COMPARISON OF POSTOPERATIVE ANALGESIC EFFECT OF US-GUIDED TRANSVERSES ABDOMINIS PLANE BLOCK WITH PARAVERTEBRAL BLOCK FOR UNILATERAL INGUINAL HERNIA REPAIR IN ADULT PATIENTS UNDER GENERAL ANAESTHESIA

Girish Sharma[1], Beauty Chowdahry[2], Shweta Mahajan[3]

[1]Associate Professor, Department of Anaesthesia, Indira Gandhi Medical College, Shimla.
[2]Postgraduate Student, Department of Anaesthesia, Indira Gandhi Medical College, Shimla.
[3]Assistant Professor, Department of Anaesthesia, Indira Gandhi Medical College, Shimla.

ABSTRACT

BACKGROUND

Both Transverse Abdominis Plane (TAP) block and Paravertebral Block (PVB) can be used to provide postoperative analgesia in inguinal hernia surgeries. Present study was done to evaluate the postoperative analgesic effect of USG-guided TAP block with USG-guided PVB for unilateral inguinal hernia repair under general anaesthesia.

MATERIALS AND METHODS

Sixty, American Society of Anesthesiologist (ASA) grade 1 and 2 adult patients undergoing inguinal hernia repair under general anaesthesia were randomly allocated to TAP (Gp I) and PVB (Gp II) group of 30 each. In Gp I patients received local anaesthetic mixture of 0.5% bupivacaine (15 mL) and 2% Xylocaine with adrenaline (15 mL) in TAP plane under real time USG. In Gp II, the same anaesthetic mixture was injected 1 cm deep to superior surface of transverse process of $T_{10,12}$ and L_2 vertebra under ultrasound guidance. The postoperative pain using the Visual Analogue Scale (VAS), the number of analgesic doses and total drug requirement in the first 24 hours of postoperative period was noted.
Statistical Analysis Used- SPSS version 14.0 (SPSS Inc., Chicago, IL), Chi-square test, Student's t-test. P <0.05 was taken as statistically significant.

RESULTS

VAS scores were statistically significantly lower in Gp II as compared to Gp1 at 1, 2, 4 and 6 hours postoperative time interval (p value <0.05). The difference in VAS scores became insignificant at 12 and 24 hours of postoperative period. Mean time to first analgesic in postoperative period in Gp I was 5:06 hrs. (range 2-10 hrs.) and in Gp II was 7.7 hrs. (range 5-10 hrs.) (p value <0.001). Twenty two patients in Gp I and ten patients in Gp II required analgesic in postoperative period (p <0.001). Total number of diclofenac doses required in postoperative period was significantly lower in Gp II than in Gp I (10 v/s 25). Total dose of diclofenac consumed in first 24 hrs. was significantly lower in Gp II (750 mg) than in Gp I (1875 mg) (p value <0.001).

CONCLUSION

PVB is better than TAP block regarding postoperative analgesia in unilateral inguinal hernia repair. Unilateral ultrasound-guided paravertebral block is better than unilateral ultrasound-guided transverses abdominis plane block for postoperative pain control in unilateral inguinal hernia surgeries. The time to first analgesic dose, total number of analgesic doses and total drug requirements in first 24 hours of postoperative period were significantly better in paravertebral group. Both blocks showed haemodynamic stability, no motor weakness, no urinary retention or vomiting in postoperative period. Performing the block under ultrasound guidance also prevented complications associated with these blocks.

KEYWORDS

Paravertebral Block, Transverses Abdominis Plane Block, Inguinal Hernia, USG.

