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Is TAP block better than bupivacaine spray for relieving post-cholecystectomy pain?

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ABSTRACT

Introduction: The choice of anesthetic is a determinant of post-cholecystectomy pain perception by patients. The efficacy of Transversus Abdominis Plane (TAP) block in reducing such pain needs to be investigated.

Objectives: To compare the mean postoperative pain scores of TAP block and intraperitoneal bupivacaine spray in patients undergoing laparoscopic cholecystectomy for chronic cholecystitis.

Materials & Methods: This comparative study was carried out at Al-Tibri Medical College and Hospital, Karachi, from 15 June 2023 to 15 December 2023, after approval from hospital ethical committee. All patients aged 18-65 years of both genders, diagnosed with chronic cholecystitis were included in the study. A total of 112 patients were selected using nonprobability, consecutive sampling, with 56 patients in each group. Laparoscopic cholecystectomy was done in both groups: Group A was given TAP block, Group B was given intraperitoneal bupivacaine spray, and post-operative pain was compared in both groups. SPSS 22 was utilized for descriptive and comparative statistics, with $p \leq 0.05$ denoting significance.

Results: The mean age of 112 enrolled patients was 33.53±5.1 years. There were 29 (25.9%) males and 83 (74.1%) females. Age, gender distribution, height, weight, and body mass index were almost the same in both groups. VAS score in group B was 3.75±2.2 at 2 hours, 3.63±2.1 at 6 hours, 3.46±1.7 at 12 hours and 3.3±1.01 after 24 hours of surgery. In group A VAS was 4.10±1.9 at 2 hours, 3.95±1.6 at 6 hours, 3.02±1.2 at 12 hours and 2.10±1.3 after 24 hours of surgery. When 24-hour post-operative pain was compared in both groups pain was significantly lower in group A (TAP block) with p-value <0.001.

Conclusion: TAP block is associated with decreased post-operative pain as compared with intraperitoneal bupivacaine spray.

Keywords: Transversus Abdominis; Peritoneal Cavity; Laparoscopy; Laparoscopic Surgery; Cholecystectomy, Laparoscopic; Bupivacaine; Cholecystitis.

The authors declared no conflict of interest. All authors contributed substantially to the planning of research, data collection, data analysis, and write-up of the article, and agreed to be accountable for all aspects of the work.

INTRODUCTION

Laparoscopic cholecystectomy, being safe and effective, is the gold standard method to treat gallstones.[1,2] It was carried out for the first time in France in 1987 and since then has spread rapidly all over the world. It minimizes length of stay in the hospital, decreases post-operative pain, allows quicker return to normal activities and has superior cosmetic results.[3] The average number of days for postoperative pain after laparoscopic cholecystectomy is 1.13 days, compared to 2.7 days for open cholecystectomy.[4,5] Even though laparoscopic cholecystectomy is superior to open cholecystectomy in terms of postoperative pain, it is one of the seven common ambulatory surgical procedures with highest incidence of moderate to severe pain 24 hours postoperatively (57.1%).[6,7]

Pain after laparoscopic cholecystectomy is an outcome of tissue injury, abdominal distension, local trauma secondary to gallbladder removal, and chemical irritation of the peritoneum and pneumoperitoneum. It can be divided into parietal, visceral and shoulder pain; occurring with different intensities and time.[8-10] Parietal pain is of sudden onset, well-localized and sharp.

Previous studies have shown that local anesthetic infiltration into the incision site significantly reduces the analgesic requirement and parietal pain in the postoperative period.[10-12] Visceral pain observed after laparoscopic cholecystectomy is a blunt, diffuse and midline pain that grows slowly and cannot be easily localized. Chemical irritants, sudden stretching of organs, excessive contractions, and reduced blood flow can be considered among the causes of visceral pain. Shoulder pain is experienced at a site different from stimulus. Irritation of the diaphragmatic muscle and phrenic nerve with CO_2 gas, and exposure to gaseous pressure manifest as postoperative shoulder pain.[13] Treatment options for postoperative pain include NSAIDS, COX 2 selective inhibitors, opioids, infiltration of the wound with a long acting local anesthetic, intraperitoneal local anesthetic after the removal of gallbladder, regional blocks, etc.[14]

Transversus Abdominis Plane (TAP) block has been introduced as a postoperative pain control modality to reduce the usage of opioids.

