Original Research Article

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Four Segments Versus two Segments Paravertebral Block for Inguinal Hernia Repair

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Abstract

Background: Paravertebral block (PVB) has been successfully used to provide good analgesia with fewer side effects in inguinal herniorrhaphy. So, the present study was conducted to compare the characteristics of two segments with four segments PVB for anaesthesia and postoperative analgesia.

Material & Methods: Fifty patients of ASA grade I and II, aged between 18-80 years scheduled for inguinal herniorrhaphy of a tertiary care teaching hospital were randomly selected in two groups of 25 each; Group F [Four segment block – T_{10}, T_{11}, T_{12}, L_1 (5ml 0.75% plain ropivacaine with 1:400000 epinephrine per segment)] and Group T [Two segment block – T_{10}, and L_1 (15ml 0.75% plain ropivacaine with 1:400000 epinephrine at T_{10} and 5 ml at L_1)]. Onset, duration of surgical anaesthesia, duration of complete analgesia and effective analgesia were recorded. Postoperative pain was assessed at predetermined time intervals using visual analogue scale (VAS).

Results: The mean duration of application was 14.94±3.30 minutes in group F and 6.16±1.57 minutes in group T. ($p<0.001$) The mean duration of surgery start time in group F and group T was 27.40±2.55 minutes, 22.79±3.55 minutes respectively. ($p<0.01$) Group T showed 84% satisfaction level while group F showed 76%. VAS score in both the groups was found statistically insignificant at 0, 6, 12, 24, 36, 48Hrs interval.

Conclusion: Two segments technique of PVB can be a viable alternative to the four segments technique for inguinal hernia surgery because it is less time consuming, provides similar analgesia as compared to the four segment technique. Furthermore, decreasing the number of injections in the two segment block technique may further increase patient comfort and satisfaction.

Keywords: Paravertebral Block; Inguinal Herniorrhaphy; Analgesia; Visual Analogue Scale.

Introduction

Inguinal herniorrhaphy is commonly performed under various techniques viz. general anaesthesia, infiltration anaesthesia, central neuraxial anaesthesia, nerve-blocks and paravertebral blocks [1]. The choice of anaesthesia for inguinal hernia remains a controversial topic [2]. The regional technique of paravertebral block has been successfully used for inguinal herniorrhaphy. Its attributes are prolonged unilateral sensory block with minimization of postoperative pain, reduction of nausea and vomiting, shortened hospital stay, patient satisfaction and rapid return to normal activities [1,3].

Paravertebral nerve block is an old technique and was initially utilized as an alternative to spinal anesthesia in order to minimize the cardiovascular and respiratory effects of central neuraxial blockade [4]. However, after its initial description paravertebral nerve block was sparingly used to provide anesthesia and analgesia. More recently, there has been renewed

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interest in this technique for the treatment of acute and chronic pain. Paravertebral nerve block involves injection of local anesthetic in a space immediately lateral to where spinal nerves emerge from the intervertebral foramina [5]. Because of the multiple neurologic structures confined within paravertebral space local anesthetic introduced here can produce unilateral motor, sensory and sympathetic block [6]. The resultant anesthesia or analgesia due to paravertebral block is conceptually similar to a unilateral epidural anesthesia. Higher or lower levels can be chosen to accomplish a band like segmental blockade at the desired level [7]. Conventionally the desired effect achieved by paravertebral nerve block is by giving the drug or local anesthetic at each nerve root level. Radiographic dye studies using methylene blue have demonstrated that if the anesthetic is deposited in excess volume, then a multisegmental longitudinal spread typically results [8].