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Corresponding Author:
Dr. Girish Sharma,
Ramesht Building, Near Anku Motor Driving School,
Hospital Road, Solan-173212, (HP).
E-mail: drgsharma@yahoo.com
DOI: 10.18410/jebmh/2017/994

BACKGROUND

Preoperative and immediate postoperative pain is associated with the occurrence of chronic pain with reported frequency from 0% to 54%.[1] Favourable effects of local anaesthetic infiltration in the inguinal region on acute postoperative pain, the postoperative Visual Analogue Scale (VAS) scores, opioid consumption and the time to first analgesic use have been reported. Paravertebral Block (PVB) involves injection of local anaesthetic at the site near to where the spinal nerve emerges from the intervertebral foramina.[2,3,4] PVB have been reported to present a successful alternative for

anaesthetic management during intraoperative period and also an effective analgesic technique in the postoperative period for inguinal hernia repair.[5] The ultrasound-guided Transverses Abdominis Plane (TAP) block is anaesthesia technique that provides analgesia following abdominal surgery.[6,7] It involves a single large bolus injection of local anaesthetic into the transverses abdominis plane. TAP block significantly reduces pain associated with lower abdominal surgery regardless of whether it is used as the primary anaesthetic technique or for pain control after general or spinal anaesthesia.[8,9,10]

MATERIALS AND METHODS

After approval by the institutional scrutiny committee and written informed consent of the patients, the proposed study was carried out as prospective randomised study in ASA I and II patients, aged between 18 and 65 years, posted for unilateral inguinal hernia repair under general anaesthesia. The patients were allocated to two groups of 30 patients each using random allocation software. The sequence of allocation was kept in separate sealed envelopes and was opened in operation theatre at the time of surgery. In Gp I (TAP), the patients received transverses abdominis plane block and in Gp II (PVB) patients received paravertebral block.

Exclusion criteria included patient's refusal for block or to participate in study, allergic to local anaesthetic drugs, coagulopathy, infection at block sites, cases of obstructed/strangulated hernia and repeat surgery for inguinal hernia.

All patients underwent a routine preanaesthetic checkup. The patient was instructed for an 8 hours fasting period and prescribed Tablet Alprazolam 0.5 mg - H.S. on the night before surgery.

In operation theatre, all patients were subjected to routine monitoring. Baseline vital data including Heart Rate (HR), Noninvasive Blood Pressure (NIBP), Electrocardiogram (ECG) and Pulse Oximetry (SpO_2) were noted before giving the block and then at every 5 minutes period. All patients were preloaded with 500 mL of crystalloid solution (normal saline).

The local anaesthetic mixture was prepared by mixing 15 mL of 0.5% Inj. Bupivacaine and 15 mL of Inj. Lignocaine 2% with adrenaline thus making total volume of 30 mL.

In Gp I, unilateral USG-guided transverses abdominis plane block was performed in supine position. Linear USG probe (5-13 MHz) was positioned in the mid-axillary line halfway between the iliac crest and the costal margin on the side of surgery. Views were considered satisfactory, if subcutaneous fat, external and internal oblique muscles, transverses abdominis muscle and peritoneum were identified. A 22G Quincke's spinal needle was introduced from anterior aspect of abdomen and inserted in plane under US guidance to lie between the internal oblique and the transverses abdominis muscles with the tip in the mid-axillary line. Above-mentioned local anaesthetic solution (30 mL) was injected under ultrasound guidance and deposition of drug was seen in between internal oblique muscle and transverses abdominis muscle plane.

In Gp II, paravertebral block was carried out with the patients in sitting position. It was performed unilaterally on side of surgery with a 22G Quincke's spinal needle. The spinous processes of T_{10}, T_{12} and L_2 vertebrae were marked in the midline. A line was drawn parallel to and at a distance of 2.5 cms from midline and points corresponding to T_{10}, T_{12} and L_2 levels were marked on this line. Transverse process, paravertebral space, pleura and lungs were identified with ultrasound using linear probe (5-13 MHz). After walking off the transverse process of T_{10} vertebra, the needle was inserted 1 cm deeper to the superior surface of transverse process and 10 mL of above local anaesthetic mixture was injected under real time ultrasound guidance. The procedure was repeated at T_{12} and L_2 vertebra level. After the block, patients were returned to a supine position.

All patients received general anaesthesia with Inj. Propofol (2 mg/kg) and Inj. Fentanyl (2 mcg/kg). LMA was inserted and attached to Bain's circuit. Patient was kept on spontaneous respiration. Maintenance was done with O_2, N_2O and halothane (33%:66%:0-1%). Throughout the surgery, vitals were monitored continuously and recorded every 5 minutes till completion of the procedure. On completion of surgery and after recovery from anaesthetic agents, the patients were shifted to recovery area.

