statistically insignificant (p=0.785).

The mean age (mean±S.D) in Group A was 43±9 years and in Group B was 44±14 years. The groups were comparable in terms of age (p=0.599).

The mean height was 158±8 cm and 158±8 cm in Group A and Group B, respectively. The groups were comparable in terms of height (p=0.491).

The mean weight was 62±8 and 61±8 kg in Groups A and B, respectively, which was not statistically significant (p=0.428). Therefore, both groups were comparable in terms of their demographic profile (Table 1).



Graph 1: Number of males and females in two groups

Table 1: Demographic profile in two groups

	A		B		p value
	Mean	Standard deviation	Mean	Standard deviation	
Age	43	9	44	14	0.599
Height in cm	158	8	158	8	0.491
Weight in kg	62	8	61	8	0.428

The mean duration of surgery was 68±11 min and 66±15 min in Groups A and B, respectively, which was comparable and statistically insignificant (p=0.505). The mean time to first rescue analgesia in Group A was 416±53 min and in Group B 684±44 min (p=0.000) which was statistically significant. The mean consumption of total rescue analgesia was 215±51 mg and 105±28 mg which was statistically significant (p=0.000), as shown in Table 2.

Graph 2 shows that the mean NRS score at 1, 2, 4, 6, 12, and 24 h in Group A was 0, 0, 0.133±0.507, 2.667±1.446, 2±0.871, and 2.1±0.662, respectively, and in Group B was 0, 0, 0, 0.667±0.479, 1.333±0.479, and 1.433±0.679, respectively. The mean NRS score at 1, 2, and 4 h was not statistically significant and had nearly equal NRS score. However, at 6, 12, and 24 h, the mean NRS score was statistically significant and lower in Group B than in Group A.

Table 2: Mean duration of surgery, time of first request of analgesia, and total analgesic requirement

	A		B		p value
	Mean	Standard deviation	Mean	Standard deviation	
Duration of surgery	68	11	66	15	0.505
Time of 1st request of analgesia	416	53	684	44	0.000
Total analgesic requirement	215	51	105	28	0.000

Table 3: Patient satisfaction score of two groups

		Patient satisfaction score			p value
		Excellent	Very good	Satisfactory	
Group	A	0	16	14	0.000
		0.00%	53.30	46.70	
	B	10	20	0	
		33.30	66.70%	0.00%	

Table 4: Side effects in two groups

		Side effects		p value
		n	PONV	
Group	A	27	3	0.237
		90.00%	10.00%	
	B	30	0	
		100.00%	0.00%	

Table 3 shows that the overall patient satisfaction score at 24 h postoperatively was found to be considerably higher in Group B than in Group A (p=0.000).

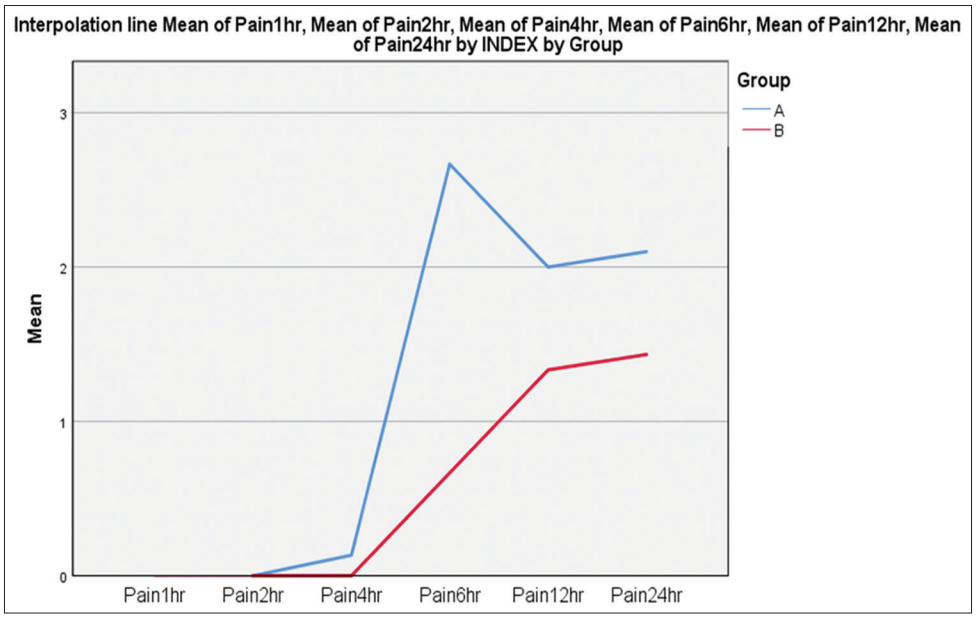
This study found that mean vitals such as heart rate, arterial blood oxygen saturation, mean arterial pressure, and respiratory rate were stable and comparable at all times; however, at the 6th h, there was an increase in HR and RR in Group A but statistically insignificant (Graphs 3-6).