It is a peripheral nerve block designed to anesthetize the nerves supplying the anterior abdominal wall (T6 to LI), first described in 2001 by Rafi.[15] Intraperitoneal local anesthetic also exhibited beneficial effects on postoperative abdominal, visceral, and shoulder pain.[6,16,17] Intraperitoneal bupivacaine spray irrigated over the surgical bed is also an effective method for reducing pain during the initial postoperative hours after laparoscopic cholecystectomy.[18]

A meta-analysis on the clinical effectiveness of transversus abdominis plane block by Siddiqui et al. demonstrated a morphine-sparing effect of TAP blocks in the first 24 hours after surgery.[19] Similarly, meta-analysis by Charlton et al., which reviewed 236 participants from 5 studies including landmark-and ultrasound-guided TAP blocks), demonstrated a significant reduction in 24-hour morphine requirements (average-22 mg. 95% confidence interval -38 mg to-6 mg) in TAP block patients compared to controls.[20] Another study done at Copenhagen University Hospital[21] also showed beneficial effect of TAP block in reducing postoperative pain, with the mean VAS score at 6hrs in patient receiving pain control being 2.6±1.9. Mean post-operative score in patients receiving intraperitoneal bupivacaine spray was 3.3±0.8 in a further study.[22]

TAP block was found to be a safe and effective procedure when compared to both standard postoperative care and other analgesic techniques such as wound infiltration and epidural block.[23] Limited efficacy of intraperitoneal local anesthetic administration can be explained by the rapid dilution of the local anesthetics in the intraperitoneal area. It may require administering a sufficient quantity of drug onto the site of tissue injury, which we may not be able to achieve by intraperitoneal injections due to the toxicity of drugs.[24,25] Although studies show varying effectiveness of TAP block and intraperitoneal bupivacaine during different surgeries, international studies as well as local data are limited in comparing these two approaches. Hence, the study would also be a determining factor in reporting better approach for postoperative pain control after laparoscopic cholecystectomy and would be preferred in future.

This study was conducted to examine and compare the results of TAP block and Intraperitoneal Bupivacaine spray on pain faced after laparoscopic cholecystectomy, among the local population, as pain scores are reported to vary, according to the geographical variation.

The alternate hypothesis was that TAP block would be better at reducing postoperative cholecystectomy pain in comparison to intraperitoneal bupivacaine.

MATERIALS & METHODS

The study adopted a comparative design, employing a randomized double-blind trial methodology, conducted within the premises of Al-Tibri Medical College, Karachi, over a duration spanning from June 15, 2023, to December 15, 2023. Statistical parameters were set at a significance level of 5% and a power of 90%. Each group consisted of 56 participants, leading to a total sample size of 112, determined through nonprobability consecutive sampling. Inclusion criteria encompassed adults diagnosed with chronic cholecystitis, confirmed through clinical, laboratory, and ultrasound assessments, scheduled for a laparoscopic cholecystectomy with four ports. Eligible participants fell within the age bracket of 18 to 65 years, regardless of gender, and exhibited an American Society of Anesthesiologists (ASA) physical status classification of I or II. Exclusion criteria comprised a history of local anesthesia allergy, diagnosis of acute cholecystitis, psychiatric illness, substance abuse, or opioid tolerance, Patients with drains placed during surgery, surgical durations exceeding 2 hours due to complexity, uncompensated systemic illnesses, pregnancy, chronic pain from other sources, surgical complications, or renal dysfunction (Serum Creatinine >1.2) were also excluded from the study.VAS was assessed by a 100 mm baseline drawn with the left end marked as no pain (Score 0) and right end marked as worst pain (score 100). Patients were asked to indicate on the line where the pain was in relation to the two extremes which was measured from the left hand side to the mark (1mm=1score) at 2, 6, 12, and 24 hours after surgery, with the duration of surgery measured from time of incision to time of closure.