The patients were assessed for postoperative pain using the Visual Analogue Scale (VAS). In case of postoperative pain (VAS >4), the patient was given Inj. Diclofenac sodium 75 mg intravenously slowly. If pain persisted after 30 minutes, then Inj. Morphine sulphate 6 mg IV was to be used as an additional analgesic.

The time for first dose of supplemental analgesia, total number of analgesic doses and total analgesic requirement in first 24 hours of postoperative period were noted. Patients were also assessed for any adverse events such as urinary retention, postoperative nausea or vomiting, motor weakness, pneumothorax, dural puncture, nerve damage or peritoneal administration of drug or any other complication. Any postoperative complication was managed as per requirement.

The data obtained was tabulated and statistically analysed using SPSS version 14.0 (SPSS Inc., Chicago, IL), Chi-square test and Student's t-test. $P < 0.05$ was taken as statistically significant.

RESULTS

All 60 patients were adults, divided into two groups of 30 patients each. The mean age of patients in group I was 52.2 ± 13.01 and in group II 51.7 ± 14.24 (p value 0.888). The mean weight of patient in group I was 55 ± 4.48 and in group II was 53.87 ± 4.05 (p value 0.309). Twenty nine patients in Gp I were male and one was female, while in Gp II, all patients were male (p value 0.313). The baseline heart rate in Gp I was 83.33 ± 7.01 and in Gp II was 82.13 ± 8.05 (p value 0.541). The baseline mean blood pressure in Gp I was 85.4 ± 4.78, and in Gp II, it was 86.67 ± 7.09 (p value 0.421). The baseline SpO_2 in Gp I was 98 ± 4.9, while in Gp

II, the value was 98.7 ± 0.46 (p value 0.441). The two groups were comparable with respect to age, gender, bodyweight and preoperative baseline vital parameters.

Time (hrs.)	Group G1 Mean ± SD (TAP)	Group G2 Mean ± SD (PVB)	p value
0	0	0	-
1	0.33 ± 0.711	0.03 ± 0.183	0.029
2	0.7 ± 1.236	0.13 ± 0.434	0.021
4	1.37 ± 0.89	0.77 ± 0.817	0.009
6	2.5 ± 0.938	1.73 ± 0.785	0.001
12	2.13 ± 0.0819	2.23 ± 0.626	0.597
24	2.3 ± 0.596	2.13 ± 0.629	0.296

Table. 1 Postoperative VAS Scores

Patients from both the groups experienced no pain at 0 hour of postoperative period. Henceforth, postoperative VAS scores were comparable in the immediate postoperative period and the difference was not statistically significant. In Gp II, mean VAS scores were significantly lower as compared to group Gp I at 1, 2, 4 and 6 hours postoperative time interval and the VAS scores at these times were statistically significant (p value <0.05). The difference in VAS scores became insignificant at 12 and 24 hours of postoperative period (Table 1). The mean time to analgesic requirement in Gp I was 5.06 hrs. (range 2-10 hrs.) and in Gp II was 7.7 hrs. (range 5-10 hrs.) (p <0.001).

No. of Doses of Inj. Diclofenac SOD (75 mg/dose)	Gp I (TAP)	Gp II (PVB)	P value
Nil dose	8	20	<0.001
1 dose	19	10	
2 dose	3	0	
Total no. of doses	25	10	<0.001
Total diclofenac required in 24 hrs. (mg)	1875	750	
Mean (mg)	62.5	25	<0.001

Table 2. Analgesics Required in Postoperative Period

In Gp I, nineteen patients required single dose and 3 patients required 2 doses of Inj. Diclofenac sodium, while in Gp II only 10 patients required single dose of Inj. Diclofenac sodium (p <0.001) (Table 2).