There were no cases of local anesthetic systemic toxicity (LAST) or hematomas. Table 4 shows three cases of post-operative nausea and vomiting (PONV) in port site infiltration (Group A) group but was statistically insignificant (p=0.237).

DISCUSSION

Post-operative laparoscopic cholecystectomy pain is usually less in intensity with reduced duration than open cholecystectomy surgery. As the pain and functional impairment associated with laparoscopic cholecystectomy is quite less, patients can be discharged and can resume their daily activities earlier [5]. The pain is at its peak in first few hours and starts reducing in next 2–3 days and it is aggravated on mobilization [6]. Acute pain being inadequately treated after laparoscopic cholecystectomy may lead to chronic pain, i.e., "post-laparoscopic cholecystectomy syndrome" [7]. Hence, effective post-operative pain management is must and is an integral component of adequate perioperative care. It is accompanied with better outcome, decrease post-operative stress, better satisfaction of the patients, reduced opioid consumption, and side effects. This study explains that combined rectus sheath and subcostal TAP block is an effective analgesia in terms of increase duration of action, decrease pain scores, and reduced opioid consumption.

The primary objective of our study was to measure the time to first request of analgesia which was not done before in any studies to the best of our knowledge with combination RSB and SCTAP block. The combined block group had significantly higher duration of analgesia than the port site infiltration group.



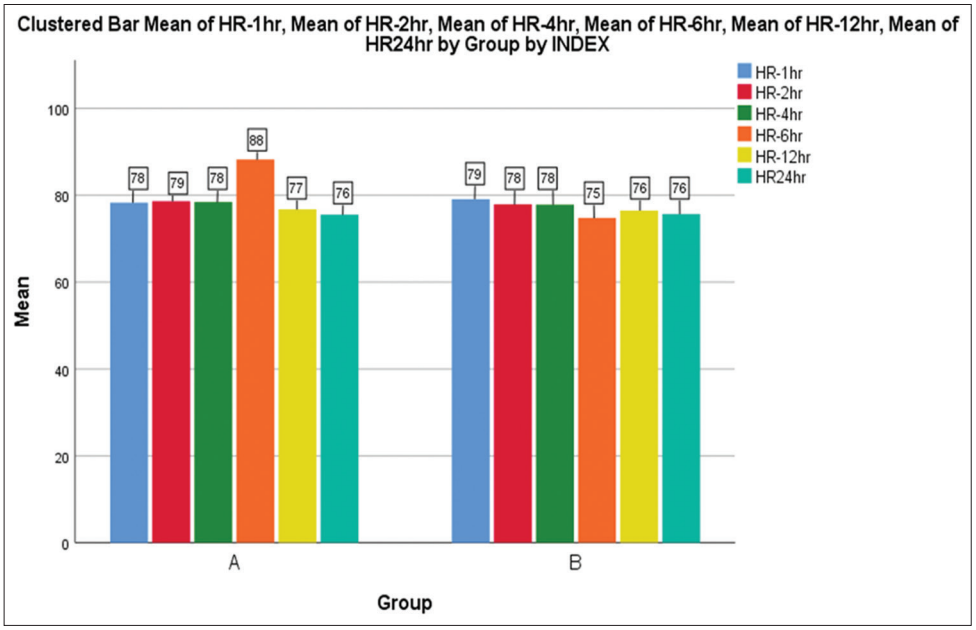
Graph 2 : Mean pain scores at various times

Bisgaard *et al.* described that incisional pain accounts for increased pain than that of visceral pain in laparoscopic surgeries postoperatively [8]. Hence, we focused on combination of two blocks that are RSB and SCTAP block to attenuate pain in the first 24 h postoperatively.