Paravertebral nerve block has been an established technique for providing analgesia to the chest and abdomen for many years. It has multiple applications and may serve as the primary anesthetic for chest trauma, chest tube insertion, breast surgery, herniorrhaphy, soft tissue mass excision, bone harvesting from the iliac crest, as an adjunct in laparoscopic surgery, cholecystectomy, nephrectomy and other abdominal and thoracic surgeries [8]. Effective pain control during operation and postoperative period is essential for optimal care of surgical patients. Thus satisfactory analgesia is essential not only to keep up the morale of the patients but also to avoid harmful effects. In the current cost-conscious environment, it is important to examine the impact of anaesthetic techniques on recovery process after ambulatory surgery because proposed recovery times and perioperative complications increase the cost of patient care. In addition patient satisfaction is improved when the anaesthetic technique choosen for the procedure is associated with lesser incidence of post-operative side-effects [9]. Paravertebaral block provides good analgesia with fewer side-effects in inguinal herniorrhaphy patients [10]. The present study was conducted to compare the characteristics of two segment paravertebral block with four segment paravertebral block for anaesthesia and postoperative analgesia for inguinal hernia repair surgeries.

Materials & Methods

The present study was conducted in the department of Anaesthesiology and Critical Care of a tertiary care teaching hospital. After getting approval from Institutional ethics committee patients of ASA grade I and II, aged between 18-80 years scheduled for inguinal herniorrhaphy were included in this study. All patients were thoroughly examined and informed consent was taken. Patients allergy to local anesthetic, coagulopathy, blood dyscrasias, anticoagulant therapy, infection at the site of needle insertion, empyema, tumour occupying the paravertebral space were excluded from the study. Patients were randomly selected in two groups:

Group F: Four segment block – T_{10}, T_{11}, T_{12}, L_1 (5ml 0.75% plain ropivacaine with 1:400000 epinephrine per segment)

Group T: Two segment block – T_{10}, and L_1 (15ml 0.75% plain ropivacaine with 1:400000 epinephrine at T_{10} and 5 ml at L_1)

All the monitoring equipments (Non-invasive blood pressure cuff, pulse oximetry probe, ECG) were attached to the patient and base line values of heart rate, blood pressure, SpO_2 and respiratory rate were recorded.

After cleansing the skin with an antiseptic solution, 6-8 ml of dilute local aesthetic was infiltrated subcutaneously alongside the line where the injections would be made. The injection was carried out slowly to avoid pain on injection and new needle reinsertions were made through already anesthetized skin. The needle was inserted perpendicular to the skin with constant attention to the depth of needle insertion and the medial-lateral needle orientation. Drug was injected after aspiration. Iliac crest (corresponds to L3-4 or L2-3), spinous processes (midline) and tips of scapulae (corresponds to T7) were helpful to identify spinal levels and to estimate the position of the transverse processes. After contacting the transverse process of the individual vertebrae and noting the depth of the bony contact, the needle was hold at 1cm finger backstop and withdrawing the needle almost upto skin level and was reinserted with a 10^0 caudal angulation to a depth till 1cm finger backstop; then the drug was injected after aspiration.

Onset and duration of surgical anaesthesia was assessed by pinprick method. Pain was evaluated using standard 10 cm linear visual analogue scale (VAS) with, 0 corresponding to no pain and 10 to worst pain possible. Duration of complete analgesia (time from onset to first report of pain) and effective analgesia (from onset to first dose of rescue analgesic) was recorded. In failed block, general anesthesia was induced with propofol 2 mg/kg and fentanyl (50-100 μg) intravenously.

Blood pressure, heart rate and respiratory rate were recorded immediately prior to skin incision (baseline), 60s after skin incision, during sac traction and on closure of the wound. Postoperative pain at rest was assessed during the first two postoperative days at predetermined time intervals (0, 6, 12, 24, 36 and 48 h) using VAS score. The analgesic used was oral tablet paracetamol 650 mg 3 times a day to be given after the period of effective analgesia of the procedure, if VAS score was >3.

Data were analysed using SPSS Statistics software. The qualitative data between two groups were compared using chi square test and for comparison of the continuous variable, student t-test were used. p<0.05 was considered statistically significant at 95% confidence interval.

