COMPARISON OF EFFECTIVENESS OF THORACIC EPIDURAL AND PARAVERTEBRAL BLOCK FOR POST THORACOTOMY PAIN RELIEF

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ABSTRACT

Objective: To compare the effects of thoracic epidural and thoracic paravertebral block in post thoracotomy pain relief and early ambulation.

Study Design: Randomized control trial (RCT).

Place and Duration of Study: Combined Military Hospital Rawalpindi a tertiary care health facility, from Jan 2007 to Dec 2007.

Patients and Methods: Thoracic epidural block was given in group-A while thoracic paravertebral block was given in group-B patients post operatively. Pain scores were assessed at 30 min intervals after the dose of 0.25% Bupivacaine using visual analogue scale (VAS).

Results: There was no significant difference for pain scores in first 24 hours after surgery between paravertebral block (PVB) and thoracic epidural group measured at 30 min interval. But complication like hypotension occurred less with PVB.

Conclusion: Paravertebral block is a safe and effective technique and can to be used more widely for unilateral post thoracotomy pain relief.

Keywords: Bupivacaine, Thoracic epidural, Thoracic Paravertebral block, VAS.

INTRODUCTION

Pain following surgery is a universal phenomenon, yet it is often under estimated and under treated. Any post operative analgesia technique should meet three criteria viz; effectiveness, universal applicability and safety. Pain following thoracotomy is particularly severe as the surgery involves muscle-dividing incision of the chest wall, which moves during respiration[1,2]. The stretching of skin during deep inspiration and active exhalation results in severe pain; it results in hypoxemia, reduced lung volumes and capacities with impairment of ability to cough. Failure to expel sputum results in atelectasis and pneumonia. Pain can also result in cardiovascular stress like tachycardia, hypertension, and myocardial ischemia. Delayed ambulation may lead to deep vein thrombosis and consequently thromboembolic phenomenon.

The proper control of post thoracotomy pain in addition to providing comfort to the patient, facilitates chest physiotherapy, effective expectoration and early ambulation. Moreover, it reduces cardiovascular stress to the optimum level. Although currently various methods of post thoracotomy pain relief are available, none has matched the requirement of an effective pain relief technique.

Regional techniques have received much attention because they are associated with less sedation and early ambulation with preservation of lung functions[3,4]. Thoracic epidural analgesia is the gold standard for relief of post thoracotomy pain and is routinely employed, although there are many other modalities[3,5]. Paravertebral analgesia has been rediscovered and redefined. Paravertebral blocks have shown great promise and it has been demonstrated that they can be performed effectively and safely and prolonged pain relief can be provided[6].

Studies have demonstrated that a unilateral block may have less effect on circulation and breathing. Paravertebral blocks are technically easier to perform with relatively lesser complications like haemodynamic instability and spinal cord injury[7]. The purpose of this study was to compare thoracic epidural and paravertebral block in terms of their effectiveness and hypotension in post thoracotomy pain relief.

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PATIENTS AND METHODS

These randomized control trails were conducted in the Department of Anesthesiology, CMH Rawalpindi, from Jan 2007 to Dec 2007. One hundred patients were divided into two equal groups randomly, group A-Epidural and group B-paravertebral.

Inclusion Criterion:

- Patients of both the genders, aged 15 to 70 years, weight 40–80 kg.
- Patients with ASA grade I, II and III.
- Patients willing to co-operate.

Exclusion Criterion:

- Patients with history of neuropathies, psychiatric illnesses or deformities of vertebral column.
- Patients with local infection, systemic sepsis and coagulopathy.
- Patients with allergy to amide type local anaesthetics.

Procedure:

The study was conducted after approval from the Hospital Ethics Committee and all the data was collected after the informed consent of the patients. Patients were randomly divided into two groups by using random number table. Group A (patients receiving thoracic epidural analgesia) and group B (patients receiving paravertebral block) and visual analog scale was explained to the patients pre-operatively.

After shifting the patients to the induction room, ECG, pulse oximeter and non-invasive blood pressure monitors were attached. Venous line was established with a 16G intravenous cannula. Patients were given balanced endotracheal anaesthesia. Intra-operative problems like hypotension, arrhythmias, etc; were managed appropriately. After the surgical procedure was completed patients' blood pressure and heart rate were noted. These values were considered as the baseline values for the further haemodynamic monitoring and manipulations.