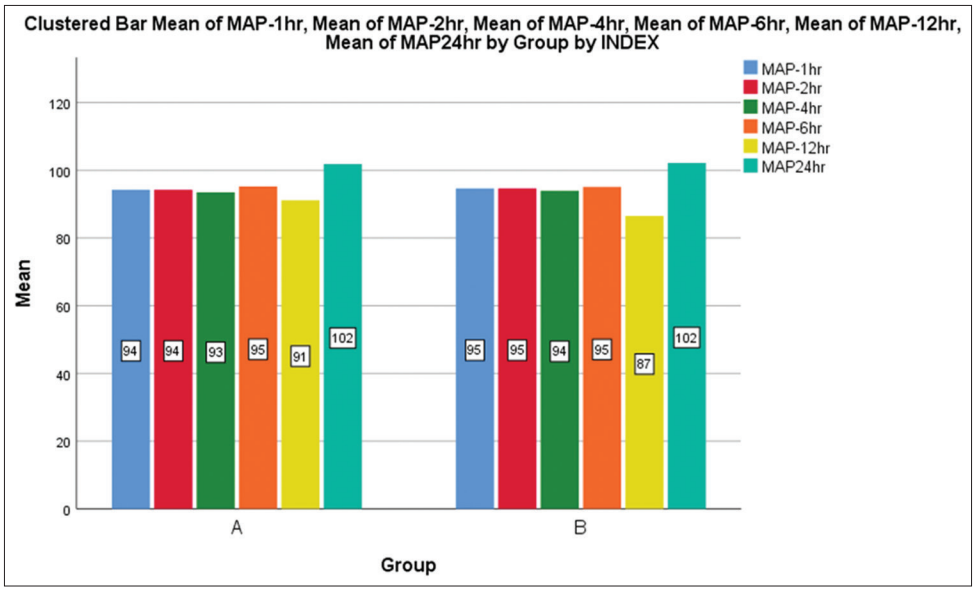
The present study compares the analgesic efficacy of USG-guided abdominal field blocks with port site local anesthetic infiltration technique for post-operative pain relief, first request of analgesia, opioid consumption, patient satisfaction, and side effects following elective laparoscopic cholecystectomy. This study comprises right subcostal TAP with rectus sheath block as abdominal field blocks. SCTAP block provides effective analgesia to anterolateral upper abdominal wall, but its spread is limited by the lateral border of the rectus sheath, limiting its analgesic effect in midline and necessitating modification of port sites. Addition of posterior rectus sheath block provides adequate analgesia covering T5–T10 dermatomes in midline producing complementary results in terms of analgesic effects covering anatomical area of all the port sites without modifying their location.

Port site infiltration involves the injection of local anesthetics subcutaneously into the incisional site. This blocks Aδ and C fibers in periportal fascia, the muscle, and parietal peritoneum. The effect of port site infiltration is small, lasting only for few hours and of doubtful clinical relevance [9]. Analgesia with regional blocks lasts for 36–48 h, which might be due to the slow clearance of local anesthetics in the transversus abdominis plane where relatively fewer blood vessels are located [10]. Reduced vascularity also reduces the risk of systemic toxicity from the local anesthetic agents.

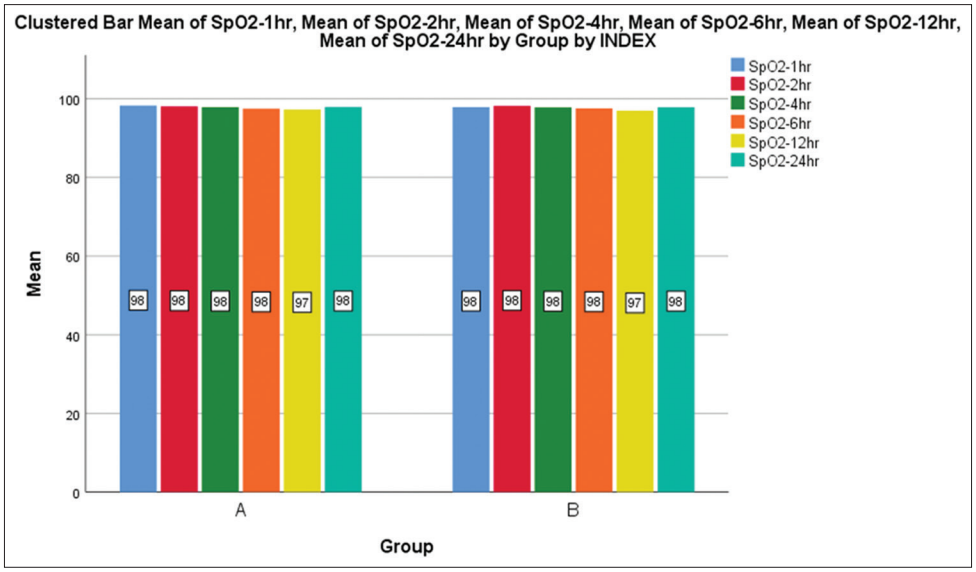
Previously, studies were done taking TAP block and subcostal TAP block into account for which port sites were changed favoring the block. After changing port sites, TAP block and SCTAP block had provided effective pain relief as described in El Dawlatly *et al.* and Tolchard *et al.*, respectively [11,12].