Chronic Cholecystitis was diagnosed when a patient presented with recurrent pain in the upper right abdomen which may be associated with nausea and vomiting and ultrasound showed stones in gallbladder and a thick-walled gallbladder.

Adult male and female patients admitted via OPD to surgical unit for 4 port laparoscopic cholecystectomy were recruited in the study. Detailed written informed consent was taken prior to inclusion in trial. A Performa was used to document findings. Variables included age, weight, height, BMI, gender, American Society of Anesthesiologists (ASA) class, duration of surgery, comorbids, complications in surgery, and Visual Analogue Scale (VAS) for pain (0 no pain, 100 worst imaginable pain) were noted.

The primary outcome measure was post-operative pain on VAS score, assessed at 2, 6, 12, and 24 hours after surgery; the pain score was assessed by a physician who was blinded to the group allocations using a visual analogue scale.

(VAS: 0 - no pain, 100 = the most severe pain imaginable).

Laparoscopic cholecystectomy was performed under supervision of one consultant surgeon using standard technique.

Randomization was done by sealed envelope method. Group A received bilateral TAP block, using traditional blind landmark technique, at lumbar triangle of petit; the margins of the inferior lumbar (Petit's) triangle are composed of the iliac crest inferiorly and the margins of two muscles-latissimus dorsi (posteriorly) and external abdominal oblique anteriorly). The floor of the inferior lumbar triangle is the internal abdominal oblique muscle; 20cc of 0.5% bupivacaine was injected between the internal oblique and transverse abdominis muscles (the plane through which the sensory nerves pass), after induction and before starting surgery with 20 ml of 0.5% bupivacaine on each side. Group B received 20 ml of 0.5% bupivacaine, intraperitoneally at gall bladder bed

and under the domes of diaphragm after the dissection of the gall bladder and before deflation of pneumoperitoneum.

Post-operative assessment was done in a double blinded manner, neither the patient nor the pain assessor and post-operative care givers were aware of groups in which patient had been randomized. All patients were prescribed standard post-operative analgesia i.e. Injection Tramadol 50mg intravenously thrice daily for one day followed by Oral Diclofenac Sodium 50 mg thrice daily for five days.

Approval of ethical committee was taken from Isra university ethical review board; data were collected after approval from Head of Department of Surgery; written informed consents were taken from patients and data were kept confidential.

All data were entered in statistical software SPSS version 22. Means and SDs were calculated for age, weight, height, BMI, duration of surgery and VAS score. Frequencies were calculated for gender, ASA class, diabetes mellitus, and hypertension. The Independent Samples T test was applied to compare mean postoperative pain among groups with a p-value ≤0.05 taken as significant. Stratification with respect to age, gender, BMI, hypertension, and diabetes mellitus was done. Post stratification Independent Samples T test was applied with a p-value ≤0.05 taken as significant.

RESULTS

The mean age of 112 patients was 33.53±5.1 years. There were 29 (25.9%) males and 83 (74.1%) females. Table 1 shows the further demographic characteristics of patients of both groups. There were 38.4% patients in ASA 1 class and 61.6% in ASA class 2; 30.4% of patients were diabetic and 19.6% hypertensive.

Table 1: Demographic data of patients based on the two comparative groups (n=112).

