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Efficacy of USG Guided Subcostal Transversus Abdominis Plane Block for Postoperative Analgesia after Laparoscopic Cholecystectomy

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Abstract

Backgroud and Aims: The advent of ultrasound guided techniques has led to increased interest in Transversus Abdominis Plane block (TAP) for abdominal surgeries. Recently the transversus abdominis plane block (TAP block) has been used as a part of multimodal analgesia with promising results. The oblique subcostal approach (OSTAP block), a variant of the TAP block, produces reliable supra umbilical analgesia. This study aimed to compare the efficacy of ultrasound guided OSTAP block with portsite infiltration in laparoscopic cholecystectomy for postoperative analgesia. *Methods:* Eighty patients scheduled to undergo laparoscopic cholecystectomy under general anaesthesia were divided into two groups: Group A (n=40) patients received oblique subcostal transversus abdominis plane block with 15 ml of 0.25% bupivacaine on each side and Group B (n=40) received local portsite wound infiltration with 30 ml of 0.25% bupivacaine in all four ports. The primary and secondary outcome variables were postoperative pain relief, duration of analgesia, rescue analgesic requirement and any side effects, which were noted. *Results:* The postoperative VAS scores were significantly lower in group A (OSTAP) compared to group B (Portsite) at 0, 1, 2 and 3 hours postoperatively. OSTAP block resulted in longer duration of analgesia as compared to portsite infiltration. The mean duration of analgesia recorded in OSTAP group A was 5.68±2.08 hours and in portsite infiltration group B was 2.53±1.19 hours. The total dosage demand for rescue analgesia in first 24 hours was also less in the study group A compared to group B i.e 91.87±31.71mg of diclofenac sodium in group A and in group B was 135.01±34.80 mg. Postoperative nausea vomiting score though was less in group A than in group B but there was no statistically significant difference in between the groups. *Conclusion:* The results suggest that the use of Ultrasound guided bilateral oblique subcostal transversus abdominis plane block reduces postoperative pain scores, prolongs the duration of analgesia and decreases demand for rescue analgesia without causing any adverse effects in comparison to portsite infiltration.

Keywords: Transverses Abdominis; Bupivacaine; Portsite; Postoperative; Analgesia.

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Introduction

Pain is the most common human experience bringing patient to medical care; a symptom frequently encountered in clinical practice and is consistent and predominant complaint of most individuals following surgical intervention [1]. Since Eric Mouret's first laparoscopic cholecystectomy in 1987, this procedure has become the gold standard treatment for symptomatic cholelithiasis. The reasons behind the increasing number of laparoscopic surgeries are improved healing time as compared to open surgery resulting in early recovery and discharge from the hospitals [2,3]. Pain after laparoscopic cholecystectomy is considered to arise from 3 main

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sources: i.e., incision sites, the pneumoperitoneum and the post cholecystectomy wound within the liver.[4] The TAP block is a peripheral nerve block designed to anaesthetize the nerves supplying the anterior abdominal wall (T_6 to T_{11}). Since standard landmark based approach to the TAP block is inaccurate and the incidence of peritoneal placement is high, an ultrasound guidedapproach was first described in 2007 by Hebbard et al. [5] In 2008, Hebbard et al. [6] described another ultrasound guided tap block technique designed for upper abdominal surgery referred to as the oblique subcostalapproach. The search for ideal postoperative analgesia regimens following laparoscopic cholecystectomy still continues which should facilitate high quality analgesia with low incidence of postoperative nausea and vomiting so as to provide early hospital discharge. Our study aimed to compare the analgesic efficacy of the OSTAP block using bupivacaine in laparoscopic cholecystectomy with the portsite infiltration.

