Transversus Abdominis Plane Block Vs. Paravertebral Block for Post-Operative Analgesia Following Inguinal Herniorrhaphy - A Cross-Sectional North Indian Sub-Population Study

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ABSTRACT

BACKGROUND

Inguinal hernia is a frequently encountered surgical problem. General anaesthesia carries the risk of possible airway complications. Regional blocks improve acute post-operative pain, decrease post-operative visual analogue scale (VAS) score and patient can mobilise early. The purpose of this study was to compare the effectiveness of transversus abdominis plane (TAP) block vs. paravertebral (PVB) block for post-operative analgeia in inguinal hernia surgeries.

METHODS

We conducted a research on 64 patients of age > 18 years with American society of Anaesthesiologists (ASA I – III) to undergo unilateral inguinal herniorrhaphy. Patients were randomized into two groups. Group T received TAP block in which 20 ml of 0.25 % bupivacaine was injected and Group P underwent PVB in which 5 ml of bupivacaine (0.25 %) at each segment from T10-L1 was injected slowly (total dose of 20 ml). Post-operative VAS score, time for first rescue analgesia, total diclofenac requirement, total anti-emetic requirement and complications if any was noted.

RESULTS

The demographic data of both the groups were comparable. Also, pre and post-operative heart rate, blood pressure, IV fluids, ephedrine use, operative time and complications were statistically insignificant. As compared to group T, group P had lower VAS score from 2nd – 12th hour which was statistically significant ($P < 0.05$). Although more time is required to perform paravertebral block but the time for request of first rescue analgesia was quite prolonged in paravertebral block. Time of ambulation in group P was significantly lower than group T.

CONCLUSIONS

PVB requires more time to perform due to multiple site of injection, the comparison of both techniques in the present study revealed that PVB showed relatively higher efficacy in the management of post-operative pain, early ambulation and had significant reduction in dose requirement of additional analgesia (diclofenac) and antiemetics (ondansetron) over tap block.

KEYWORDS

Paravertebral Block, Transversus Abdominis Block, Inguinal Hernia

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BACKGROUND

Inguinal hernia occurs in about 15 % of adult males which is more common on the right side. This procedure can be performed under various anaesthetic techniques. General anaesthesia and spinal anaesthesia have their own risk. Regional blocks for pain management improves acute post-operative pain, decreases post-operative verbal analogue scale scores, opioid demand, and time to first rescue analgesic administration. Patients can mobilize and take oral liquids and solid foods much earlier.[1] The external oblique, internal oblique and the transversus abdominis are the three muscle layers that form the abdominal wall along with their associated fascial sheaths. The muscular wall is innervated by nerve afferents that course through the transversus abdominis neuro fascial plane.[2]

A promising approach to the provision of post-operative analgesia after abdominal incision is to block the sensory nerve supply to the anterior abdominal wall.[3,4] The transversus abdominis plane block is a novel method of regional anaesthesia that provides unilateral anaesthesia to the anterolateral abdominal wall. A bilateral technique has also been used in various clinical situations.[5,6,7,8] The paravertebral block has been used with success, both as anaesthetic and analgesic techniques, for inguinal herniorrhaphy.[9,10] PVB has been found to be more advantageous than conventional spinal anaesthesia for inguinal hernia repair, in terms of early ambulation and better post-operative pain scores.[11]

Aim

Aim of the study was to compare the effectiveness of transversus abdominis plane block vs. paravertebral block for post-operative analgesia in inguinal hernia surgeries.

Objectives

To know the time of first demand of analgesia after the surgery and total requirement of additional analgesic during first twenty-four hours post-operatively.

METHODS

With the approval of hospital research ethical committee and informed and written consent, this study was conducted in cross-sectional way at Department of Anaesthesia and Critical Care of S.N. Medical College, Agra from March 2017 to July 2018. The subjects belonged mainly to the catchment area of this government district hospital.

Inclusion Criteria

Patients with unilateral inguinal hernia, all adult patients (age > 18 years) of American society of Anaesthesiologists grade I to III requiring unilateral herniorrhaphy.

Exclusion Criteria

Patients with recurrent/incarcerated hernia, patients with bilateral hernia, patients with body mass index (BMI) > 40 kg/m2, patients having infection at the site of intervention, patients with coagulopathy and significant cardiovascular, respiratory, renal, hepatic or metabolic disease.

