Original Research Article

A comparative study to assess the analgesic and respiratory function after laparoscopic cholecystectomy in patients receiving ultrasound- guided oblique subcostal transversus abdominis plane block vs. port site infiltration

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Abstract

Background: Safe and effective modalities of perioperative analgesia are essential for enhancing recovery after surgery. present study was conducted to compare the efficacy of subcostal TAP block vs port site infiltration with respect to pain and post-operative respiratory functions in patients undergoing laparoscopic cholecystectomy. **Material and Methods:** Present study was single-center, hospital based randomized, observer blinded, interventional study, conducted in patient of 18-60 years age, ASA Grade I/II, undergoing laparoscopic cholecystectomy under general anesthesia. 120 patients undergoing laparoscopic cholecystectomy were randomly divided into Group 1 (Oblique subcostal TAP block group) and group 2 (Port site infiltration) **Results:** The mean duration of surgery, mean duration of analgesia was comparable between the groups and statistically not significant. There was no significant difference in the baseline Peak Expiratory Flow Rate (PEFR) between two groups (372.35±55.83 l/min vs. 373.25±56.49 l/min; $p>0.05$) but there was significant decrease in PEFR in Group 2 than Group 1 at postoperatively 24 hours (329.83±17.36 l/min vs. 266.83±39.08 l/min; $p<0.05$). The VAS score on shift was comparable between both the groups but the VAS score at post-operative time intervals (2,4,8,12 and 24 hours) was significantly lower in Group 1 compared to Group 2. 2 (3.3%) and 11 (18.3%) patients in Group 1 and Group 2 respectively required rescue analgesic. It was observed that significantly lower number of patients in Group 1 required rescue analgesic compared to Group 2. 2 (5%) and 5 (8.3%) patients in Group 1 and Group 2 respectively had nausea and vomiting. **Conclusion:** Pain and post-operative respiratory functions measured by PEFR after laparoscopic cholecystectomy and VAS score at post-operative time intervals (2,4,8,12 and 24 hours) was significantly lower in TAP Group compared to port site infiltration Group.

Keywords: subcostal TAP block, port site infiltration, analgesia, laparoscopic cholecystectomy.

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One of the major changes during the evolution of surgical procedures is minimally invasive surgery which includes endoscopy and laparoscopy.[1] Benefits of laparoscopic surgery technique are well documented and include reduction in post-operative pain, decreased hospital stay, improved cosmetic results and patient satisfaction. Safe and effective modalities of perioperative analgesia are essential for enhancing recovery after surgery. Optimal regimens of analgesia seek to improve patient comfort and mobilization whilst minimizing the risk of complications

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that may inhibit postoperative recovery.[2] Control of postoperative pain is imperative for patient comfort, early mobilization, and faster recovery.[3] Subcostal transversus abdominis plane (TAP) block can provide sensory block of the T7 to T12 nerves as against the classical posterior approach which provides sensory block from T10 to L1 spinal segment levels.[4] The accuracy and quality of nerve blockade can be enhanced with the guidance of ultrasound. Port-site infiltration with local anesthetics is another effective method of providing analgesia after laparoscopic cholecystectomy.[5] However, there is a paucity of literature comparing the efficacy of subcostal TAP block vs port site infiltration with respect to pain and post-operative respiratory functions in patients undergoing laparoscopic cholecystectomy, hence the present study was done at our tertiary care center with that objective in mind.

MATERIAL AND METHODS

Present study was single-center, hospital based randomized, observer blinded, interventional study, conducted in department of anaesthesia with help from Department of Surgery, at Topiwala National Medical College And B.Y.L Nair Ch. Hospital, India. Study duration was of 18 months (July 2019 to January 2021). Study was approved by institutional ethical committee.

Inclusion criteria: Patient of 18-60 years age, ASA Grade I/II, undergoing laparoscopic cholecystectomy under general anesthesia.

Exclusion criteria: Those getting converted to open cholecystectomy. ASA Grade Ill and IV. Local site infection. Patient with pre-operative respiratory and cardiac complications. Allergy to local anesthetics (local anesthetic sensitivity test will be performed in all patients preoperatively).

A valid informed consent was obtained from the patients once they were enrolled for the study, a thorough history and physical examination was done as per proforma. 120 patients undergoing laparoscopic cholecystectomy were randomly (by sealed envelope) divided into following two groups:

Group 1: Oblique subcostal TAP block group (by anesthesiologists with expertise in ultrasound-guided truncal blocks, under ultrasound guidance)

Group 2: Port site infiltration (by the operating surgeon at the end of the surgery.)

