VOLUME - 12, ISSUE - 02, FEBRUARY - 2023 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper

Anaesthesiology

THE ANALGESIC EFFICACY OF TRANSVERSUS ABDOMINIS PLANE (TAP) BLOCK VERSUS EPIDURAL ANALGESIA IN LAPAROSCOPIC LOWER ABDOMINAL SURGERIES IN ADULTS: A CASE STUDY

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ABSTRACT

Background: The aim of the study was to compare the analgesic efficacy of epidural analgesia and transversus abdominis plane (TAP) block in laparoscopic lower abdominal surgeries for postoperative pain management. Over time, TAP block has gained popularity, however its superiority versus epidural analgesia is still debatable. **Methods:** 120 patients undergoing lower abdominal surgeries under general anaesthesia were randomly allocated into two groups, to postoperatively receive lumbar epidural analgesia (Group E) or USG guided TAP block (Group T). Group E received 0.125% bupivacaine (20ml) as a single shot postoperative analgesic via lumbar epidural catheter Group T received 0.125% bupivacaine (20ml) as a single shot postoperative analgesic via USG guided TAP block Pain at rest, Numeric Rating Scale (NRS) and first request for rescue analgesia (Inj. Paracetamol 20mg/kg IV) were recorded

KEYWORDS : abdominal surgery, analgesia, epidural analgesia, TAP block, postoperative pain, NRS, USG

INTRODUCTION:

Regional anaesthesia and analgesia has shown to provide excellent pain relief and other benefits which extend beyond the perioperative period. For lower abdominal surgeries, epidural analgesia has been the gold standard and time-tested technique for providing postoperative analgesia, but contraindications for the same would warrant need for other equally good analgesic techniques.[1]

There are regional anaesthesia techniques which provide analgesia to the skin and muscles of the anterior abdominal wall[2]. One such technique is Transversus Abdominis Plane (TAP) block. Advantage of TAP block over neuraxial technique is absence of hemodynamic instability, early mobilisation and not requiring prolongs urinary catheterisation[3]

A substantial component of the pain experienced by patients after abdominal surgery is derived from the abdominal wall incision[4]. Transversus abdominis plane (TAP) block is an effective method of blocking the sensory afferents supplying the anterior abdominal wall. Subcostal TAP block, first described by Hebbard et al., has been reported to provide analgesia even for incisions extending above the umbilicus[5-7]. There have been no clinical trials examining the analgesic efficacy of either single-shot TAP blocks or TAP catheters after lower abdominal surgery. Lumbar epidural analgesia has been considered the gold standard in providing pain relief after surgery on the lower abdominal wall[8]. This study compared the efficacy of single shot TAP block with that of epidural analgesia for postoperative pain management following lower abdominal surgeries.

The transversus abdominis plane (TAP) block was first introduced by Rafi [9] in 2001 as a landmark-guided technique via the triangle of Petit to achieve a field block. It involves the injection of a local anaesthetic solution into a plane between the internal oblique muscle and transversus abdominis muscle. Since the thoracolumbar nerves originating from the T6 to L1 spinal roots run into this plane and supply sensory nerves to the anterolateral abdominal wall[10], the local anaesthetic spread in this plane can block the neural afferents and provide analgesia to the anterolateral abdominal wall. Although its analgesic effect covers only somatic pain with short duration[11], single-shot TAP block plays a valuable role in multimodal analgesia.

Effective epidural analgesia for abdominal surgery has a number of well-documented advantages. In the postoperative phase, a well-managed epidural can offer good analgesia, enabling the patient to be pain-free when at rest and when mobilizing. Additionally, an epidural block will obtund the immediate stress reaction associated with surgery. As a result, individuals are less likely to have cardiac, respiratory, or gastrointestinal adverse effects in addition to the analgesic advantages. When an epidural is working well, patients can receive great and frequently total pain relief immediately following surgery. Patients report lower visual analogue pain scores both at rest and when moving, the latter of which is advantageous for patient's early mobilisation. The few studies seeking the patient's perspective on postoperative epidural analgesia show a high level of satisfaction and quality of recovery.[12]

MATERIALS AND METHODS:

The study was conducted in the Department of Anaesthesiology at Mahatma Gandhi Mission College and Hospital, Kamothe, Navi Mumbai with clearance of the institutional ethical committee and informed written consent of the patients undergoing the procedure.