Before start of the surgery, each was put in the lateral position. The back was prepared with povidine iodine and draped with sterile towels. In group "A", under strict aseptic precautions thoracic epidural was performed using a 16 gauge epidural needle by a median/paramedian approach. The epidural space was identified by the loss of resistance technique. In group "B", the skin was punctured approximately 3 cm from the midline and the level with the cephalad end of the spinous process. The needle was then advanced at 90^0 to skin in all planes to strike the transverse process of the head of the rib at a depth of approximately 2.5 to 3.5 cm. The needle was then walked over the top of the transverse process of the rib. Loss of resistance was used to identify the paravertebral space as the needle passed through the costotransverse ligament. Epidural or paravertebral catheter was placed at T5-T7 level and 03 ml of Lignocaine 02% with adrenaline was given as test dose. Eight milliliters of 0.25% Bupivacaine was given at the end of the surgery before extubation. After skin closure, patients were turned supine and ventilation was assisted until patients had spontaneous respiratory attempts. They were later reversed with pyrrolate-N and extubated after adequate reversal.

Effectiveness of the block was measured by Visual Analog Scoring (VAS) 30 min after giving the dose, next dose was offered on patient's demand but not before 01 hour of previous dose. Study was conducted in first 24 hrs after surgery. VAS for pain, extubation and ambulation time was recorded. Hypotension was defined as 30% fall in the systolic pressure from baseline pressure. Procedure was considered as a failure, if there was unsatisfactory post operative analgesia with a VAS score greater than 4 at the first assessment.

All patients were kept in the post-operative recovery room for about an hour after the blockade with the same monitoring before shifting the patients to the post-operative intensive care units. Patient's blood pressure, pulse rate and oxygen saturation were noted every 10 minutes for the initial one hour of blockade.

All the information i.e., VAS for pain, extubation, ambulation time and hypotension

were recorded and collected through a proforma. Data was analysed using Statistical Package for Social Sciences (SPSS) version 10.0.

Mean and standard deviation was calculated for age and weight. Frequencies were calculated for gender, hypotension, extubation (early, late), ambulation (early, late) and pain score (>4 and <4).

Both groups were compared by "chi-square test" for extubation, ambulation, hypotension and category of pain score. *p* value <0.05 was considered statistically significant.

RESULTS

The mean age group in group A was 39.56±16.96 years and in group B was 41.76±17.88 years. The mean weights in group A and B were 65.22±9.88 kgs and 66.26±9.60 kgs respectively.

In group A there were 34 males and 16 females. In group B there were 39 males and 11 females. Both the groups were compareable with respect to age (p=0.599), weight (p=0.546) and gender (p=0.435).

ASA status of patients in both the groups was comparable (p=0.411). In group 'A' there were 33 ASA-II and 17 ASA-III patients. In group 'B' there was 37 ASA-II and 13 ASA-III patients.

Pain relief as measured by VAS at 30 minutes interval after each dose in first 24 hrs after the procedure wa <4 in 84% patients in group 'A' and 90 % patients in group 'B'. The overall failure rate was 16% in group A and 10% in group B (p>0.05).

Extubation was early in 86% patients in group 'A' and 84% in group 'B' (p>0.05).

Ambulation was early in 86% patients in group 'A' and 82% in group 'B' (p>0.05).

Hypotension occurred in 42% (21 patients) in group 'A' and 04% (02 patients) in group 'B' (p<0.001). Both patients were those who had vascular puncture. But in these two patients the block could be performed in adjacent spaces.

DISCUSSION

An apparently simple but largely unsolved problem which challenges the competence of all anaesthesiologists is the reliable and effective relief of post thoracotomy pain. In addition to human factor, development in the modalities to provide effective pain relief has improved patient's prognosis.

Post thoracotomy pain is morbidly severe and is exaggerated by movement especially deep breathing and coughing and is less amenable to treatment with opioids. The chest wall cannot be immobilized to control this pain rather it has to be kept in constant vigorous motion to get rid of secretions; otherwise it can lead to considerable morbidity such as deep vein thrombosis and pulmonary embolism, muscle weakness and loss of postural stability. The avoidance of deep breathing truncal movement and coughing as a result of thoracic pain may lead to a decreased functional residual capacity, increased airway closure and hypoxemia, segmental or lobar pulmonary collapse, retention of secretion and bronchopneumonia.