While comparing postoperative analgesic requirement in 24 hrs. between the two groups, the difference was statistically significant. Eight patients required no dose, 19 patients required one dose and 3 patients required 2 doses of Inj. Diclofenac during the first 24 hours postoperatively in group G1 in contrast to group G2 where only 10 patients required one dose of diclofenac and no patient required more than one dose (p <0.001). As the 'p' value was <0.001, the difference was found to be statistically significant between the 2 groups in postoperative analgesic requirement (Table 2). No patient required the administration of Inj. Morphine in either of the 2 groups.

The total dose of diclofenac sodium required in the first 24 hours of postoperative period was 1875 mg in TAP group and 750 mg in PVB group (p value <0.001). This difference is considered to be extremely significant statistically (Table 2).

No patient in either group had nausea or vomiting, retention of urine, motor weakness, pneumothorax or any other complication attributed to above techniques.

DISCUSSION

Multimodal or balanced analgesia uses a combination of various drugs, techniques and route of administration, so that effective analgesia is provided in postoperative period with minimal side effects. In present study, we compared the effectiveness of ultrasound-guided TAP block and PVB in controlling pain in postoperative period of inguinal hernia repair under general anaesthesia.

The result of this study shows that paravertebral block is more effective in reducing postoperative pain as compared to transverses abdominis plane block in patients undergoing unilateral inguinal hernia surgeries under general anaesthesia. The vital signs did not show any significant changes in both groups. No patient in either group developed urinary retention, motor weakness, pneumothorax or peritoneal puncture implying that both techniques are safe when applied with care. The root value of obturator nerve is $L_{2,3,4}$ (anterior division), femoral nerve is $L_{2,3,4}$ (posterior division) and for sciatic nerve is $L_{4,5}$ $S_{1,2,3}$. In our study, in the PVB group 10 mL of local anaesthetic mixture was injected 1 cm deep to superior surface of transverse process of T_{10}, T_{12} and L_2 vertebra each under ultrasound guidance. Moreover, only 10 mL of drug consisting of 0.25% bupivacaine with 1% lignocaine/adrenaline was given at superior surface of L_2 level. The above amount and concentration of drugs did not cause motor weakness in lower limbs. TAP block covers ilioinguinal and iliohypogastric nerve mainly, which have no major role in motor power of lower limbs.

There are chances of haemodynamic changes in PVB group due to possible spread in epidural space. In our study, we used multiple injection technique with small amount of drug at each site, thus limiting the drug spread in epidural space, if any. It is also suggested that that the prolongation of analgesic effect in paravertebral group maybe due to unilateral spread of local anaesthetic mixture in epidural space on same side.[11,12] As patients remained haemodynamically stable and there was no sensory loss on other side, the spread of local anaesthetic solution in epidural space was ruled out.

In our study, the paravertebral block was given under ultrasound guidance, thus avoiding epidural spread, but unilateral spread of anaesthetic mixture cannot be entirely ruled out in post block period. Moreover, drug is deposited away from sympathetic chain lying on anterolateral side of vertebra and also by not affecting sympathetic chain on other side. Relatively, avascularity of paravertebral space and addition of adrenaline also results in better and prolonged analgesia in postoperative period. PVB is purely somatic block, which does not prevent the occurrence of visceral pain.

In TAP block, the postoperative VAS scores and diclofenac consumption was on higher side. The plane of drug deposition is in fascia between internal oblique and transverses abdominis muscle carrying lower thoracic and ilioinguinal, iliohypogastric and genitofemoral nerves supplying the lower abdomen. As it is covered by muscles on both sides and with no limiting barrier to contain the drug in confined space except for rectus sheath anteriorly and thin fascia on either side, the effect and duration of analgesia is less. The TAP block is adjunctive technique for analgesia as they do not provide complete anaesthesia for surgery as there is no visceral anaesthesia resulting in discomfort during traction on cord structures. Moreover, there is some contribution of sensory nerve supply from opposite side, which is not blocked by unilateral TAP block. Similar results were seen by Kaya Cengiz and others in their study evaluating the postoperative analgesic effects of PVB and TAP block in inguinal hernia surgeries.[13]

Thus, our study shows that ultrasound-guided PVB is more effective in controlling postoperative pain in inguinal hernia surgery as compared to ultrasound-guided TAP block. Use of USG results in placement of drugs in proper space and in avoiding peritoneal puncture in TAP block and also perforation of pleura and lungs in paravertebral block. The PVB block requires multiple pricks, longer onset time, with increased risk of pneumothorax and chances of epidural spread of local anaesthetic agent when ultrasound guidance is not used. Also, paravertebral block needs more skill, but is easy to learn and is safe technique.