The study was designed to be a prospective randomized controlled study. The study was conducted between December 2021 and December 2022.

Inclusion Criteria:

1. Patient age between 18-60 years
2. ASA physical status I or II
3. Either sex
4. Patients posted for elective surgery

Exclusion Criteria:

1. Patient refusal
2. Allergy to local anaesthetics
3. Infection at the site of needle puncture
4. Spine deformities
5. Bleeding diathesis and coagulopathy

A computer-generated random number table was used to randomize the patients in two groups (Group A and Group B). In both groups, patients were premedicated with peroral tablet pantoprazole 40 mg and tablet alprazolam 0.25mg. All the patients underwent laparoscopic lower abdominal surgery under general anaesthesia.

Patients in Group E had a lumbar epidural catheter (22-gauge, multi-orifice) placed at L1–L2 or L2–L3 (best available) intervertebral space. The catheter was placed with the patient seated, before administering general anaesthesia. "Loss of resistance to air" technique with 18-gauge Tuohy needle was used and 5 cm of the catheter was left in situ. A test dose of 3 ml solution of 2% lidocaine with 5 g/ml adrenaline was given to rule out intrathecal and intravascular placement of the catheter. However, the epidural catheter was not activated till at the end of the surgery. At the end of the surgery, they received a single top up of 20 ml of 0.125% bupivacaine through the epidural catheter.

Patients in Group T received bilateral ultrasound-guided TAP block at the end of the surgery. A portable ultrasound machine with a high-frequency linear probe of 8–13 MHz was used. The ultrasonography probe was placed transversely over the anterior abdominal wall over its anterolateral aspect, across the midaxillary line, and just above the iliac crest. At this location, the three muscle layers of the anterior abdominal wall were visualized.

A 23G Quince spinal needle was advanced by the in-plane approach from the anterior direction. After placement of the needle in between the internal oblique and the transversus abdominis muscles (TAP), 20 ml of 0.125% bupivacaine was injected and the spread of the local anaesthetic (LA) solution was visualized in real time through ultrasound.

Patients were assessed for pain at 4,6,8 and 12 h postoperative. Assessment of the pain was done using Numerical Rating Scale (NRS) and score noted for:

Pain at rest
Pain on coughing
First rescue analgesia time

Postoperative pain was graded into four categories depending upon the VAS scores as:

Nil = NRS score 0
Mild = NRS score 1–3
Moderate = NRS score 4–6
Severe = NRS score >6.

IV Inj. paracetamol 20mg/kg was the first line analgesic. Paracetamol was given to patients if their VAS scores were >3/10. If the patient's pain score was >3/10 even after 1 h of IV paracetamol, then they were administered injection tramadol 50 mg as slow IV infusion and the total analgesic consumption at the end of 12 h were noted.

Sample size: was calculated by $P*Z^2*Q/L$
P= prevalence
Q=100-P
Z= random number variable
L=level of precision

It was calculated that to obtain a power of 80% within a confidence interval of 95%, a minimum of sixty patients were required in each of the two groups. Thus, a total of 120 patients were required at the least. An additional 5% (6 in each group) was taken to account for dropouts from the study.

Data analysis was done using SPSS Statistics for Windows, Version 20.0. IBM Corp., Armonk, NY.

Data were compared for demographics, NRS score at 4, 6, 8, and 12 h; consumption of paracetamol in the first 12 h and total analgesic consumption were also compared. Demographic data such as age, sex, ASA status, weight, height, BMI, baseline heart rate, blood pressure, and respiratory rate were compared using the Student's t-test.

RESULTS:

Of the 140 patients selected, 120 completed the trial, of which 60 were allotted in the epidural group and 60 in the TAP block group via envelope method.