Methods

It was a prospective, randomized, double blind, controlled clinical trial. The study protocol was approved by the institutional ethics committee and written informed consent was obtained from all patients recruited from August 2016 to September 2017. This study was carried out on 80 American Society of Anesthesiologists' (ASA) physical status I and II patients of both gender, in the age group of 20–60 years, scheduled for laparoscopic cholecystectomy under GA. Patient's refusal for block, history of cardiac, renal or hepatic disease, CNS disorders, neuropathy, bleeding disorders, hypersensitivity to local anaesthetics, local infection at the site and BMI >30 formed the exclusion criteria. The anaesthetic procedure was explained to the patients enrolled for study.

All patients were kept nil orally as per protocol. They were given premedication in the form of tablet Alprazolam 0.5 mg and tablet Ranitidine 150 mg 2 hours prior to surgery . On arrival in operation theatre, intravenous line was secured in nondominant upper limb using an 18 gauge IV cannula and crystalloid fluid was started. Patients received a standard general anaesthetic regimen consisting of injection fentanyl (2 mg/kg) iv, injection propofol (2 mg/kg) iv and injection atracurium (0.5 mg/kg) iv for intubation during induction. Anaesthesia was maintained with N_2O, O_2 and isoflurane (66%, 33% and 1% MAC) respectively. An intermittent dose of injection atracurium (0.1mg/kg) iv was given for adequate muscle relaxation. Ventilation was adjusted to maintain end tidal CO_2 between 30 to 40 mm of Hg, whereas intra abdominal pressure was maintained between 10 to 12 mm of Hg. In group A before the surgery started, bilateral oblique subcostal transversus abdominis plane block was performed aseptically under ultrasound guidance (Sonosite Micromax) using linear probe (6-13 MHz frequency). The rectus abdominis and transversus abdominis muscles were identified near the costal margin and xyphoid. A 22 G echogenic needle advanced by an ultrasound guided inplane (medial to lateral) technique through rectus muscle 2 to 3 cm medial to the probe. Once the tip of the needle was visualized in between the rectus muscle and transversus abdominis muscle facial plane, 1 ml of normal saline was injected to open the plane and after confirmation of hypoechoic area on ultrasonography imaging, injection of 15 ml of drug solution was given. Hydrodissection was demonstrated by the needle passing along the oblique subcostal line inferolaterally from xyphoid towards the anterior part of the iliac crest. A contralateral oblique subcostal transversus abdominis plane block was subsequently performed in similar manner with 15 ml of 0.25 % bupivacaine. In group B 30 ml of 0.25% bupivacaine was infiltrated at the portsites by surgeon as 7.5 ml at the epigastric port, 7.5 ml at the umbilical port and 7.5 ml at each two working port, before the surgery started. At the end of surgery, isoflurane and N_2O was turned off and muscle relaxation was reversed with injection neostigmine (50 mcg/kg) and injection glycopyrrolate 0.08 mg/kg intravenously. Patients were extubated, once they demonstrated spontaneous eye opening, good cough reflex, hand grip and were able to generate good tidal volume. The time of arrival in the postoperative unit was defined as 0 hour postoperatively. For the first 24 hours, the protocol for postoperative analgesia consisted of standard orders for intravenous diclofenac 75 mg on demand for VAS> 4. Postoperatively, the patients were evaluated for pain, nausea or vomiting, in the post anaesthesia care unit at 0 1, 2, 3, 4, 6, 8, 12, 24 hours by an investigator blinded to group assigned. Postoperatively, pain level at rest (supine) and pain on movement (sitting up from supine) was quantified with a 10 cm visual analogue scale (VAS) pain score.

1. Patients were asked to rate the pain they experience over 24 hours postoperatively on a 10 cm VAS (visual analogue scale) between no pain – 0 very severe pain – 10
2. Patients were asked to rate the severity of nausea, vomiting on three point scale no nausea, no

vomiting -0 nausea present, no vomiting -1, nausea present, vomiting present -2

The primary outcome measure in this study was the time to first analgesic request. The secondary outcome measure included the number of supplemental analgesic requirements, VAS pain scores at different time interval, nausea and vomiting and any other side effects.