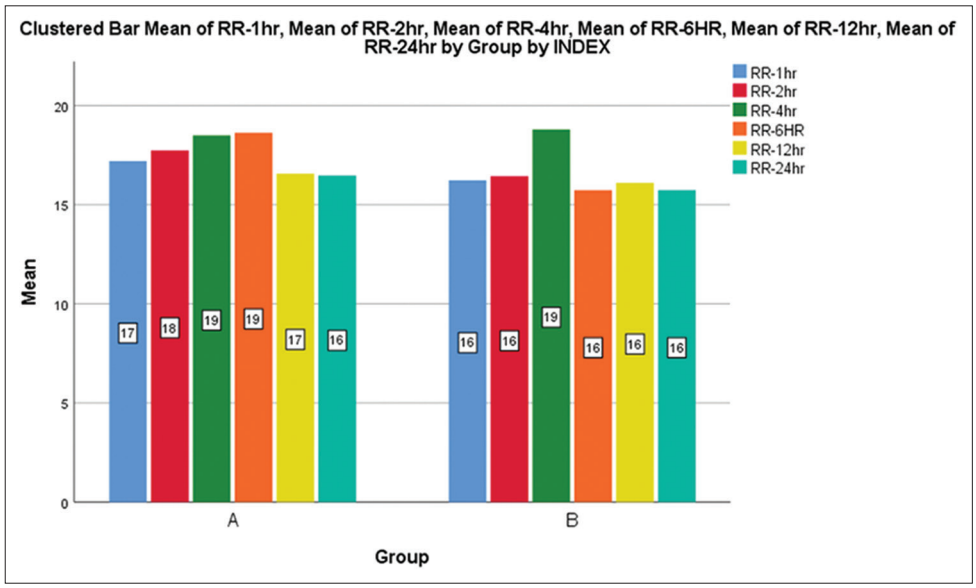
Graph 3: Mean heart rate at various intervals of time postoperatively



Graph 4: Mean of mean arterial pressure at various intervals of time postoperatively



Graph 5: Mean SPO2 at various intervals of time postoperatively



Graph 6: Mean Respiratory rate at various intervals of time postoperatively

On literature review, we found very few literature on combined rectus sheath and subcostal TAP block on laparoscopic cholecystectomy patients without modification of port sites. Saxena *et al.* and Ramkiran *et al.* are two such studies which have described combined blocks for laparoscopic cholecystectomy and have similar results like we do in terms of post-operative pain relief, total tramadol consumption, and side effects [13,14].

In our study, we found that first request of analgesia was significantly longer in combined block group than in the port site infiltration group (p=0.000). The numeric rating scale was reduced in patients given with abdominal field blocks when compared to patients obtaining port site infiltration. Mean NRS score at 1, 2, and 4 h was not statistically significant; however, there was peak in pain score at the 6th h postoperatively in Group A and remained higher till 24 h in comparison Group B and was statistically significant. The overall tramadol consumption in Group A was approximately twice (215±51 mg) as compared to Group B (105±28 mg). The difference was found to be statistically significant (p=0.000). Three cases of PONV were seen in Group A, however, statistically not significant and no other side effects were observed in both the groups. The patient satisfaction score after 24 h was much higher with Group B in comparison to Group A (p=0.000).

The RSB and subcostal TAP block are advantageous in terms of improved comfort of the patient as far as pain is concerned, decreased use of opioids, decrease side effects such as nausea, vomiting, sedation, and respiratory depression, and increase satisfaction.