Statistical data:

Patients in both the groups were comparable with respect to age, sex, ASA status, weight, height, and BMI. [Table 1]

Table 1:

VARIABLE	GROUP E (n=60)	GROUP T (n=60)	P- value
Age(years)	46.03±11.958	40.52±11.732	0.058
Sex Male Female	 12/60 48/60	 14/60 46/60	0.669
Weight(kgs)	63.5±6.57	62.03±6.536	0.356
Height(cms)	162.11±5.075	160.03±3.610	0.091
BMI	24.132±1.934	24.118±2.220	0.979
ASA status ASA I ASA II	 33/60 27/60	 34/60 26/60	0.854

*All variables except sex and ASA expressed as mean ± SD
*p<0.050= statistically significant
* SD= Standard Deviation; ASA=American Society of Anaesthesiologists; BMI=Body Mass Index

All patients were evaluated for postoperative pain at rest at 0, 4, 8 and 12 h; pain scores documented using NRS. However, at the end of 12h, the patients in the epidural group (group E) had significantly better analgesia when compared to TAP group (group T), (P = 0.001 and 0.004, respectively) with greater number having nil pain at rest and fewer patients reporting mild to moderate pain [Table2].

Table 2:

TIME(h)	NRS	GROUP E(n=60)	GROUP T(n=60)	P-value
0	Nil Mild Moderate	53 6 1	50 7 3	0.44
4	Nil Mild Moderate	54 5 1	51 8 1	0.54
8	Nil Mild Moderate	57 2 1	44 16 0	0.001
12	Nil Mild Moderate	55 5 0	42 15 0	0.004

*P-value<0.05= statistically significant

All patients were also evaluated for pain scores on coughing at 0, 4, 8 and 12 h using NRS. There were significantly higher number of patients in the epidural group (group E) who had nil or mild pain compared to the number in the TAP group (group T), (P = 0.008 and 0.001 at 4,8 and 12 h, respectively), a significant proportion of whom had mild to moderate pain [Table 3]

TIME(h)	NRS	GROUPE(n=60)	GROUPT(n=60)	P-value
0	Nil Mild Moderate Severe	40 17 3 0	20 20 19 1	0.04

4	Nil Mild Moderate Severe	33 22 3 2	14 42 4 0	0.008
8	Nil Mild Moderate Severe	30 28 0 2	7 40 13 0	0.001
12	Nil Mild Moderate Severe	43 15 2 0	18 33 9 0	0.001

*p-value<,0.05=statistically significant

IV paracetamol 20mg/kg was the first-line rescue analgesic. In our study, it was found that group E took longer than group T to request for analgesia.

VARIABLE	GROUP	MEAN	p-value
Request for first dose of analgesic	E T	11.03 8.45	0.0001

*p-value<0.05= statistically significant

DISCUSSION:

As our understanding of pain and the pathophysiology of the postoperative period has improved, the importance of adequate management of postoperative pain is increasingly being appreciated, to avoid respiratory and cardiovascular complications that can arise due to inadequate analgesia. This has led to an increase in the use of regional anaesthesia techniques for postoperative pain relief.

For analgesia following lower abdominal surgeries, a variety of pain relief techniques can be used as epidural analgesia, TAP block, and infiltration of LA at the site of incision and quadratus lumborum block. Epidural anaesthesia considered as the "gold standard" has been established to provide excellent analgesia as well as attenuation of neurogenic contribution to inflammation. However, it can cause hemodynamic disturbances with concerns of epidural catheter placement and removal in patients on anticoagulants therapy.

The TAP block provides reliable somatic analgesia in lower abdominal incision surgeries. Use of ultrasound helps in correct localization of the plane and accurate placement of the needle and catheter. Surgeries for which TAP block have been used as part of multimodal analgesia includes cesarean section, total abdominal hysterectomy ,open inguinal hernia, renal transplant, open appendectomies, and open prostatectomy. Supporters of the technique claim superior analgesia compared to that provided by systemic opioids.[13,14] Lower abdominal surgeries were chosen because the TAP block is known to anesthetize 9th to 12th thoracic nerves along their course in the anterior abdominal wall. This would be adequate for analgesia for infra-umbilical abdominal surgeries. To avoid the confounding effect of bilateral effect of epidural analgesia, surgeries with bilateral incisions, midline incisions or incisions crossing the midline were chosen and bilateral TAP block was used in the comparison.

