

## COMPARISON OF ANALGESIC EFFICACY OF TRANSVERSUS ABDOMINIS PLANE BLOCK WITH CONVENTIONAL LOCAL ANESTHETIC WOUND INFILTRATION

Liaquat Ali, Majid Waseem, Amjad Iqbal

Combined Military Hospital/National University of Medical Sciences (NUMS) Rawalpindi Pakistan

### ABSTRACT

**Objective:** To determine the analgesic efficacy of ultrasound guided transversus abdominis plane block in comparison to conventional local anesthetic wound infiltration technique in patients undergoing laproscopic cholecystectomy.

**Study Design:** Randomized controlled trial.

**Place and Duration of Study:** Combined Military Hospital Rawalpindi, from Jan 2016 to Jun 2016.

**Material and Methods:** This study was conducted after approval from the ethical committee. Total of 132 patients, American Society of Anesthesiologists physical status I or II, were randomized to group A and group B (n=66), received ultrasound guided transversus abdominis plane block on each side and local anesthetic wound infiltration with 0.5% bupivacaine (1mg/kg). Injection nalbuphine was used as a rescue analgesic if needed. Mean pain score and total rescue analgesia required were recorded on emergence, then 2 hourly for next 12 hours postoperatively, in numerical rating scale and in milligram (mg).

**Results:** Mean pain score at 12 hours postoperatively in group A and group B were  $4.01 \pm 2.55$  and  $6.04 \pm 2.74$  respectively ( $p$ -value  $<0.05$ ). Similarly the mean opiate requirement till 12 hour postoperatively in group A and group B were  $6.39 \pm 3.86$  (mg) and  $9.95 \pm 4.62$  (mg) ( $p$ -value  $<0.05$ ). Nausea/vomiting were observed in 19 (28.78%) and 31 (46.96%) patients in group A and group B respectively.

**Conclusion:** Ultrasound guided transversus abdominis plane block has shown to be an effective modality for providing adequate postoperative analgesia with significantly less post-operative opiate requirement when compared to local anesthetic wound infiltration.

**Keywords:** Local anesthesia, Nausea and vomiting, Postoperative Pain, TAP block.

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### INTRODUCTION

Post operative pain management is one of the most difficult challenges faced by the anesthetist and the surgical team since the time of evolution of surgery. To address postoperative pain is the prime responsibility of perioperative team to reduce the morbidity associated with persistent post operative pain. Poorly controlled post operative pain is associated with adverse systemic effects including hypertension, tachycardia, atelectasis and thromboembolic phenomenon; prolong hospital stay, increase cost and conversion into persistent or chronic pain<sup>1</sup>. Pain was labeled as the "fifth vital sign" by American Pain Society in 1995<sup>2</sup>. Around 30-55% patients experience moderate to severe post-operative

pain posing huge burden on the health care system<sup>3</sup>.

Different modalities are now in practice to manage postoperative pain including administration of systemic non steroidal anti-inflammatory drugs, opioids, patient controlled analgesia, continuous epidural analgesia and regional nerve blocks techniques. Local anesthetic infiltration at the site of surgery is traditional, very old and most commonly used modality for post-operative pain management<sup>4</sup>. Transversus abdominis plane (TAP) block was first described by Rafi<sup>5</sup>. TAP block is a regional anesthesia technique that provides analgesia by blocking neural afferents to the parietal peritoneum, skin and muscles of the anterior abdominal wall<sup>6</sup>. It involves blocking T6-L1 mid/lower thoracic and upper lumbar spinal [ilioinguinal (IIN)/ iliohypogastric (IHN)] nerves travelling in the

**Correspondence:** Dr Liaquat Ali, Classified Anaesthesia, CMH Rawalpindi Pakistan (Email: [liaquatanaes@gmail.com](mailto:liaquatanaes@gmail.com))

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plane between internal oblique and transversus abdominis muscle. TAP block is indicated to provide analgesia for various surgical procedures and it blocks the thoraco-lumbar nerves (T6-L1) which supply sensory fibers to the anterior abdominal wall<sup>7</sup>.

The objective of this study was to determine the efficacy of ultrasound guided TAP block in comparison with conventional local anesthetic infiltration (LAI) technique in reducing post-operative pain and opiate consumption after laparoscopic cholecystectomy and ultimately better patient comfort, less hospital stay and reduces cost.