Demographic Variables	Group A (TAP block)	Group B (Intraperitoneal spray)	Total
Gender			
Male	16	13	29 (25.9%)
Female	40	43	83 (74.1%)
Age (Mean ± SD)	33.66 ± 4.6	33.39 ± 5.6	33.53 ± 5.1
BMI	29.8 ± 5.7	29.8 ± 6.19	29.8 ± 5.9
Hypertension			
Yes	7	15	22 (19.6%)
No	49	41	90 (80.4%)
Diabetes mellitus			
Yes	17	17	34 (30.4%)
No	39	39	78 (69.6%)
ASA Class			
ASA Class I	23	20	43 (38.4%)
ASA Class II	33	36	69 (61.6%)

Mean duration of surgery was 109.4 ± 25.2 minutes. VAS score in group B (Intraperitoneal spray) was 3.75 ± 2.2 at 2 hours, 3.63 ± 2.1 at 6 hours, 3.46 ± 1.7 at 12 hours and 3.3 ± 1.01 after 24 hours of surgery. In group A (TAP block) VAS was 4.10 ± 1.9 at 2 hours,3.95 ± 1.6 at 6 hours, 3.02 ± 1.2 at 12 hours and 2.10 ± 1.3 after 24 hours of surgery, as shown in Table 2.

Table 2: Pain measurements by Visual Analogue Score among the two study groups (n=112).

Groups		Pain Scores at different postoperative hours			
		2 hours	6 hours	12 hours	24 hours
Group B (Intraperitoneal spray)	N	56	56	56	56
	Mean	3.75	3.63	3.46	3.33
	St. Deviation	2.24	2.1	1.7	1.01
Group A (TAP Block)	N	56	56	56	56
	Mean	4.10	3.95	3.02	2.1071
	St. Deviation	1.96	1.6	1.2	1.30
Overall (both groups)	N	112	112	112	112
	Mean	3.92	3.67	2.94	2.72
	St. Deviation	2.10	1.45	1.39	1.31

When 24-hour post-operative pain was compared in both groups pain was significantly lower in group A (TAP block) i.e., p<0.001 (Table 3).

Data stratification of pain at 24-hour post-operative period was significant for age, gender, duration of surgery, BMI, hypertension and diabetes i.e. p-value was 0.001.

Table 3: Comparison of pain in both groups after 24 hours of surgery (n=112).

Group	N	Mean	St. Deviation	St. Error Mean
Group B (Intraperitoneal spray)	56	3.3393	1.01403	0.13550
Group A (TAP Block	56	2.1071	1.30284	0.17410

p-value <0.001

DISCUSSION

Laparoscopic cholecystectomy (LC) is one of the most common operations performed in the last 2 decades. LC is associated with less postoperative pain than open cholecystectomy, abdominal and shoulder pain after LC are a considerable cause of patient's distress, both are the primary reasons of prolonged convalescence and overnight hospital stay. Many methods have been tried to treat post LC pain as, non-steroidal anti-inflammatory drugs, local infiltration with local anesthetics, epidural and intrathecal opioids and local anesthetics, intercostal nerve blocks as well as intraperitoneal instillation (IPI) of saline and local anesthesia (LA), saline and LA solution decreases the overall pain sensation after laparoscopic cholecystectomy.

Sinha et al[26] studied 100 patients laparoscopic surgery. They were randomly allocated to study (USG-TAP block) and control groups. Pain scores at rest and on movement at various time points up to 24 postoperative hours were compared. Other parameters evaluated were patients requiring Tramazac hydrochloride (TMZ) as rescue analgesic, sedation score, time to ambulate, any adverse events, and patient satisfaction. The median visual analogue scale pain score of the study (USG-TAP) group was consistently lower at 1, 3, 6, 12, and 24 h at rest and on movement, in the postoperative period. The number of patients requiring TMZ required in the first, third, and sixth hour was significantly lower in the USG-TAP group. The prolonged sedative effect of the TMZ affected the time to ambulate. Patients in the control group remained more sedated. Four patients in the control group required BIPAP support postoperatively; no adverse event was observed. Time to ambulate was 6.3 ± 1.8 h in USG-TAP and 8 ± 1.8 h in control groups; P < 0.001. Patient satisfaction scores were significantly higher in the USG-TAP group (p<0.001).