Results

Fifty male patients of ASA grade I and II, aged between 18-80 years scheduled for inguinal herniorrhaphy were randomly allocated into two groups of 25 each. The mean age, weight, height and body mass index (BMI) of the patients in both the groups was comparable and the p value between the groups was >0.05 i.e. statistically insignificant.

The mean duration of surgery in group F and group T was 87.60+10.21 minutes, 92.20+12.50 minutes respectively. The p value between the two groups was >0.05 i.e. statistically insignificant. The mean duration of application in group F was 14.94±3.30 minutes and in group T, it was 6.16±1.57 minutes.

The p value in both the group was <0.001 i.e. statistically significant. The mean duration of surgery start time in group F and group T was 27.40±2.55 minutes, 22.79±3.55 minutes respectively. The p value between the two groups was p<0.01 i.e. statistically significant (Table 1).

Group T showed 84% satisfaction level while group F showed 76%. Contra-lateral spread was found only in 2 (8%) cases of group F and 1 case (4%) of group T. Failure of block was 20% in group F and 28% in group T which was statistically insignificant (Table 2).

VAS score in both the groups was found statistically insignificant at 0, 6, 12, 24, 36, 48 Hrs interval. (Table 3) Paracetamol rescue was given in 3

Table 1: Comparison of demographic characteristics and other variables in both the groups

	Group-F (Mean ± SD)	Group-T (Mean ± SD)	
Age(yrs)	47.84 ±5.12	48.16±8.63	p>0.05
Height (cms)	154.8 ± 4.44	156.92 ± 3.96	p>0.05
Weight (kgs)	54.7 ± 4.36	56.36 ± 3.63	p>0.05
Body Mass Index (kg/m2)	23.13 ± 1.68	22.89 ± 1.36	p>0.05
Duration of surgery period (min)	87.60± 10.21	92.20±12.50	p>0.05
Duration of application (min)	14.94±3.30	6.160±1.57	**p<0.001**
Surgery start time (min)	27.40±2.55	22.79±3.55	**p<0.01**
Duration of sensory block (hours)	12.84±2.04	13.44±1.66	p>0.05

Table 2: Contra-lateral spread, patient satisfaction, success of block and motor block in both the groups

	Group-F N (%)	Group-T N (%)	
Contra-lateral spread			
Yes	2 (8.0%)	1 (4.0%)	p>0.05
No	23 (92.0%)	24 (96.0%)	
Patient satisfaction			
Yes	19 (76.0%)	21 (84.0%)	p>0.05
No	6 (24.0%)	4 (16.0%)	
Success of block			
Yes	20 (80.0%)	18 (72.0%)	p>0.05
No	5 (20.0%)	7 (28.0%)	
Motor block			
Yes	3 (15.0%)	1 (5.6%)	p>0.05
No	17 (85.0%)	17 (94.4%)	

Table 3: Comparison of Visual Analogue Score at 0, 6, 12, 24, 36, 48 Hrs in both the groups

Time interval	VAS score	Group-F N=20	Group-T N=18	
0 Hr	VAS 0	20 (100.0%)	18 (100.0%)	
6 Hr	VAS 0	20 (100%)	17 (94.44%)	p>0.05
	VAS 1	0 (0%)	1 (5.55%)	
12 Hr	VAS 0	19 (95.0%)	16 (88.88%)	p>0.05
	VAS 2	1 (5%)	2 (11.12%)	
24 Hr	VAS 0	18 (90.0%)	16 (88.9%)	p>0.05
	VAS 3	2 (10.0%)	2 (11.1%)	
36 Hr	VAS 0	17 (85.0%)	15 (83.33%)	p>0.05
	VAS 3	3 (15.0%)	3 (16.66%)	
48 Hr	VAS 0	17 (85%)	14 (77.77%)	p>0.05
	VAS 3	3 (15.0%)	4 (22.22%)	

cases (15%) of group F and 4 cases (22.22%) of group T. There was no significant difference in HR, SBP, DBP, MAP, SpO2 and respiratory rate during the intra/post operative period (p>0.05).