### **MATERIAL AND METHODS**

This prospective, comparative, randomized controlled study (RCT) was carried out over a period of six months from Jan 2016 to Jun 2016 in the department of anaesthesia, pain management centre CMH Rawalpindi, a tertiary care hospital. WHO sample size calculator was used for sample size calculation with 95% confidence interval and absolute precision of 0.05. The absolute population proportions in group A and in group B were 0.30 and 0.55 respectively. Calculated sample size (n) was 66 in each group<sup>4</sup>. After approval from ethical review committee and written consent, 132 patients with ASA (American Society of Anesthesiologist) physical status of I-II, 20 to 60 yrs of age requiring laproscopic choleystectomy were included in the study. Technique used was non probability consecutive sampling. All the patients with coagulopathies, known allergy or sensitivity to local anesthetic, BMI >30 kg/m<sup>2</sup> and ASA III and IV were excluded. Patients were randomized into two groups, by computer generated method. Group A received ultrasound guided bilateral TAP block and group B received local anesthetic preparation into wound by the infiltration method. All patients underwent general endotracheal anesthesia and were premedicated with IV metoclopramide 10mg and dexame-thasone 8mg 30 minutes before induction. All patients were induced with injection Nalbuphine 0.1mg/

kg and propofol 2-2.5mg/kg intravenously and maintained with inhaled anesthetics (isoflurane) in 50% oxygen with air. Airway was maintained with endotracheal tube and mechanical ventilation was continued on continuous mandatory ventilation (CMV) mode. Group A patients received ultrasound guided bilateral TAP block immediately after completion of surgical procedure with 1mg/kg of 0.5% bupivacaine on each side. TAP block was done under ultrasound guidance with "HS 2000" by Honda using linear probe (5-10MHz) oriented transversely to the anterolateral abdominal wall where the three muscle layers were most distinct. Probe was then moved posterolaterally towards the midaxillary line just superior to iliac crest (triangle of petit) after recognizing the plane between internal oblique and transversus abdominis muscle. The 25 G spinal needle was used as block needle, introduced anteriorly via inplane approach, advanced under ultrasound visualization. Drug was injected and hypoechoic deposition of injectate with hydrodissection of transversus abdominis plane confirmed the placement, While group B patients received the similar dose of local anesthetic wound infiltration after completion of surgical procedure by injecting local anesthetic in and around the wound margins using 20ml syringe with 25 G needle. There was only one operator for the TAP block while surgeons were responsible for the local anesthetic infiltration (LAI) in group B. All the patients were recovered from general anaesthesia and assessed for pain in recovery area as soon they became conscious and then 2 hourly for up to 12 hours in wards. Pain score was assessed by numerical rating scale (NRS) ranges from 0-10cm. Score of 0 was taken as no pain, Score 1-3 was considered as minimal pain requiring no rescue analgesia, 3-6 was considered as moderate pain while 7-10 as severe pain and was treated with rescue analgesia. Average NRS for 12 hours was calculated for individual patient and then used in statistical analysis. Moderate to severe pain was treated with injection nalbuphine 2mg IV PRN and total rescue dose consumed in 12 hr was calculated.

Mean pain score and mean nalbuphine dose consumed in 12hr were calculated in both groups. Patients were also monitored for any procedure (TAP & LAI) related complications.

Data were analyzed with the help of statistical software SPSS version 20. Mean and standard deviation were calculated for quantitative variables, while categorical variables were presented by frequency and percentages. Chi

group B were  $42.19 \pm 9.28$  years and  $44.04 \pm 9.22$  years respectively ( $p=0.25$ ). Weight was statistically significant but ASA scores were not statistically significant between two groups as shown in table-I. Mean pain score at 12 hours postoperatively in group A and group B were  $3.01 \pm 2.55$  vs  $6.04 \pm 2.74$  ( $p<0.05$ ). The mean rescue analgesia dose required in 12 hrs in group A and group B were  $6.39 \pm 3.86$  mg vs  $9.95 \pm 4.62$

**Table-I: Patient demographic characteristics.**

Patient Parameters	Group A (n=66)	Group B (n=66)	p-value
Age (Mean $\pm$ SD)	$42.19 \pm 9.28$	$44.04 \pm 9.22$	0.25
Weight (Mean $\pm$ SD)	$66.89 \pm 9.40$	$70.63 \pm 8.45$	0.02
ASA Level n(%)			
ASA I	40 (60.6)	36 (54.5)	0.48
ASA II	26 (39.4)	30 (45.5)	
Gender n(%)			
Male	36 (54.5)	38 (57.5)	0.93
Female	30 (45.5)	28 (42.5)	
Nausea/Vomiting n(%)	19 (28.78)	31 (46.96)	0.024

**Table-II: Mean pain score and mean rescue analgesic dose at 12 hours postoperatively.**

Outcome variables	Group A (Mean $\pm$ SD)	Group B (Mean $\pm$ SD)	p-value
Mean pain Score (NRS)	$3.01 \pm 2.55$	$6.04 \pm 2.74$	<0.001
Rescue Analgesia required (mg)	$6.39 \pm 3.86$	$9.95 \pm 4.62$	<0.001

**Table-III: Frequency of pain in group A & B.**

Pain severity	Frequency	Percentage (%)
<b>Group A</b>		
No pain	08	12.1
Mild pain	21	31.8
Moderate Pain	27	40.9
Severe Pain	10	15.2
Total	n=66	100
<b>Group B</b>		
No pain	4	6.1
Mild Pain	10	15.2
Moderate Pain	26	39.4
Severe Pain	26	39.4
Total	n=66	100

square test was used for qualitative variables while Independent samples t-test was used to compare means. A  $p$ -value  $\leq 0.05$  was considered statistically significant.