Following aspiration, Bupivacaine and lignocaine were deposited in the plane (dosage as per body weight). Volume of infiltration in oblique subcostal transversus abdominis plane block was 10 ml on each side. Port site infiltration was performed post-operatively in the usual manner using the same quantities and the dosage of local anesthetic were divided equally between the port sites. A standardized general anesthetic regime was employed comprising of preoperative (before induction) non-opioid analgesia of Inj. Paracetamol (15mg/kg), baseline vitals were noted post attachment of non-invasive monitors (ECG, non-invasive blood pressure, pulse oximetry and end-tidal CO2) following which patient was induced after pre-oxygenation with Inj. Fentanyl (1mcg/kg), Inj. Propofol (2mg/kg), and Inj. Atracurium (0.5mg/kg), and then intubated with appropriate size endotracheal tube was carried out. Inj. Dexamethasone 8mg were given intra-operatively to all patients. Anesthesia was maintained by volume- controlled ventilation, sevoflurane and Inj. Atracurium (0.1mg/kg) every 20-25 minutes. At the end of the operation sevoflurane was discontinued and muscle relaxant was reversed by a mixture of Inj. Neostigmine (0.05mg/kg) and Inj. Glycopyrrolate (0.008mg/kg), and then the patients were extubated and were transferred to PACU post-operatively where the recovery anesthesiologist was blinded to the group intervention and informed that local anesthetics have been given to the patients in view of patient safety. Rescue analgesia (postoperatively for VAS ≥ 4) was given to the patients in the recovery. First rescue analgesia used was Paracetamol followed by Tramadol and Diclofenac was the third rescue analgesic. Post operatively, VAS (Visual Analogue Scale) pain scores were analyzed in the first 24 hours. (On shift, at 2 hours, 4 hours, 8 hours, 12 hours, 24 hours) Respiratory function was assessed by PEFR which was recorded preoperatively at the time of assessment (best of the three readings was taken) and post operatively at the end of 24 hours and arterial blood gas variables was assessed in the first 24 hours to assess the change in respiratory function.

RESULTS

Among patients undergoing laparoscopic cholecystectomy. 120 patients were randomly divided into following two groups: Group 1 (Oblique subcostal TAP block) and Group 2 (Port site infiltration). The mean age of the patients among Group 1 was 41.05 ± 11.08 years and Group 2 was 42.65 ± 9.35 years.

There was no statistically significant difference between the groups for mean age, gender, BMI and ASA grade as per Student t-test ($p>0.05$).

Table 1: General characteristics

General characteristics	Group 1	Group 2	P value
Age (years)	41.05 ± 11.08	42.65 ± 9.35	>0.05
Gender			>0.05
Male	34 (56.7%)	32 (53.3%)	
Female	26 (43.3%)	28 (46.7%)	
Mean BMI	25.27 ± 4.09	25.86 ± 4.00	>0.05
ASA grade			>0.05
I	40 (66.7%)	43 (71.7%)	
II	20 (33.3%)	17 (28.3%)	

The mean duration of surgery was comparable in Group and Group B (41.08 ± 9.07 mins vs. 42.62 ± 9.22 mins). The mean duration of analgesia was comparable between the groups and statistically not significant as per Student t-test (54.35 ± 9.39 minutes vs. 56.25 ± 7.67 minutes; p>0.05). Intraoperatively throughout the study, heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP), SpO2 levels were comparable between the groups as per Student t-test (p>0.05). There was no significant difference in the baseline Peak Expiratory Flow Rate (PEFR) between two groups (372.35±55.83 l/min vs. 373.25±56.49 l/min; p>0.05) but there was significant decrease in PEFR in Group 2 than Group 1 at postoperatively 24 hours as per Student t-test (329.83±17.36 l/min vs. 266.83±39.08 l/min; p<0.05). There was no significant difference in the baseline partial pressure of carbon dioxide ($PaCO_2$) between two groups (40.37±6.78 mmHg vs. 41.72±5.94 mmHg; p>0.05) and $PaCO_2$ at postoperatively 24 hours (44.88±9.82 mmHg vs. 47.07±9.13 mmHg; p>0.05).

