Original Research Article

Clinical outcome of pain management in paravertebral block and continuous intercostal nerve block for post-thoracotomy pain

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International Archives of Integrated Medicine, Vol. 6, Issue 3, March, 2019.

Available online at http://iaimjournal.com/
ISSN: 2394-0026 (P) **ISSN: 2394-0034 (O)**
Received on: 18-02-2019 **Accepted on:** 23-02-2019
Source of support: Nil **Conflict of interest:** None declared.
How to cite this article: Pon. A. Rajarajan. Clinical outcome of pain management in paravertebral block and continuous intercostal nerve block for post-thoracotomy pain. IAIM, 2019; 6(3): 99-104.

Abstract

Introduction: Thoracic epidural analgesia has greatly improved the pain experience and its consequences and has been considered the 'gold standard' for pain management after thoracotomy. This view has recently been challenged by the use of paravertebral nerve blocks. Nevertheless, severe ipsilateral shoulder pain and the prevention of post-thoracotomy pain syndrome remain the most important challenges for post-thoracotomy pain management.

Aim of the study: To compare paravertebral block and continuous intercostal nerve block after thoracotomy.

Materials and methods: Fifty adult patients undergoing elective posterolateral thoracotomy were randomized to receive either a continuous intercostal nerve blockade or a paravertebral block. Opioid consumption and postoperative pain were assessed for 48 hours. Pulmonary function was assessed by forced expiratory volume in 1 s (FEV1) recorded at 4 hours intervals.

Results: With respect to the objective visual assessment (vas), both techniques were effective for post-thoracotomy pain. The average vas score at rest was 29±10 mm for paravertebral block and 31.5±11 mm for continuous intercostal nerve block. The average vas score on coughing was 36±14mm for the first one and 4 ±14 mm for the second group.

Conclusion: Thoracic epidural analgesia or nerve blocks are so far considered as the best option but one needs to consider personnel and equipment resources available. A combination of local anesthetics along with opioids can be given to reduce the agony of the patient and early discharge from the hospital.

Key words

Paravertebral Block, Continuous Intercostal Nerve Block, Forced Expiratory Volume In 1 S (FEV1), Visual Assessment Score.

Introduction

Post-thoracotomy pain is frequent and associated with considerable complications. Severe postoperative pain, in general, impairs postoperative patient mobilization, increases perioperative morbidity, and potentially triggers a chronic pain syndrome with an incidence, dependent on the analgesic regimen, ranging from 21 to 61% [1]. Post-thoracotomy pain, in particular, will adversely affect pulmonary function by impairing deep breathing and effective coughing, resulting in retention of secretions, atelectasis, and pneumonia [2]. Despite these findings, the impact and the functional relevance of aggressive, optimized analgesia on patient outcome remain unclear [3]. Post-thoracotomy pain can be acute (up to 30 days) and chronic (2-6 months) pain after surgery. Pre-emptive analgesia with adequate intra and postoperative analgesia is the best approach in the prevention of both acute and chronic pain in a thoracotomy patient [4]. Among various approaches to analgesia; a multimodal approach is probably the most effective. In post-thoracotomy patients, analgesia can be administered as boluses or continuous infusion with pharmacokinetic and patient-controlled systems like PCA (Patient Controlled Analgesia) Target Control Infusion (TCI) and a new approach of PMA (Patient Maintained Analgesia) [5]. A continuous infusion with initial bolus results in rising blood concentrations with time and requires repeated adjustment of the infusion rate. This is overcome by Target-Controlled Infusion (TCI) where the administration is driven by microprocessor-controlled algorithms based on pharmacokinetic models. The main advantage of intravenous PCA is that it takes into consideration the different subjective pain sensitivities of each patient [6].