Sample Size

Based on previous study, 12 we presumed that PVB can reduce 24-hour post-operative additional analgesic requirement by 30 % when compared to TAP block, considering type I error 5 % & power of 0.8. 64 patients (32 per group) were taken into account. Informed written consent were obtained from the patients and then they were randomized into two groups, group T and group P. Sealed envelopes containing randomization numbers were used for double blind randomisation (simple randomization using a randomization table from a statistic book).

In the procedure room, cannulation using 18-G cannula was done for patients of both the groups through which crystalloids were infused. A multichannel monitor was attached for monitoring the heart rate (HR), electrocardiogram (ECG), non-invasive blood pressure (NIBP), mean arterial pressure (MAP) and peripheral arterial haemoglobin oxygen saturation during the procedure and surgery. Patients were given spinal anaesthesia for surgical repair of unilateral inguinal hernia and at the end of surgery, for post-operative analgesia, Group T received TAP block in which 20 ml of 0.25 % bupivacaine was injected, and Group P underwent PVB in which 5 ml of bupivacaine (0.25 %) at each segment from T10 to L1 was injected slowly (total dose of 20 ml).

Technique of Tap Block

TAP block was given using double pop technique. The patients were in supine position. 5 cm 26-G needle was inserted perpendicular to the skin just superior to iliac crest and behind midaxillary line. After eliciting 2 pops one as the needle penetrates, the external oblique fascial layer and another as it penetrates the internal oblique fascia layer and enters the TAP.[6,12] To avoid vascular puncture, negative aspiration for blood was done and then 1 ml was injected as test dose. Needle was repositioned and test was repeated in case any resistance was felt while injecting the drug. After confirmation of the position of the needle 12 – 15 ml of 0.25 % bupivacaine was injected.

Technique of PVB

The unilateral PVB was performed in a sitting position. After marking a point 3 cm lateral to the cephalad aspect of the spinous processes of T10, T11, T12 and L1 vertebrae, lignocaine 1 % was infiltrated. Under all aseptic precautions, 18-G Tuohy needle was inserted usually at a depth of about 5 – 8 cm in lumbar region and 2 – 4 cm in thoracic region and perpendicular to the skin in all planes. The needle was then withdrawn a bit and walked off the transverse process by redirecting the needle to the caudad in case of lumbar

PVB and cephalad in case of thoracic PVB. A 'loss of resistance' to normal saline was felt at a depth of 1 to 2 cm from the transverse process, after negative aspiration of blood and cerebrospinal fluid (CSF), 5 ml of bupivacaine (0.25 %) at each segment from T10 to L1 was injected slowly. Heart rate, mean arterial pressures and spo2 were recorded before stating the procedure and every 15 minutes after the subarachnoid block was given. Injection ephedrine 5 – 10 mg IV was given whenever MAP fell below 65 mmHg. After the block, the patients were shifted to PACU for observation.

1. All patients were monitored according to the post-anaesthetic care unit (PACU) protocol regarding vital parameters.
2. Verbal analogue score (on 0 - 10 cm scale, where 0 is no pain and 10 is worst possible pain) was noted on arrival in PACU 2, 6, 12 and 24 hours at rest and on direct pressure on the surgical wound.
3. Time of first demand for analgesic was noted and patient was administered diclofenac 75 mg.
4. Total rescue analgesic consumption during first 24 hours was recorded.
5. Time of voiding of urine, first oral feed and ambulation was noted.
6. Any side effect related to the block was also recorded.
7. After 24 hours patient was enquired about satisfaction regarding analgesia.

Residents of the recovery room who were not involved in the study and were blinded about the anaesthetic technique due to identical dressings, recorded the data. During follow-up their blood pressure, heart rates and VAS values were recorded at arrival in PACU, 30 minutes, 45 minutes and at 1, 2, 6, 12 and 24 hour. After the regain of proprioception of great toe, ability to dorsiflex the foot and return of perianal sensation, observer encouraged the patient to ambulate under supervision. When the patient succeeded in ambulation, the time to ambulation was noted. Post-operative pain was assessed with the verbal analogue scale (VAS) score of 0 - 10 (0 = no pain and 10 = worst catheter of appropriate size, maintaining strict asepsis. Other post-operative adverse events were recorded.

Statistical Analysis

The descriptive data were expressed as the mean ± SD or median (min – max). The normality of data was evaluated using the Shapiro-Wilk test. The student t-test was used to compare the mean values between groups. In case of non-normal distribution, the Mann-Whitney U test was applied for between group comparison. For comparison of categorical data, the chi-square test was used. All tests were carried out at 5 % level of significance. Statistical analysis was performed using statistical package for social sciences (SPSS) software (version 23.0 for Windows; SPSS, Chicago, Illinois).