It is accepted that in our study, the sample size was small, no control group was present, double blinding was not possible due to difference in two techniques as per injection sites and unilateral epidural spread on same side in paravertebral group cannot be entirely ruled out. Accepting all these limitations, we recommend that paravertebral block is better than transverses abdominis plane block in controlling postoperative pain in unilateral inguinal hernia surgeries.

CONCLUSION

Unilateral ultrasound-guided paravertebral block is better than unilateral ultrasound-guided transverses abdominis plane block for postoperative pain control in unilateral inguinal hernia surgeries. The time to first analgesic dose, total number of analgesic doses and total drug requirements in first 24 hours of postoperative period were significantly better in paravertebral group. Both blocks showed haemodynamic stability, no motor weakness, no urinary retention or vomiting in postoperative period. Performing the block under ultrasound guidance also prevented complications associated with these blocks.

REFERENCES

[1] Aveline C, Hetet L, Roux A, et al. Comparison between ultrasound-guided transverses abdominis plane and conventional ilioinguinal/iliohypogastric nerve blocks for day case open inguinal hernia repair. Br J Anaesth 2011;106(3):380-386.

[2] Kaya C, Koksal E, Yasmin B. Comparative effects of transverses abdominis plane block and paravertebral block on postoperative pain in inguinal hernia surgery. Acta Medica Mediterranea 2014;30:341-346.

[3] Miller R, Eriksson L, Fleisher L, et al. Millers anaesthesia. 7th edn. Philadelphia: Churchill Livingston 2010;1:1669.

[4] Mandal MC, Das S, Gupta S, et al. Paravertebral block can be an alternative to unilateral spinal anaesthesia for inguinal hernia repair. Indian J Anaesthesia 2011;55(6):584-589.

[5] Akcaboy EY, Akcaboy ZN, Gogus N. Ambulatory inguinal herniorrhaphy: paravertebral block versus spinal anaesthesia. Minerva Anestesiol 2009;75(12):684-691.

[6] Belavy D, Cowlishaw PJ, Howes M, et al. Ultrasound-guided transverses abdominis plane block for analgesia after caesarean delivary. Br J Anaesth 2009;103(5):726-730.

[7] Sandeman D, Bennett M, Dilley A, et al. Ultrasound guided transverses abdominis plane blocks for laparoscopic appendicectomy in children: a prospective randomized trial. Br J Anaesth 2011;106(6):882-886.

[8] Sivapurapu V, Vasudevan A, Gupta S, et al. Comparison of analgesic efficacy of transverses abdominis plane block with direct infiltration of local anaesthetic into surgical incision in lower abdominal gynaecological surgeries. J Anaesthesiol Clin Pharmacol 2013;29(1):71-75.

[9] Niraj G, Searle A, Mathews M, et al. Analgesic efficacy of ultrasound-guided transverses abdominis plane block in patients undergoing open appendicectomy. Br J Anaesth 2009;103(4):601-605.

[10] Sharma P, Chand T, Saxena A, et al. Evaluation of postoperative analgesic efficacy of transverses abdominis plane block after abdominal surgery. A comparative study. J Nat Sci Biol Med 2013;4(1):177-180.

[11] Conacher ID, Kokri M. Postoperative paravertebral block for thoracic surgery. A radiological appraisal. Br J Anaesth 1987;59(2):155-161.

[12] Jones GP, Pither CE, Justin DM. Paravertebral somatic nerve block: a clinical, radiographic and computed tomographic study in chronic pain patients. Anesth Analg 1989;68(1):32-39.

[13] Cengiz K, Ersin K, Yasemin BU, et al. Comparative effects of transverses abdominis plane and para vertebral block on postoperative pain in inguinal hernia. Acta Medica Mediterranea 2014;30:341-346.