A systematic literature search[27] was conducted to identify randomized controlled trials that compared ultrasound-guided TAP block with control for analgesia in adult patients undergoing LC. The original data were pooled for the meta-analysis using Review Manager. The main outcomes included postoperative pain intensity, opioid consumption, and adverse events. Out of a total of 77 trials, 7 were included. Results showed that when compared with control, ultrasound-guided TAP block reduced the following: (1) postoperative pain intensity (visual analog scale: 0-10) both at rest and on movement at 0, 2, 4, 8, and 24 h (at rest: mean difference, MD(0 h) = -2.19, 95% confidence interval, CI: -3.46 to -0.91, p = 0.0008; on movement: MD(0 h) = -2.67, 95% CI: -3.86 to -1.48, p < 0.0001); (2) intraoperative fentanyl consumption (MD = -27.85 µg, 95% CI: -44.91 to -10.79, p = 0.001), and (3) morphine consumption in the recovery room (MD = -1.57 mg, 95% CI: -3.0 to -0.14, p = 0.03) and 0-24 h postoperatively. Fewer patients required analgesics in the recovery room when receiving TAP blocks (risk ratio, RR = 0.35, 95% CI: 0.20 to 0.62, p = 0.0003). TAP blocks also reduced postoperative nausea and vomiting (RR = 0.48, 95% CI: 0.28 to 0.81, p = 0.006).

However, Albrech et al[28] reported some different results. Seventy patients undergoing laparoscopic gastric-bypass surgery were randomized to receive either bilateral ultrasound-guided subcostal TAP block injections after induction of general anesthesia or none. All patients received trocar insertion site local anesthetic infiltration and systemic analgesia. The primary outcome was cumulative opioid consumption (IV morphine equivalent) during the first 24 h postoperatively. Interval opioid consumption, pain severity scores, rates of nausea or vomiting, and rates of pruritus were measured during phase I recovery, and at 24 and 48 h postoperatively. There was no difference in cumulative opioid consumption during the first 24 h postoperatively between the TAP (32.2 mg [95% CI, 27.6-36.7]) and control (35.6 mg [95% CI, 28.6-42.5]; P=0.41) groups. Postoperative opioid consumptions during phase I recovery and the 24-48-h interval were similar between groups, as were pain scores at rest and with movement during all measured intervals. The rates of nausea or vomiting and pruritus were equivalent. This difference can be attributed to different technique of giving TAP block as compared to our study.

Our study shows significantly higher visual pain scores in female patients as compared to male patients, while other studies comparing gender differences in postoperative pain after laparoscopic cholecystectomy also show higher VAS scores in female at 24 hours and 48 hours.[29,30] A study done by Hussain et al[31] shows that female patients exhibit greater intensity of pain and required higher doses of analgesics compared to males in in the immediate postoperative period to achieve a similar degree of analgesia.

CONCLUSION

TAP block led to superior analgesia as compared to intraperitoneal bupivacaine spray. It may help to decrease use of opioids and reduce opioids related side effects in patients undergoing Laparoscopic cholecystectomy compared with those receiving conventional treatment alone. TAP block may have an important role in multimodal pain therapy.

LIMITATIONS

While this study provides valuable insights into the effectiveness of TAP block compared to intraperitoneal bupivacaine spray in reducing postoperative pain following laparoscopic cholecystectomy, it is essential to recognize the study's limitations. One significant limitation is the use of a non-probability sampling technique, which may introduce selection bias and limit the generalizability of the findings. Additionally,

the inherent biases associated with non-randomized allocation of participants could affect the study outcomes, as uncontrolled variables might have influenced the results.

RECOMMENDATIONS

Future research should aim to address these limitations by employing randomized sampling methods and considering the potential impact of other confounding factors. This would help in ensuring that the findings are more robust and applicable to a broader patient population. More studies are required to investigate the optimal dose and concentration of injected local anesthetics and long-term outcomes in these patients.

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