RESULTS

Patient's characteristics were comparable among the two groups in the demographic data. (Table 1). All the patient's parameters were comparable before and after block in both the group except time to perform the block which is statistically significant (P < 0.05). Paravertebral block required significantly more time to perform as compared to TAP bock. Also, total duration for which the patient was in the operating room (OR) was significantly higher in group P as compared to group T and was statistically significant (P < 0.05). This may be attributed to more time required to perform paravertebral block. (Table 2)

Demographic Features	Group P Mean ± SD	Group T Mean ± SD	P - Value†
Age (years)	42.15 ± 8.33	44.25 ± 9.04	0.396
Weight (kg)	56.88 ± 11.67	55.68 ± 7.69	0.664
Duration of surgery (min.)	61.24 ± 8.164	58.23 ± 8.96	0.712
Height (cms.)	163.3 ± 8.1	162.3 ± 6.7	0.036
Sex (M / F)	27 / 5	29 / 3	0.452
ASA Grade (I / II / III)	1 (1 - 3)	1 (1 - 3)	0.932

Table 1. Demographic Data

† P - values are based on t-test / Mann-Whitney U test for continuous measurements and x-square for categorical data

Parameters	Group P Mean ± SD	Group T Mean ± SD	P - Value
Time to perform block (mins.)	15.17 ± 4.395	9.73 ± 2.766	0.002*
HR before block (beats/minute)	75.1 ± 10.36	72.7 ± 8.583	0.334
HR after block (beats/minute)	72.9 ± 9.932	68.07 ± 9.501	0.474
MAP before block (mmHg)	82.83 ± 5.566	81.13 ± 4.404	0.869
MAP after block (mmHg)	80.03 ± 7.252	77.87 ± 3.55	0.308
Duration of surgery (mins.)	61.24 ± 8.164	58.23 ± 8.96	0.712
Duration in OR (mins.)	83.45 ± 13.24	72.05 ± 11.56	0.004*
I.V fluids	924 ± 142	948 ± 133	0.542
Ephedrine requirement	1 ± 0.8	2 ± 0.4	0.754

Table 2. Haemodynamic Parameters

* statistically significant (P < 0.05)

† P - values are based on t-test/ Mann-Whitney U test for continuous measurements and x-square for categorical data

	Group P	Group T
Excellent (no supplement required)	78.00	69.26
Good (analgesic required)	22.00	31.74

Table 3. Quality of Block (%)

Interval	Group P Mean ± SD	Group T Mean ± SD	P - Value
Arrival at PACU	0 ± 0	0 ± 0	NA
1st hour	0 ± 0	0 ± 0	NA
2nd hour	0 ± 0	5 ± 3.04	NA
6th hour	9 ± 7.21	17 ± 5.13	< 0.05
12th hour	20 ± 8.17	26 ± 5.22	< 0.05
24th hour	17 ± 6.84	18 ± 5.49	0.7842

Table 4. Pain at Surgical Site at Rest (Verbal Analogue Scale 0-10)

NA- Not applicable

* Statistically significant (P < 0.05)

† P - values are based on t-test/Mann-Whitney U test for continuous measurements and x-square for categorical data

	Group P Mean ± SD	Group T Mean ± SD	P - Value
Analgesic requirement for the first time (mins.)	731 ± 304.2	289.6 ± 84.22	< 0.05
VAS at time of first analgesic requirement	4.21 ± 1.26	4.68 ± 1.84	< 0.05
Total consumption of diclofenac in mg within 24 hours duration after surgery	127.76 ± 28.23	192.45 ± 32.87	< 0.05
Total antiemetic requirement (ondansetron in mg)	2.16 ± 2.42	4.68 ± 3.85	< 0.05

Table 5. First Time Analgesic Requirement

* statistically significant (P < 0.05)

† P - values are based on t-test/Mann-Whitney U test for continuous measurements and x-square for categorical data

Parameters	Group P Mean ± SD	Group T Mean ± SD	P - Value
Time of ambulation of the patient (mins.)	278.58 ± 88.54	315.74 ± 40.27	< 0.05
Time of first oral feed of the patient (liquid intake)	344.24 ± 45.76	357.56 ± 40.27	< 0.05
Time of voiding of urine (mins.)	254.08 ± 32.54	262.74 ± 36.27	0.0625
Urinary catheterization	1.00 ± 0.23	1.00 ± 0.35	0.0941