A study performed by Vandendriessche, et al. compared bilateral transverses abdominis catheter infusion of levobupivacaine against epidural infusion with levobu pivacaine with sufentanil[15].On the basis of VAS scores at rest and on coughing, they concluded that the quality of analgesia was comparable in the two groups with VAS score at rest 15 ± 12 in the TAP block vs. 4 ± 8 in the epidural group while the VAS scores on coughing were 48 ± 18 and 32 ± 21, respectively. Our results show better analgesia at rest (after first 16 h) and on coughing (throughout the postoperative period) in the epidural group.

Rao et al. studied the analgesic efficacy of continuous epidural analgesia with continuous TAP block for major abdominal surgery[16]. The authors found no differences in regard to pain scores at any point or over time, postoperative fentanyl requirement, and patient satisfaction. In contrast to results of Rao et al., we found analgesia comparable between the groups only till the first 4 h beyond which the patients in the epidural group reported better NRS scores both at rest and during coughing. In our study, the epidural group took a longer time to request for the first dose of rescue analgesic.

In another study done by Kandi, evaluating the efficacy of ultrasound-guided TAP block versus epidural analgesia in pain management following lower abdominal surgery,[17] the author has reported that TAP block provided highly effective postoperative analgesia in the first 24 h with longer analgesic free periods in the TAP group compared to the epidural group during the first 24 h postsurgery. There was also a significant reduction in the number of cases needing more than 200 g/kg of morphine in the TAP group when compared to the epidural group.

Kanazi et al. compared subarachnoid morphine with TAP block in postcesarean section pain.[18]They primarily evaluated the time to first request for analgesia while secondarily they looked at consumption of tramadol (rescue analgesia) in first 12 h. The results favored intrathecal morphine wherein median (range) time to first request for analgesic was 8 (2–36) h compared to 4 (0.5–29) h in the TAP group (P = 0.005). Even the tramadol consumption was shown to be significantly lower in the subarachnoid morphine group (0–1 vs. 0–2, P = 0.03).

Niraj et al. compared the analgesic efficacy of a four-quadrant TAP block and continuous posterior TAP analgesia with epidural analgesia in patients undergoing laparoscopic colorectal surgery.[19] The authors report a significantly higher consumption of the rescue analgesic tramadol in the TAP group (400 mg) than in the epidural group (200 mg) (P = 0.002), similar to the results of our study. The authors also report comparable pain scores between patients in the two groups with comparable incidence of PONV.[19]

None of the patients in our study in either group had any complications arising from the regional technique. Both groups of patients were hemodynamically stable during the 12 h of follow-up.

The epidural catheter was placed before administering the general anaesthesia for convenience. The TAP block was given after the surgery via USG guidance. To compensate for the discrepancy in the timing of administration of the actual drug, the epidural administration of the drug was also done in the postoperative period.

CONCLUSION:

Analgesia for lower abdominal surgeries provided by intermittent boluses of 0.125% bupivacaine was comparable when provided by either the epidural catheter or the TAP catheters, albeit only for a short postoperative course beyond which the epidural analgesia is superior to that provided by TAP block with reduced analgesic consumption and no incidence of hemodynamic disturbances. However, due to the limited number of studies evaluating the analgesic efficacy of the two techniques, more randomized trials need to be performed to reach any definite conclusion.