Materials and methods

Totally 50 patients were included in the study. The study was conducted in the Department of Cardiothoracic Surgery, Government Mohan Kumaramangalam Medical College Hospital, from 2016-2017. Elective poster lateral thoracotomy was randomized to receive either a continuous intercostal nerve blockade or a paravertebral block. Opioid consumption and postoperative pain were assessed for 48 hours. Pulmonary function was assessed by forced expiratory volume in 1 s (FEV1) recorded at 4 hours intervals. Exclusion criteria were: lack of patient consent, inability to comprehend pain scale, localized or systemic sepsis, contraindications to regional techniques, need for an additional incision (e.g. laparotomy), coagulopathy or metabolic diseases. Patients in whom the pleura had to be sacrificed were also excluded. Preoperatively, patients were trained for visual analog scale (VAS) and patient-controlled analgesia. Premedication consisted of 1 mg/Kg hydroxyzine administered orally 90 minutes before the intervention. General anesthesia was induced with 3–5 mg/kg thiopental and 2–3 g/kg fentanyl, double-lumen endotracheal intubation was facilitated by 0.5 mg/kg atracurium, and lungs were mechanically ventilated. Anesthesia was maintained with fentanyl at the rate of 1g/kg every 30 minutes, halothane (0.6–1 minimum alveolar anesthetic concentration) and a mixture of air-oxygen (50/50), and muscle relaxation was maintained with additional doses of atracurium.

Results

With respect to the objective visual assessment (VAS), both techniques were effective for post-thoracotomy pain (**Table – 1**).

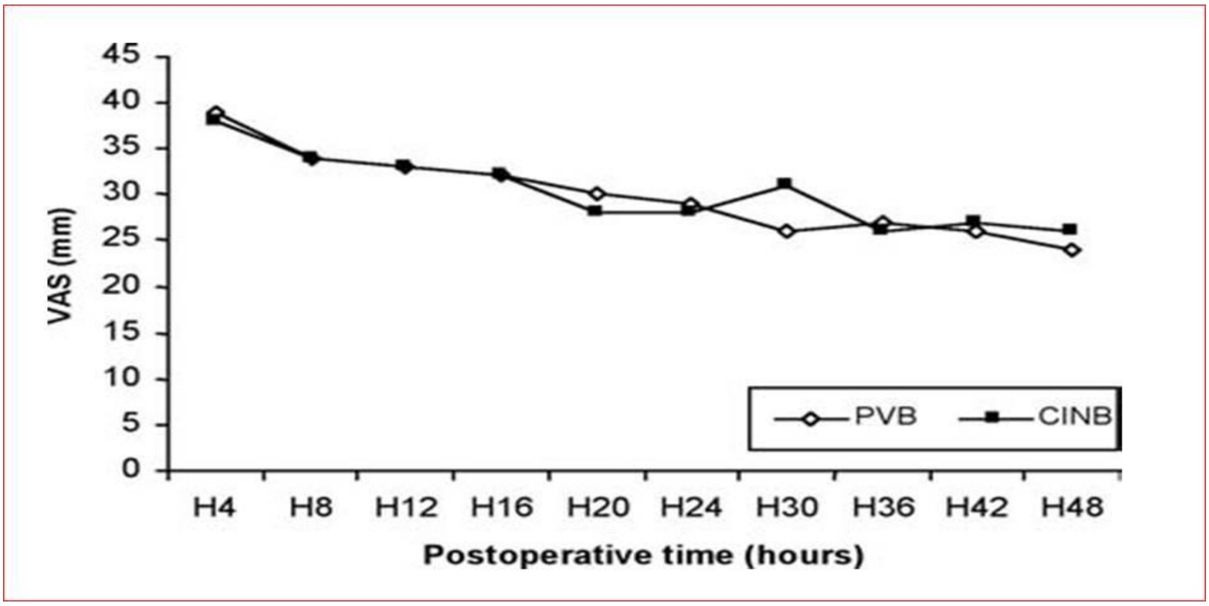
VAS scores on coughing were lower in the paravertebral block group with the difference being significantly lower at 42 and 48 H (**Graph – 1, 2**).

Table - 1: Patients distribution.