Table 6. Ambulation Time, Time of First Oral Feed, Time of Voiding of Urine and Urinary Catheterization

* statistically significant (P < 0.05)
† P - values are based on t-test/Mann-Whitney U test for continuous measurements and x-square for categorical data

It was observed that paravertebral block provided better quality of block as compared to TAP block. (Table 3) Pain scores were 0 in PACU and at 1st hour in both the groups (may be due to effect of spinal anaesthesia and inj. diclofenac). Reduced pain scores were seen in PVB block group as compared to TAP block group from 2nd to 12th hour. During 24th hour, pain score in PVB block group was statistically comparable to TAP block group. (Table 4).

Time for first request for analgesia was quite prolonged in PVB group in comparison to TAP block group. Also, VAS score was significantly higher in TAP block group as compared to PVB group. Diclofenac consumption was almost reduced by approximately 33 % in PVB group as compared to TAP block group. 24 hours antiemetic requirement was reduced in PVB group by 46 % and statistically significant difference was observed in comparison with TAP block group. (Table 5) The time of ambulation in PVB group was significantly lower than TAP Block group i.e. patients who received PVB were able to mobilize earlier than patients who received TAP block. All other parameters like intake of first oral feed, time of voiding of urine and patients requiring urinary catheterization were similar and comparable in both the groups. (Table 6).

DISCUSSION

Main finding of this study was that there is a significant decrease in the post-operative pain, VAS score and a decreased need for analgesic drugs after herniorrhaphy treated with PVB as compared with TAP block. Pain scores at rest were 0 in PACU and at 1st hour in both the groups which may be attributed to effect of spinal anaesthesia and inj. diclofenac. Reduced pain scores were seen in PVB block group (Group P) as compared to TAP block group (Group T) from 2nd to 12th hour. During 24th hour, pain score in PVB block group was statistically comparable to TAP block group. Pain scores were statistically insignificant at 24th hour among both the groups which might be due to diminished effect of PVB or TAP block or post-operative pain may have reduced in intensity by this time. This corroborates with the finding of Ozkan D and others.[13,14,15,16] Another important finding is decreased requirement of post-operative antiemetics, with PVB as less analgesic is required in PVB, duration of surgery and better quality of block is with paravertebral technique. Similar findings were observed in study conducted by Cengiz Kaya et al. (2014).[17]

In our study, the demographic data of the patients including age, weight, and height and ASA grade, duration of surgery were comparable in group P and group T. Also, in our study various parameters of vital signs like pulse rate (beats/min), MAP (mm of Hg), and oxygen saturation SpO2 (%) were comparable in both the groups between pre and intra operative periods and was statistically insignificant. Amount of IV fluids and similar amount of ephedrine was required to rescue drop in BP in both the group.

The time required to perform the surgery was also comparable in both the group but the total duration for which the patient was in the operating room was significantly higher in group P as compared to group T and was statistically significant (P < 0.05). This may be attributed to the more time required to perform paravertebral block. Local anaesthetic injected para vertebrally exert their effect by blocking the spinal nerves in para vertebral space or due to epidural spread.

Our study demonstrates that the PVB block group (Group P) have reduced overall post-operative diclofenac requirement by approximately 33 % in first 24 post-operative hours as compared to TAP block group (Group T). Along with reduced analgesic consumption we also observed that the patients in PVB group (Group P) took a longer time to request for the first rescue analgesic as compared to TAP block group (Group T). The mean time for first analgesic requirement in group P was 731 min, as compared to group T where it was 289.6 min in group T (P < 0.001). Also, VAS score was significantly higher in TAP block group as compared to PVB group at the time of demand of rescue analgesia. Our findings are comparable with the study done by Mcdonnel et al. (2008),[7] Cengiz Kaya et al. (2014).[17]

One of the overwhelming findings of our study was that patients receiving PVB block were able to ambulate early during the post-operative period due to low pain scores at rest as compared to patients who receive TAP block. They also had sound sleep during night reason being the same as above. All other parameters like intake of first oral feed, time of voiding of urine and patients requiring urinary catheterization were similar and comparable in both the groups. When we enquired about patient satisfaction, overall, 95 % of the patients in PVB block group (Group P) were satisfied with their analgesic regimen as compared to 85 % among the TAP block group. Also, there was no significant difference in discharge of patients from PACU and hospital in both the groups.