## RESULTS

Total 132 patients were included in the study, divided into two groups. Both groups had 66 patients in each. Mean age in group A and

mg of injection Nalbuphine ( $p<0.05$ ) (table-II). In group A (n=66), 08 (12%) patients had no pain, 21 (31.8%) had minimal pain, 27 (40.9%) patients had moderate pain and only 10 (15.2%) patient had the severe pain when compared to 4 (6.1%), 10 (15.2%), 26 (39.4%) and 26 (39.4%) in group B respectively as shown in table-III. Nausea/vomiting were observed in 19 (28.78%) versus

31 (46.96%) of patients in group A (TAP) and group B (LAI) respectively, which is statistically significant ( $p < 0.005$ ).

## DISCUSSION

This study was performed to assess the efficacy of TAP block and LAI in post operative pain control and ultimate reduction of post-operative morbidities associated with poor pain control. In this study TAP block proved a better quality of analgesia as compared to local anesthetic infiltration of surgical incision with less postoperative analgesic requirements and ultimately decreased incidence of complications. The TAP block is effective in patients undergoing lower abdominal surgeries such as laparoscopic cholecystectomy<sup>8</sup>, abdominal hysterectomy, cesarean section<sup>9</sup>, open prostatectomy<sup>10</sup> and appendectomy<sup>11</sup>.

LAI is an oldest and most commonly practiced postoperative analgesia method, which has been widely performed<sup>12</sup> and on the other side ultrasound guided TAP block is now commonly used modality for reducing post-operative pain and morphine consumption after lower abdominal surgery<sup>13</sup>. In our study, pain relief in terms of mean numerical rating scale (NRS) and requirement of mean opioid dose in postoperative period was evaluated in both groups. We found significantly lower mean pain scores in the TAP group in first 12 hrs postoperatively. The results of our study are consistent with the observations by other studies in context of analgesia and post operative opiate requirement and associated side effects that may be detrimental to patient's recovery. It also reduced the overall post-operative nausea and vomiting when compared to LAI group, which may be due to decrease in opiates consumption.

Khan *et al* studied ultrasound guided TAP block in lower abdominal surgeries and found it efficient mode of analgesia in the intraoperative and immediate post operative period for patients undergoing lower abdominal surgeries (open appendectomy and inguinal hernia surgery)<sup>14</sup>.

Sivapurapu *et al.* did comparison of analgesic efficacy of TAP block with direct infiltration of local anesthetic into surgical incision in lower abdominal gynecological surgeries. They concluded that TAP block is a promising technique in alleviating postoperative pain in patients undergoing lower abdominal gynecological surgeries especially when used as part of multi-modal analgesia regimen. The procedural simplicity of this block, along with reliable level of analgesia (T10-L1), longer duration as well as better quality, with lesser opiate requirement and their side-effects makes the TAP block a good option for lower abdominal gynecological surgeries<sup>15</sup>.

Petersen *et al.* did a randomized clinical trial to study the beneficial effect of TAP block after laparoscopic cholecystectomy in day-case surgery. They concluded that patients who received TAP block in addition to a basic analgesic regimen with acetaminophen and ibuprofen after laparoscopic cholecystectomy had reduced pain scores and coughing as well as reduced morphine consumption in the first 2 postoperative hours, but these reductions were rather small. The procedure was without reported complications and may be considered as part of multimodal analgesic treatment for laparoscopic cholecystectomy in day-case surgery<sup>16</sup>.

Yu *et al* performed a systematic review and meta-analysis of randomized controlled trials on TAP block versus local anesthetic wound infiltration (LAI) in lower abdominal surgery. They found that TAP block is comparable to LAI for short-term analgesia; it could also provide better long-lasting analgesia especially at 24 hrs after surgery<sup>17</sup>.

No complications related to TAP block were observed; however, TAP block known associated complications are block failure, vascular injury, abdominal visceral and nerve injuries. With ultrasound-guidance, TAP is better located with unproved control of needle and the deposition of drug is well guided under imaging. As a result, lower complications and clinically significant results were seen.