As the pain after thoracotomy is 'neurogenic' due to damaged intercostal nerves and central hyperexcitability, known to be poorly sensitive to opioids and reliance on these drugs has detrimental effects as respiratory depression, hypoxia and long term drug dependence. The logical choices therefore are regional analgesia techniques and amongst these, thoracic epidural analgesia is considered by many the gold standard for post thoracotomy pain relief but it has its own complications. In this study we compared thoracic epidural with thoracic paravertebral block for post thoracotomy pain control.

The pain relief as assessed by VAS in both the groups was comparable and did not show statistically significant difference, reflecting that both techniques offer almost equal amount of pain relief. When effective there was no statistically significant difference in extubation and ambulation time. These results are quite similar and consistent with the studies of Mathew et al and Bimston et al where 8 ml of bupivacaine was injected epidurally at T5–T6 interspace and paravertebrally, they found that both methods provide adequate post operative

analgesia[8,9]. Effective concentrations of bupivacaine that would optimize pain relief and minimize side effects were found to be 0.125% to 0.375%. Sebanathan et al. claimed better pain relief and pulmonary function with 0.25% bupivacaine compared with placebo after thoracotomy[10].

The VAS of 4 or less in group 'A' was 84% and in group 'B' was 90% in first 24 hours, measured at 30 minutes intervals after each dose. These results concur with the studies of Perttunen, who also showed no significant difference in analgesia by VAS recorded over different time intervals up to 24 hours[11]. Mehta et al observed lower VAS score at 2, 6, 8 and 12 hours following epidural 08 ml of 0.25% bupivacaine[12].

Unsatisfactory post operative analgesia with a VAS score 5 and more or a request for pain relief in the recovery room or late ambulation due to pain were labeled as failed blocks. The overall failure rate in group A was 16 %(8 patients) and in group B it was 10% (5 patients), which compares with the failure rate of 10% with Lonnquvist et al for paravertebral block[13]. Inability to identify the space was the reason for failure in group B.

The incidence of hypotension that is more than 30% drop in baseline blood pressure was recorded 42% (21 patients) in group 'A' and 04% (02 patients) in group 'B'. The significant incidence of hypotension in thoracic epidural group compared to thoracic paravertebral group concurs with the study of Mathews et al, whereas Lonnquvist et al found a 4.6% incidence of hypotension following thoracic paravertebral block[13]. Mehta et al found no significant difference in hemodynamic parameters in thoracic epidural group[14]. The paravertebral block produces predominantly unilateral sympathetic blockade compared to bilateral sympathetic blockade after thoracic epidural block. This explains the occurrence of hypotension between the two groups. In this study, there was no significant change with respect to heart rate and oxygen saturation between the 2 groups. This concurs with studies of Mathews et al and Perttunen et al[8,9].

Vascular puncture was encountered in 02 patients of TPVB during the procedure but catheter was successfully placed in another space. The rich vascularisation of paravertebral space is the reason for vascular punctures.

Pneumothorax was not a problem in our study because all our patients had intercostal chest drainage post operatively. This concurs with the study of Perttunen et al and Mehta et al[9,12]. Similarly urinary retention was not a concern as all our patients remained catheterized in first 24 hours. Mathews et al reported incidence of urinary retention in the epidural group in their study.

Sabanathan et al reported improved respiratory function following thoracic paravertebral block[10]. According to Karmarkar et al, they found catheter insertion under direct vision in thoracic paravertebral space was an effective technique even in the smallest neonate without any complication[15]. Similarly dural puncture did not occur in any patient.

In paravertebral block the anaesthetic agent is delivered to most logical space through which runs the intercostal nerve as it exits intervertebral foramina, its dorsal primary ramus (supplying posterior spinal muscles and costovertebral ligament strained at thoracotomy), its collateral branch (supplying the parietal pleura) and the sympathetic afferents on that side (supplying the visceral pleura). Thus paravertebral block is the most appropriate technique for effective pain relief after unilateral thoracotomies especially when we consider safety of the procedure and avoidance of complications.

CONCLUSION

Both thoracic epidural block and thoracic paravertebral block provide effective postoperative analgesia following thoracotomy. However in paravertebral block hypotension is much less compared to thoracic epidural block.

Paravertebral block is therefore a safe and effective technique and deserves to be used more widely for unilateral post thoracotomy pain relief.

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