Results

The total number of patients enrolled during the study was 85 for the two groups; 5 patients were excluded from study because of conversion to open cholecystectomy [Figure 1]. Thus, the total number of patients completing the study was 40 in each group. They were comparable to each other with respect to age, body mass index (BMI), and ASA status [Table 1]. VAS measurements were performed to assess the quality of analgesia. The OSTAP group had a

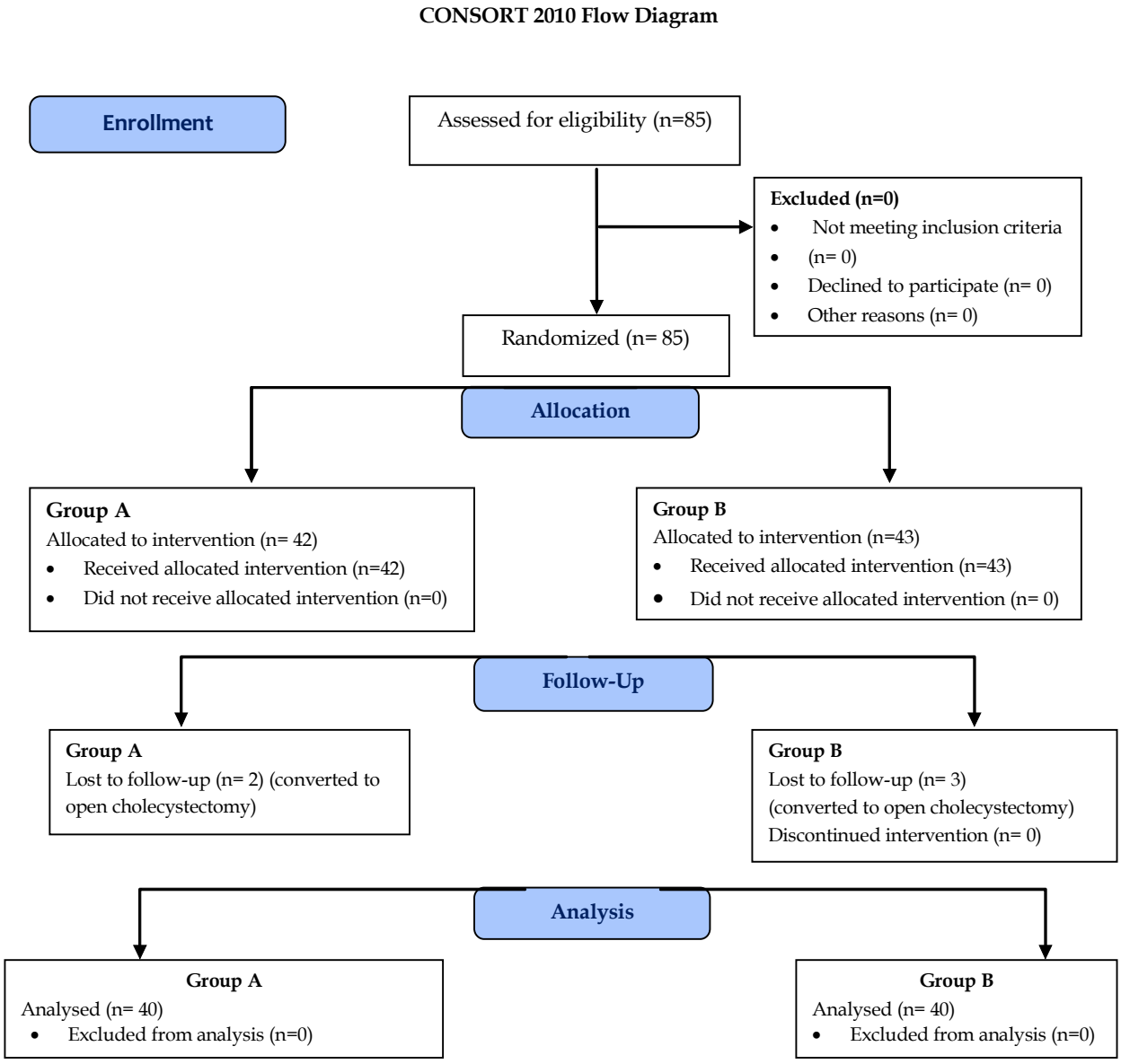


Fig. 1: Flow chart of patients recruited and analyzed in two groups

statistically significant lower VAS scores at 0, 1, 2, 3 hours postoperatively both at rest and on movement (Table 2 & 3) (Figure 2 & 3). Total duration of analgesia (defined as time interval between shifting patient to PACU and demand for first rescue analgesic) was more in OSTAP group as compared to portsite infiltration group. In OSTAP group, pain free period was 5.68±2.08 hours while it was 2.53±1.19 hours in local infiltration group (p< 0.000) [Table 4, Figure 4a]. 