CONCLUSIONS

Hence, we conclude that PVB holds considerable promise as a part of analgesic regimen for inguinal hernia surgeries as compared to TAP block. Although TAP block and PVB block were easy to perform (PVB requiring more time to perform) and provided reliable and effective analgesia in this study and no complications due to the TAP block or PVB block were detected. We also conclude that although the PVB requires more time to perform due to multiple site of injection, the comparison of both techniques in the present study revealed that PVB showed relatively higher efficacy in the management of post-operative pain, early ambulation and had significant reduction in dose requirement of additional

analgesia (diclofenac) and antiemetics (ondansetron) over TAP block.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.
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REFERENCES

[1] Aveline C, Hetet HL, Roux AL, et al. Comparison between ultrasound-guided transversus abdominis plane and conventional ilioinguinal/iliohypogastric nerve blocks for day-case open inguinal hernia repair. British Journal of Anaesthesia 2011;106(3):380-386.
[2] Netter FH. Back and spinal cord. In: Netter FH, edr. Atlas of Human anatomy summit. New Jersey, USA: The Ciba-Geigy Corporation, 1989: p. 145-155.
[3] Kuppuvelumani P, Jaradi H, Delilkan A. Abdominal nerve blockade for postoperative analgesia after caesarian section. Asia Oceania J Obstet Gynaecol 1993;19(2):165-169.
[4] Dierking GW, Dahl JB, Kanstrup J, et al. Effect of pre- vs. postoperative inguinal field block on postoperative pain after herniorrhaphy. Br J Anaesth 1992;68(4):344-348.
[5] O'Donnell BD, McDonnell JG, McShane AJ. The transversus abdominis plane (TAP) block in open retropubic prostatectomy. Reg Anesth Pain Med 2006;31(1):91.
[6] McDonnell JG, O'Donnell B, Curley G, et al. The analgesic efficacy of transversus abdominis plane block after abdominal surgery: a prospective randomized controlled trial. Anesth Analg 2007;104(1):193-197.
[7] McDonnell JG, Curley G, Carney J, et al. The analgesic efficacy of transversus abdominis plane block after cesarean delivery: a randomized controlled trial. Anesth Analg 2008;106(1):186-191.
[8] Carney J, McDonnell JG, Ochana A, et al. The transversus abdominis plane block provides effective postoperative analgesia in patients undergoing total abdominal hysterectomy. Anesth Analg 2008;107(6):2056-2060.
[9] Klein SM, Pietrobon R, Nielsen KC, et al. Paravertebral somatic nerve block compared with peripheral nerve blocks for outpatient inguinal herniorrhaphy. Reg Anesth Pain Med 2002;27(5):476-480.
[10] Weltz CR, Klein SM, Arbo JE, et al. Paravertebral block anesthesia for inguinal hernia repair. World J Surg 2003;27(4):425-429.
[11] Bhattacharya P, Mandal MC, Mukhopadhyay S, et al. Unilateral paravertebral block: an alternative to conventional spinal anaesthesia for inguinal hernia repair. Acta Anaesthesiol Scand 2010;54(2):246-251.
[12] McDonnell JG, O'Donnell BD, Farrell T, et al. Transversus abdominis plane block: a cadaveric and radiological evaluation. Reg Anesth Pain Med 2007;32(5):399-404.
[13] Özkan D, Akkaya T, Cömert A, et al. Paravertebral block in inguinal hernia surgeries two segments or 4 segments? Reg Anesth Pain Med 2009;34(4):312-315.
[14] Thavaneswaran P, Rudkin GE, Cooter RD, et al. Paravertebral block for anesthesia: a systematic review. Anesth Analg 2010;110(6):1740-1744.
[15] Dabbagh A, Elyasi H. The role of paravertebral block in decreasing postoperative pain in elective breast surgeries. Med Sci Monit 2007;13(10):CR464-CR467.
[16] Pusch F, Freitag H, Weinstabl C, et al. Single-injection paravertebral block compared to general anaesthesia in breast surgery. Acta Anaesthesiol Scand 1999;43(7):770-774.
[17] Cengiz K, Köksal E, Üstün YB, et al. Comparative effects of transversus abdominis plane and paravertebral block on postoperative pain in inguinal hernia surgery. Acta Medica Mediterranea 2014;30(2):341-346.