Discussion

Paravertebral block was first described by Hugo Sellheim in 1905 [8]. It was initially utilized as an alternative to spinal anaesthesia. More recently, this block has been successfully used to provide analgesia for multiple thoracic and abdominal procedures in both children and adults [11].

In present study the demographic data of patients was comparable in both the groups. This study found that time taken for the block was shortened when a two segment paravertebral block was used as compared with a four segment paravertebral block. Both methods gave similar anesthetic success. Satio et al used a single injection paravertebral block technique with 12 ml local anesthetic in inguinal hernia surgeries with a success rate of 60% [12]. In Satio et al cadaver study where anatomic borders of paravertebral block were investigated, fluid shift occurred between thoracic and lumbar paravertebral areas [13]. For successful inguinal hernia surgery, ilioinguinal, iliohypogastric and genitofemoral blocks have to be performed. In the present study, paravertebral block was applied at L^1 level beside T^{10}, to cover ilioguinal, iliohypogastric and the genitofemoral nerves [11,14]. In previous studies, it was reported that multiple segment paravertebral block injections were not comfortable for patients and they may increase the risk of pleural puncture (1.1%) and Penumothorax (0.5%) [11,14]. There was no pleural puncture or pneumothorax in any patient of either groups in present study.

The present study found that the shorter injection time in the two segment paravertebral block was reported to be more comfortable by the patients, but that patient satisfaction showed no significant difference between the two groups. In present study the sensory block lasted for approximately 12 hrs which is in accordance with the Weltz et al study [3]. This may be due to slow local anesthetic uptake due to the avascular structure of the paravertebral area.

In present study the time taken to perform the block was significantly more in group F as compared to group T. The surgery start time was significantly more in groups F as compared to group T. The sensory block duration was comparable in both study groups. This suggests that both methods are good choices with regard to analgesic comfort during the post operative period. These finding are in agreement with the study conducted by Ozkan et al [15].

In the literature, there are epidural and intrathecal spreads in 1% and contralateral spread in 1.1% for paravertebral block [11,16]. In present study, contralateral spread occurred in 8% of patient in Group F and 4% in Group T. Motor blockade of the ipsilateral lower limb measured in terms of knee flexion occurred in 15% in group F and 22.22% in group T, which was statistically not significant. However, larger studies would be necessary to confirm these finding; since the sample size in present study was underpowered to determine disadvantages of paravertebral block.

Prolonged postoperative analgesia and absence of motor blockade which are the key features of paravertebral block, lead to decreased opioid consumption and enable early ambulation. In present study analgesia was present even after 48 hours of surgery. The shorter hospital stay and early discharge observed in present study was in accordance with the Hadzic et al study [17].

The failure rate in present study for four segment paravertebral block was 20% and for 2 segments

paravertebral block was 28% which was higher than the 12% failure rate reported by Cheema et al [18]. Since the success rate was lower when the study began and progressively increased with the number of cases, it could be attributed to improvement of expertise in performing the block with experience. Furthermore, the use of nerve stimulator for confirmation of correct needle placement along with ultasound guidance may add objectivity to this procedure and may further decrease failure.

Conclusion

Paravertebral block can provide ideal anesthesia conditions such as prolonged postoperative analgesia, unilateral blockade, early ambulation, intraoperative hemodynamic stability, faster recovery and early discharge from the hospital. Furthermore, decreasing the number of injections in the two segment block technique may further increase patient comfort and satisfaction and perhaps decreases complications. The two segment technique is less time consuming, provides similar analgesia as compared to the four segment technique but the success rate is dependent on experience of the person performing the block. So, two segments technique of paravertebral block can be a viable alternative to the four segments technique for inguinal hernia surgery.

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