24 hours postoperative analgesic requirements was significantly lower in OSTAP group than in portsite infiltration group (i.e 91.87±31.71 mg in 40 patients of OSTAP group and 135.01±34.80 mg in 40 patients of portsite infiltration group(Table 4, Figure 4b). Both groups were comparable in terms of PONV scores (Table 4) (Figure 4c).

Table 1:

Parameter		Group A	Group B	p value
Age (years) mean±SD		41.03±10.46	42.03±11.75	0.689
BMI mean±SD		24.05±2.97	23.42±2.18	0.283
ASA grade	I	28(70%)	29(72.5%)	
(no %)	II	12(30%)	11(27.5%)	0.738

p value <0.05 (significant)

Table 2: (VAS scores at rest)

VAS scores	Group A	Group B	P values
0 hours	0.40±1.01	2.10±1.21	0.000
1 hours	1.28±1.33	3.05±1.13	0.001
2 hours	2.15±1.09	3.05±1.11	0.000
3 hours	2.45±0.09	3.85±1.25	0.000
4 hours	3.23±1.14	3.15±1.21	0.776
6 hours	3.61±1.01	3.53±0.78	0.728
8 hours	3.78±1.36	3.58±1.36	0.367
12 hours	2.32±1.32	2.78±1.31	0.122
24 hours	0.88±1.22	1.35±1.12	0.074

p value <0.05 (significant)