In our study, pain score observations were limited up to 12 hrs post-operatively and had a small sample size. Furthermore ultrasound guided TAP block is a time consuming, skill dependent and has more financial impact as compared to the simple, cheap and quick local anesthetic wound infiltration. Our results are comparable to many studies but some studies are also there with different results to this observation, perhaps large RCT's may be helpful in this regard.

### CONCLUSION

Ultrasound guided TAP block has shown to be an effective modality for providing adequate postoperative analgesia with significantly less postoperative opiate requirement when compared to local anesthetic wound infiltration.

### CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

### REFERENCES

- Joshi GP, Ogunnaike BO. Consequences of inadequate postoperative pain relief and chronic persistent postoperative pain. *Anaesthesiol Clin North America* 2005; 23(1): 21-36.
- American Pain Society. Principles of Analgesic Use in the Treatment of Acute Pain and Cancer Pain. 4. Glenview, IL: American Pain Society 1999.
- Sommer M, de Rijke JM, van Kleef M. The prevalence of postoperative pain in a sample of 1490 surgical inpatients. *Eur J Anaesthesiol* 2008; 25(4): 267-74.
- Coughlin SM, Karanicolas PJ, Emmerton-Coughlin HM, Kanbur B, Kanbur S, Colquhoun PH: Better late than never Impact of local analgesia timing on postoperative pain in laparoscopic surgery: A systematic review and Meta analysis. *Surg Endosc* 2010; 24(12): 3167-76.
- Rafi AN: Abdominal field block: a new approach via the lumbar triangle. *Anaesthesia* 2001; 56(10): 1024-26.
- Hebbard P, Fujiwara Y, Shibata Y, Roysse C. Ultrasound Guided Transversus Abdominis Plane (TAP). *Anaesth Intensive Care* 2007; 35(4): 616-7.
- Albrecht E, Kirkham KR, Endersby RV, Chan VW, Jackson T, Okrainec A, et al. Ultrasound-guided Transversus Abdominis Plane (TAP) block for laparoscopic gastric-bypass surgery: a prospective randomized controlled double-blinded trial. *Obes Surg* 2013; 23(8): 1309-14.
- Gupta A. Local anaesthesia for pain relief after laparoscopic cholecystectomy a systematic review. *Best Pract Res Clin Anaesthesiol* 2005; 19(2): 275-92.
- Kuppuvelumani P, Jaradi H, Delilkan A: Abdominal nerve blockade for postoperative analgesia after caesarean section. *Asia Oceania J Obstet Gynaecol* 1993; 19(2): 165-9
- Skjelsager A, Ruhnau B, Kistorp TK, Kridina I, Hvarness H, Mathiesen O, et al. Transversus abdominis plane block or subcutaneous wound infiltration after open radical prostatectomy: A randomized study. *Acta Anaesthesiol Scand* 2013; 57(4): 502-8.
- Charlton S, Cyna AM, Middleton P, Griffiths JD. Perioperative transversus abdominis plane (TAP) blocks for analgesia after abdominal surgery. *Cochrane Database Syst Rev* 2010; 12.
- Ventham NT, Hughes M, O'Neill S, Johns N, Brady RR, Wigmore SJ. Systematic review and meta-analysis of continuous local anaesthetic wound infiltration versus epidural analgesia for postoperative pain following abdominal surgery. *Br J Anaesth* 2013; 100(10): 1280-9.
- Ismail S, Khan MR, Urooj S. Use of transversus abdominis plane block as an anesthetic technique in a high risk patient for abdominal wall surgery. *J Anaesthesiol Clin Pharmacol* 2013; 29(4): 581-2.
- SM Khan, S Nawaz, MB Delvi, T Alzahrani. Intraoperative ultrasound guided transversus abdominis plane block in lower abdominal surgery. *Int J Perioperative Ultrasound Appl Technol* 2012; 1(1): 1-4.
- V Sivapurapu, A Vasudevan, S Gupta, AS Badhe. Comparison of analgesic efficacy of transversus abdominis plane block with direct infiltration of local anesthetic into surgical incision in lower abdominal gynecological surgeries. *J Anaesthesiol Clin Pharmacol* 2013; 29(1): 71-5.
- PL Petersen, P Stjernholm, VB Kristiansen, H Torup, EG. Hansen AU, Mitchell et al. The beneficial effect of transversus abdominis plane block after laparoscopic cholecystectomy in day-case surgery. *J Soc Ambulatory Anesthesiology* 2012; (115): 527-33.
- N Yu, X Long, JR Lujan-Hernandez, J Succar, X Xin, X Wang. Transversus abdominis-plane block versus local anesthetic wound infiltration in lower abdominal surgery: a systematic review and meta-analysis of randomized controlled trials. *BMC Anesthesiology* 2014; (14): 121-9.