Table 2: Operative parameters

Operative parameters	Group 1 (Mean ± SD)	Group 2 (Mean ± SD)	P value
Mean duration of Surgery (mins)	41.08 ± 9.07	42.62 ± 9.22	>0.05
Duration of Analgesia (mins)	54.35 ± 9.39	56.25 ± 7.67	>0.05
PEFR			
Initial	372.35 ± 55.83	373.25 ± 56.49	>0.05
Post op 24 hours	329.83 ± 17.36	266.83 ± 39.08	<0.05
$PaCO_2$ (mmHg)			>0.05
Initial	40.37 ± 6.78	41.72 ± 5.94	
Post op 24 hours	44.88 ± 9.82	47.07 ± 9.13	

The VAS score on shift was comparable between both the groups but the VAS score at post-operative time intervals (2 hours, 4 hours, 8 hours, 12 hours and 24 hours) was significantly lower in Group 1 compared to Group 2 as per Student t-test (p<0.05).

Table 3: Comparison of VAS score at various postoperative time intervals

VAS	Group 1 (Mean ± SD)	Group 2 (Mean ± SD)	p value
On shift	1.43 ± 0.59	1.53 ± 0.57	>0.05
2 hours	1.57 ± 0.67	2.82 ± 0.91	<0.05
4 hours	1.50 ± 0.60	2.57 ± 0.67	<0.05
8 hours	1.58 ± 0.67	2.65 ± 0.92	<0.05
12 hours	1.62 ± 0.64	2.62 ± 0.85	<0.05
24 hours	1.67 ± 0.66	2.63 ± 0.71	<0.05

2 (3.3%) and 11 (18.3%) patients in Group 1 and Group 2 respectively required rescue analgesic. It was observed that significantly lower number of patients in Group 1 required rescue analgesic compared to Group 2 as per Chi-Square test (p<0.05).

Table 4: Distribution of Rescue Analgesic

Requirement of Rescue Analgesic	Group 1 (%)	Group 2 (%)	p Value
Yes	2 (3.3%)	11 (18.3%)	<0.05
No	58 (96.7%)	49 (81.7%)	

2 (5%) and 5 (8.3%) patients in Group 1 and Group 2 respectively had nausea and vomiting. The incidence of nausea and vomiting was less in Group 1 compared to Group 2 however this difference was statistically not significant as per Chi Square test(p>0.05).

Table 5: Post-operative complications

Post-operative complications	Group 1 (%)	Group 2 (%)	p Value
Nausea andVomiting	3 (5%)	5 (8.3%)	>0.05
No complications	57 (95%)	55 (91.7%)	