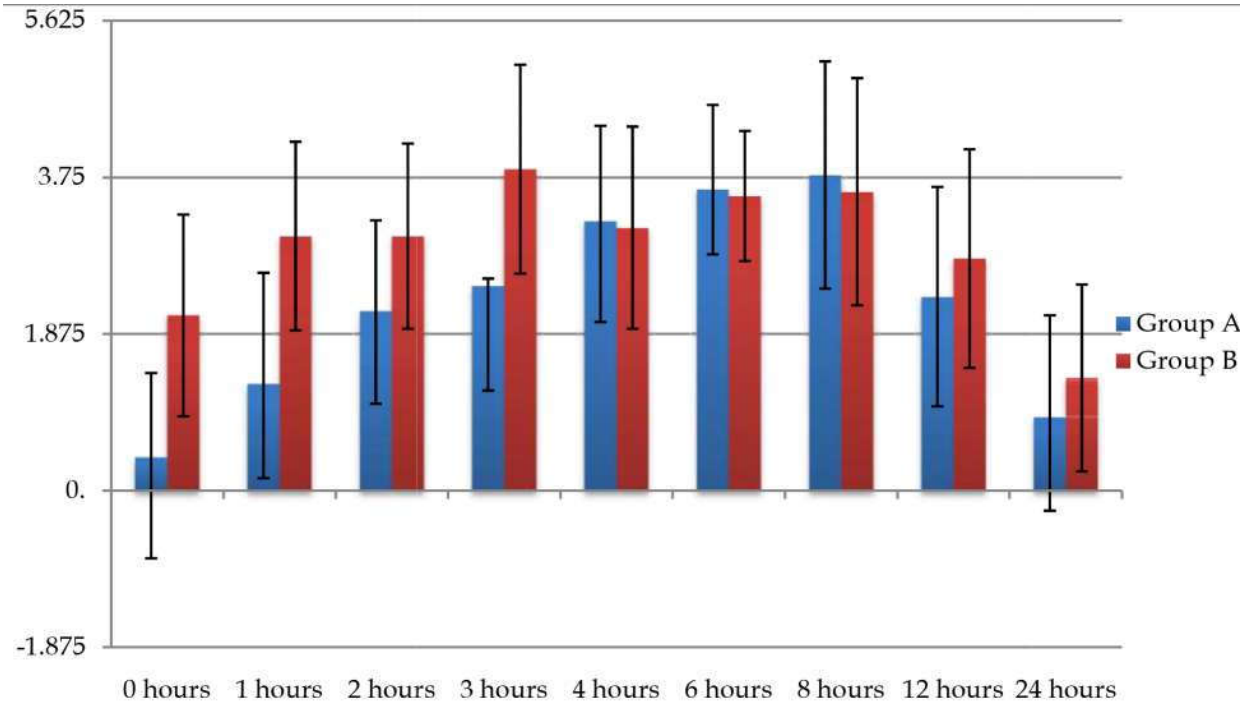


Fig. 2: VAS scores at rest

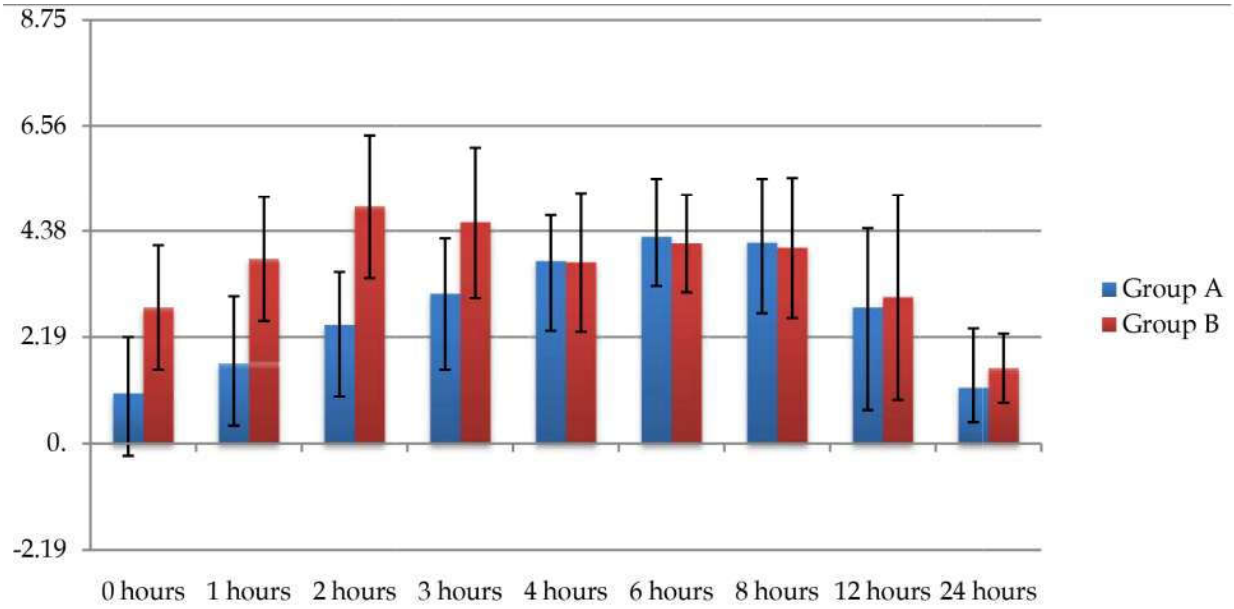


Fig. 3: (VAS scores on movement)