REFERENCES:

1. Iyer SS, Bavishi H, Mohan CV, Kaur N. Comparison of Epidural Analgesia with Transversus Abdominis Plane Analgesia for Postoperative Pain Relief in Patients Undergoing Lower Abdominal Surgery: A Prospective Randomized Study. Anesth Essays Res. 2017 Jul-Sep;11(3):670-675. doi: 10.4103/0259-1162.206856. PMID: 28928569; PMCID: PMC5594788.
2. 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:CD007705. doi: 10.1002/14651858.
3. Kearns RJ, Young SJ. Transversus abdominis plane blocks; a national survey of techniques used by UK obstetric anaesthetists. Int J Obstet Anesth. 2011;20:103–4.
4. Tran TMN, Rozen W, Ashton M, Barrington M, Ivanusic J, Taylor G. Redefining the course of the intercostal nerves: a new understanding of the innervation of the anterior abdominal wall. *Clinical Anatomy* 2008; 21: 325– 33.
5. Hebbard P. Subcostal transversus abdominis plane block under ultrasound guidance. Anesthesia and Analgesia 2008; 106: 674– 5.
6. 10 Niraj G, Kelkar A, Fox A. Oblique subcostal TAP catheters: an alternative to epidural analgesia after upper abdominal surgery? Anaesthesia 2009; 64: 1137– 40.
7. 11 Harish R. Low-dose infusion with 'surgical transverse abdominis plane (TAP) block' in open nephrectomy. British Journal of Anaesthesia 2009; 102: 889– 90.
8. Bonnet F, Berger J, Aveline C. Transversus abdominis plane block: what is its role in postoperative analgesia? *British Journal of Anaesthesia* 2009; 103: 468– 70.
9. Rafi A. N. Abdominal field block: a new approach via the lumbar triangle. *Anaesthesia*. 2001;56(10):1024–1026
10. Rozen W. M., Tran T. M. N., Ashton M. W., Barrington M. J., Ivanusic J. J., Taylor G. I. Refining the course of the thoracolumbar nerves: A new understanding of the innervation of the anterior abdominal wall. *Clinical Anatomy*. 2008;21(4):325–333. doi: 10.1002/ca.20621
11. Abdallah F. W., Laffey J. G., Halpern S. H., Brull R. Duration of analgesic effectiveness after the posterior and lateral transversus abdominis plane block techniques for transverse lower abdominal incisions: a meta-analysis. *British Journal of Anaesthesia*. 2013;111(5):721–735. doi: 10.1093/bja/aet214
12. Ali M, Winter DC, Hanly AM, O' Hagan C, Keaveny J, Broe P. Prospective, randomised, controlled trial of thoracic epidural or patient-controlled opiate analgesia on perioperative quality of life. Br J Anaesth 2010; 104: 292–7
13. Carney J, McDonnell JG, Ochana A, Bhinder R, Laffey JG. The transversus abdominis plane block provides effective postoperative analgesia in patients undergoing total abdominal hysterectomy. Anesth Analg. 2008;107:2056–60.
14. Tan TT, Teoh WH, Woo DC, Ocampo CE, Shah MK, Sia AT. A randomised trial of the analgesic efficacy of ultrasound-guided transversus abdominis plane block after caesarean delivery under general anaesthesia. Eur J Anaesthesiol. 2012;29:88–94.
15. Vandendriessche H, Hoydonckx Y, Pexsters A. Transversus abdomonis plane block (TAP) versus patient controlled epidural analgesia (PCEA) to treat post-cesarean section pain: A randomized, double-blind trial. Acta Anaesthsiol Belg. 2010;61:107.
16. Rao Kadam V, Van Wijk RM, Moran JI, Miller D. Epidural versus continuous transversus abdominis plane catheter technique for postoperative analgesia after abdominal surgery. Anaesth Intensive Care. 2013;41:476–81.
17. Kandi Y. Efficcy of ultrasound guided transversus abdominis plane block versus epidural analgesia in pain management following lower abdominal surgery. Ain Shams J Anesthesiol. 2015;8:653–7.
18. Kanazi GE, Aouad MT, Abdallah FW, Khatib MI, Adham AM, Harfoush DW, et al. The analgesic efficacy of subarachnoid morphine in comparison with ultrasound-guided transversus abdominis plane block after cesarean delivery: A randomized controlled trial. Anesth Analg. 2010;111:475–81.
19. Niraj G, Kelkar A, Jeyapalan I, Graff-Baker P, Williams O, Darbar A, et al. Comparison of analgesic efficacy of subcostal transversus abdominis plane blocks with epidural analgesia following upper abdominal surgery. Anaesthesia. 2011;66:465–71.