DISCUSSION

Provision of adequate postoperative analgesia reduces the neuro-endocrine stress response, postoperative respiratory complications and the incidence of myocardial ischemia can be minimized. TAP block is a regional anesthetic technique which blocks the abdominal neural afferents by introducing local anesthetic into the neuro-fascial plane between the internal oblique and the transversus abdominis muscle. The ultrasound-guided subcostal transversus abdominis (STA) block is a recently described variation on the TAP block which produces reliable unilateral supraumbilical analgesia.[6,7] In the present study, There was no statistically significant difference between the groups for mean age, gender, BMI and ASA grade as per Student t-test ($p>0.05$). This is similar to the studies of Abdelmaboud MA[8] and Bhalekar P *et al.*[9] Abdelmaboud MA[8] study assessing clinical utility of TAP block as analgesia after lower abdominal surgeries in morbidly obese found no statistically significant differences between the study groups with respect to age, sex, BMI, and duration of the surgery. Bhalekar P *et al.*[9] assessing whether subcostal TAP block reduces the requirement of rescue analgesics following laparoscopic cholecystectomy found both groups were comparable with respect to mean age, sex distribution, mean weight, ASA physical status, and duration of surgery. There was no significant difference in the baseline Peak Expiratory Flow Rate (PEFR) between two groups (372.35±55.83 l/min vs. 373.25±56.49 l/min; $p>0.05$) but there was significant decrease in PEFR in Group 2 than Group 1 at postoperatively 24 hours as per Student t-test (329.83±17.36 l/min vs. 266.83±39.08 l/min; $p<0.05$) which indicates that TAP block provides better pain relief than port site infiltration thus allowing the patient to breathe adequately. This is comparable to the studies of Abdelmaboud MA[8] and Basaran B *et al.*[10]. Abdelmaboud MA[8] study observed no significant difference in baseline PEFR between two groups, but there was significant decrease in PEFR in group C (Control group) than group T (TAP group) at 2, 6 h postoperatively. Basaran B *et al.*[10] in a randomized double-blind study reported OSTAP group had better FVC values at 2 ($p=0.029$) and 24 h ($p=0.019$). FEV1 /FVC and PEFR values were similar between groups. In our study, the VAS score on shift was comparable between both the groups but the VAS score at post-operative time intervals (2 hours, 4 hours, 8 hours, 12 hours and 24 hours) was significantly lower in Group 1 compared to Group 2 as per Student t-test ($p<0.05$). This is consistent with the studies of Abdelmaboud MA[8], Basaran B *et al.*[10], Bhalekar P *et al.*[9] and Saliminia A *et al.*[11] Bhalekar P *et al.*[9] study showed throughout the 24 h after surgery, mean VAS score at rest and on coughing was significantly less in patients of Group B (subcostal TAP group) as compared to Group A (control group). Saliminia A *et al.*[11] study on efficacy of transverse abdominis plane block in reduction of postoperative pain in laparoscopic cholecystectomy reported lower VAS score in the subcostal TAP group than the control group at 1 h (3.44 vs. 5.17), 6 h (3.94 vs. 6.44), 12 h (1.94 vs. 3.39), and 24 h (0.83 vs. 1.44). It was observed in the present study that 2 (3.3%) and 11 (18.3%) patients in Group 1 and Group 2 respectively required rescue analgesic (Inj. Paracetamol, Inj. Tramadol, Inj. Diclofenac). It was observed that significantly lower number of patients in Group 1 required rescue analgesic compared to Group 2 as per Chi-Square test ($p<0.05$). Similar observations were noted in the studies of Abdelmaboud MA[8], Erbabacan E *et al.*,[12] El-Dawlatly AA *et al.*[13], Ra YS *et al.*,[14], Ghisi D *et al.*,[15] Chen CK *et al.*,[16] Bhalekar P *et al.*,[9] Carrie C *et al.*,[17] Sharma P *et al.*[18] and Basaran B *et al.*,[10] Bhanulakshmi M *et al.*[19] study concluded that TAP block can be easily and safely performed and more effective with significant decrease in opioid requirement and pain score. Erbabacan E *et al.*[12] study comparing TAP block and IV patient-controlled analgesia (PCA) using opioids after lower abdominal surgery observed TAP block was preferable to IV- PCA, as the analgesic effect starts earlier and decreases the systemic effect of the morphine used in PCA. Tolchard S *et al.*[20] study on efficacy of the subcostal TAP block Comparison with conventional port-site infiltration in laparoscopic cholecystectomy reported that patients in the subcostal TAP group required morphine and tramadol in 1/21 (4.8%) and 6/21 (28.6%) patients, respectively, whereas the control group required morphine and tramadol in 3/22 (13.6%) and 8/22 (36.4%) patients postoperatively which was not statistically significant. It was observed in our study that 3 (5%) and 5 (8.3%) patients in Group 1 and Group 2 respectively had nausea and vomiting. The incidence of nausea and vomiting was less in Group 1 compared to Group 2 however this difference was statistically not significant as per Chi Square test ($p>0.05$). This finding was consistent with the studies of Abdelmaboud MA[8] and Basaran B *et al.*[10] Poorly controlled pain is associated with unwanted postoperative consequences like patient suffering, distress, confusion, respiratory and heart problems, prolonged hospital stays, and expenditures. Good postoperative pain management has been shown to be effective in reducing perioperative morbidity associated with acute coronary events and thrombotic events in high-risk patients.[21] The block of pain impulses by local anesthetic (LA) provides effective pain relief for abdominal surgery, either on its own or as part of a multimodal analgesic regimen. With the development of ultrasound imaging techniques that enable precise target identification.

CONCLUSION

The hospital based randomised, observer blinded, interventional study demonstrated that supplementing a standard multimodal analgesic regimen with a subcostal TAP block vs. port site infiltration provided superior analgesia postoperatively with respect to pain and post-operative respiratory functions measured by PEFR after laparoscopic cholecystectomy and VAS score at post-operative time intervals (2,4,8,12 and 24 hours) was significantly lower in TAP Group compared to port site infiltration Group.

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