Table 3: VAS scores on movement

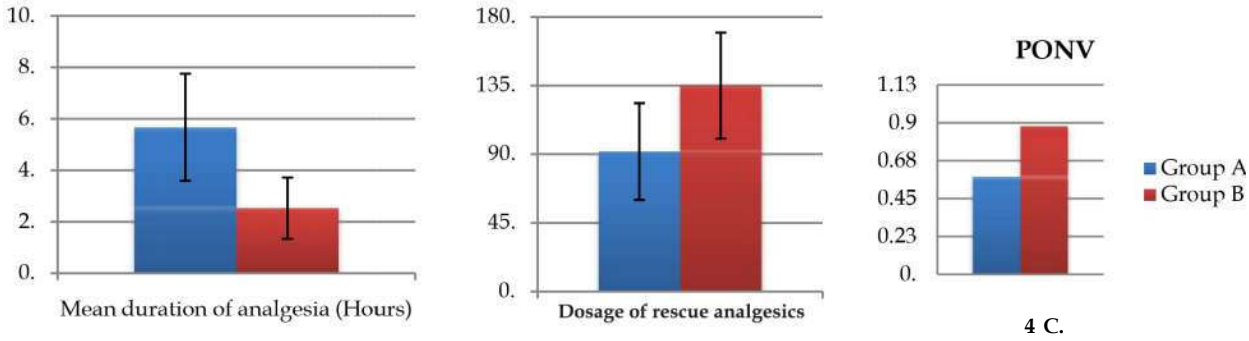
VAS scores	Group A	Group B	P values
0 hours	1.03±1.16	2.80±1.28	0.000
1 hours	1.65±1.38	3.80±1.28	0.000
2 hours	2.45±1.08	4.88±1.48	0.000
3 hours	3.08±1.14	4.55±1.56	0.000
4hours	3.75±0.95	3.73±1.43	0.927
6 hours	4.25±1.21	4.12±1.01	0.671
8 hours	4.13±1.33	4.03±1.45	0.755
12 hours	2.80±1.63	3.01±2.11	0.467
24 hours	1.15±1.22	1.55±0.71	0.117

P value <0.05 (significant)

Table 4: Other Variables

Parameter	Group A	Group B	P value
Mean duration of analgesia (Hours)	5.68 ± 2.08	2.53 ± 1.19	0.000
Dosage of rescue analgesics (doses of Diclofenac in mg)	91.87 ± 31.71	135.01 ± 34.80	0.000
PONV	0.58 ± 0.67	0.88 ± 0.82	0.078

P value <0.05 (significant)



4 A. **4 B.** **4 C.**

Fig. 4:

Discussion

Laparoscopic cholecystectomy is one of the common surgeries performed by general surgeons worldwide. Despite its many benefits, including reduced postoperative pain, smaller scars, shorter hospital stay, shorter convalescence period, and decreased risk of complications compared with open cholecystectomy, majority of patients undergoing elective laparoscopic cholecystectomy are still observed in the hospital overnight for postoperative pain and complications [7].