The limitations of the study were post-operative pain was studied for 24 h only. We did not evaluate static and dynamic pain scores separately. The abdominal field blocks were given at the end of the surgery, so it is difficult to conclude that if there would be a different outcome if the abdominal field blocks were given at the beginning of the surgery. Hence, further studies should be done in this field.

CONCLUSION

We conclude that ultrasound-guided right-sided subcostal transverse abdominis plane block and rectus sheath block produce effective post-operative analgesia for the incisional pain in laparoscopic cholecystectomy surgeries and act as a supplementary method in multimodal analgesia. It reduces the use of opioids and non-opioid analgesics in the post-operative period, speeds up the recovery, associated with better respiratory function, and reduces total hospital stay in comparison to port site infiltration.

CONFLICTS OF INTEREST

The author declares no conflicts of interest.

AUTHORS' CONTRIBUTIONS

First, second, and third author contribution includes study design, experiments, and drafted an original manuscript. Third and fourth author carried out the data analyses and reviewed the drafted manuscript. All authors approved the final version of the manuscript.

AUTHORS' FUNDING

The author received no specific funding for this research project.

REFERENCES

1. Bennett CR. Monheim's Local Anesthesia and Pain Control in Dental Practice. 7th ed. St. Louis, MO: C. V. Mosby; 1984.
2. Mitra S, Khandelwal P, Roberts K, Kumar S, Vadivelu N. Pain relief in laparoscopic cholecystectomy-a review of the current options. Pain Pract 2012;12:485-9.
3. Jankovic Z. Transversus abdominis plane block: The Holy Grail of anesthesia for (lower) abdominal surgery. Period Biol 2009;111:203-8.
4. Hebbard P. Subcostal transversus abdominis plane block under ultrasound guidance. Anesth Analg 2008;106:674-5.
5. Inan A, Sen M, Dener C. Local anesthesia use for laparoscopic cholecystectomy. World J Surg 2004;28:741-4.
6. Bisgaard T, Klarskow B, Kristiansen VB, Callesen T, Shulze S, Kehelet H, *et al*. Multi-regional local anesthetic infiltration during laparoscopic cholecystectomy in patients receiving prophylactic multi-modal analgesia: A randomized, double-blinded, placebo-controlled study. Anesth Analg 1999;89:1017-24.
7. Bisgaard T, Rosenberg J, Kehlet H. From acute to chronic pain after laparoscopic cholecystectomy: A prospective follow-up analysis. Scand J Gastroenterol 2005;40:1358-64.
8. Bisgaard T, Klarskov B, Rosenberg J, Kehlet H. Characteristics and prediction of early pain after laparoscopic cholecystectomy. Pain 2001;90:261-9.
9. Bisgaard T. Analgesic treatment after laparoscopic cholecystectomy: A critical assessment of the evidence. Anesthesiology 2006;104:835-46.
10. McDonnell JG, Curley G, O'Donnell B, Heffernan A, Power C, Laffey JG. The analgesic efficacy of transversus abdominis plane block after caesarean section: A prospective randomized controlled trial. Anesth Analg 2008;106:186-91.
11. El-Dawlatly AA, Turkistani A, Kettner SC, Machata AM, Delvi MB, Thallaj A, *et al*. Ultrasound-guided transversus abdominis plane block: Description of a new technique and comparison with conventional systemic analgesia during laparoscopic cholecystectomy. Br J Anaesth 2009;102:763-7.
12. Tolchard S, Davies R, Martindale S. Efficacy of the subcostal transversus abdominis plane block in laparoscopic cholecystectomy: Comparison with conventional port-site infiltration. J Anaesthesiol Clin Pharmacol 2012;28:339-43.
13. Saxena R, Joshi S, Srivastava K, Tiwari S, Sharma N, Valecha UK, *et al*. Comparative study of ultrasound-guided abdominal field blocks versus port infiltration in laparoscopic cholecystectomies for post-operative pain relief. Indian J Anaesth 2016;60:578-83.
14. Ramkiran S, Jacob M, Honwad M, Vivekanand D, Krishnakumar M, Patrikar S. Ultrasound-guided combined fascial plane blocks as an intervention for pain management after laparoscopic cholecystectomy: A randomized control study. Anesth Essays Res 2018;12:16-23.