Over the time, methods for providing postoperative analgesia have changed from iv opioids, central neuroaxial block, intraperitoneal and portsite infiltration to regional blocks like TAP block. TAP infiltration was originally described as a landmark guided abdominal field block for postoperative pain management. As spread of the local anaesthetic is critical for analgesic efficacy, the use of an ultrasound guided technique was a logical progression for this block. In response to clinical variations, this technique had evolved further to multiple and single injections as well as to lateral, subcostal, and posterior approaches [8]. Ultrasound guided OSTAP block is an expanding regional anaesthesia technique that provides good analgesia to the skin and musculature of the anterior abdominal wall and has proved to be an effective component of multimodal analgesic regimen for a wide variety of abdominal procedures including large bowel resection, open/laparoscopic appendicectomy, gastrectomy, upper abdominal surgeries and laparoscopic cholecystectomy [9,10]. Most randomized controlled trials demonstrate the efficacy of ultrasound guided OSTAP block by highlighting some combination of reduced postoperative opioid requirement, lower pain scores, and reduction in opioid-related side effects. Potential advantages include its simplicity and effectiveness in providing analgesia, appropriateness for surgical procedures where parietal pain is a significant component of postoperative pain. The analgesic benefit of TAP block in laparoscopic cholecystectomy has already been established by both landmark based approach and ultrasound guided approach. Therefore, we intended to compare the efficacy of ultrasound guided oblique subcostal TAP block for postoperative analgesia in patients scheduled for laparoscopic cholecystectomy with portsite infiltration.

Tolchard et al. [11] compared the efficacy of subcostal tap block with portsite infiltration in laparoscopic cholecystectomy and demonstrated lower VAS scores in OSTAP at 1 and 4 hours postoperatively. C M Breazu et al. [12] observed significant reduction in VAS score in first 24 hours postoperativly in OSTAP block with bupivacaine than in OSTAP with placebo. Our results are consistent with these studies and shows the efficacy of OSTAP block using 0.25% bupivaciane for postoperative analgesia.

Another advantage afforded by OSTAP block is that it provides longer duration of analgesia as compared to portsite infiltration. The mean duration of analgesia recorded in our study in OSTAP group (A) was 5.68±2.08 hours and in portsite infiltration group (B) was 2.53±1.19 hours. Most of the authors have claimed a mean duration of analgesia as 4-6 hours with the use of plain bupivacaine in tap block and our study also shows similar results [13,14,15]. The prolonged duration of bupivacaine in TAP block has also been attributed to the poor vascularity of transverse abdominis plane as demonstrated by Mcdonnell et al. [13] Very few studies have been reported which compared the duration of postoperative analgesia in patients receiving OSTAP block with portsite infiltration in laparoscopic cholecystectomy. The results of our present study were more consistent with the study conducted by Mohamed and colleagues [15] who compared the efficacy of OSTAP block with portsite infiltration in 63 patients undergoing laparoscopic sleeve gastrectomy. In their study recorded time for first rescue analgesic in OSTAP group was 340±72 min and in portsite infiltration group was 266±33 min which was statistically significant and is similar to the results of our study. Tramadol consumption in 24 hour postoperative period in patients undergoing laparoscopic cholecystectomy was significantly more in control group (267.1±108.6 mg) than in OSTAP group (126.3±54.2 mg) respectively (p=0.001) which is similar to our study. Mean dosage requirement of rescue analgesia (in mg) in our study in OSTAP group was 91.87±31.71 mg and 135.01±34.80 mg in portsite infiltration group. Our results show that total dosage of rescue analgesics required in 24 hour postoperative period is significantly less in OSTAP group than in portsite infiltration group. Authors [12,16,17] have used different analgesic agents while iv diclofenac was the rescue analgesia in our study, so though a direct comparison between these studies is questionable but it can be considered till further studies for evaluation are available.

Our study did not find any statistically and clinically significant differences in PONV scores and none of the patient in either group had any procedure related complications like injury to viscera or any local complication.

Our data supports prolonged action of bupivacaine on peripheral nerves in OSTAP block leading to better pain scores, decrease in postoperative analgesic requirements, PONV scores and complications.

Conclusion

We concluded that the use of Ultrasound guided bilateral oblique subcostal transversus abdominis plane block reduces postoperative pain scores, prolongs the duration of analgesia and decreases demand for rescue analgesia without causing any adverse effects in comparison to portsite infiltration. So it is recommended that Ultrasound guided oblique subcostal TAP block can be safely used as a part of multimodal analgesia for better postoperative pain scores and prolonged duration of analgesia, thereby reducing the rescue analgesic requirement with better patient satisfaction.

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