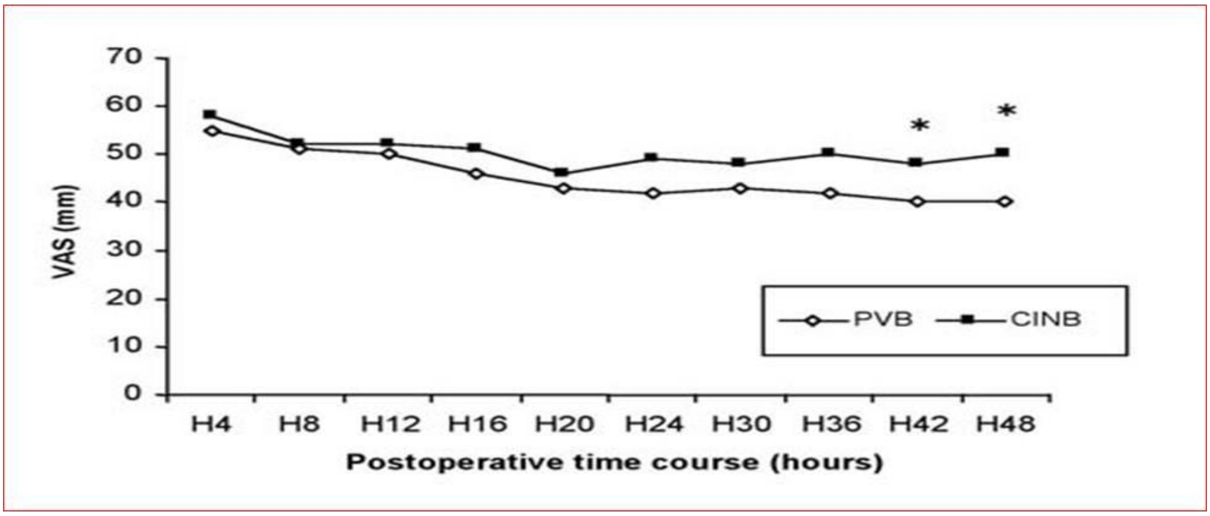
Characteristics	PVB (n=25)	CINB (n=25)
Age (years)	43±13	47±15
Preoperative diseases Chronic obstructive pulmonary disease Diabetes Arterial hypertension	9 4 2	5 5 5
Patient ASA status (II/III)	15/8	15/9

PVB: Paravertebral block; **CINB:** Continuous intercostal nerve block Values are mean ±SD or absolute numbers. No statistical difference between the two groups.

Graph – 1: Time course of post-operative visual analogue pain scores at rest. No statistical difference between the two groups.

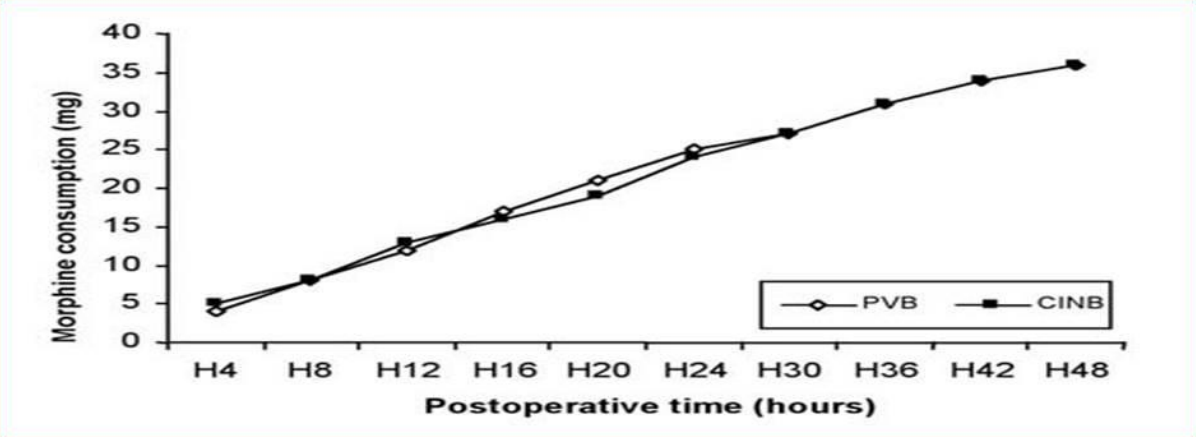


Graph - 2: Time course of postoperative visual analogue pain scores on coughing.

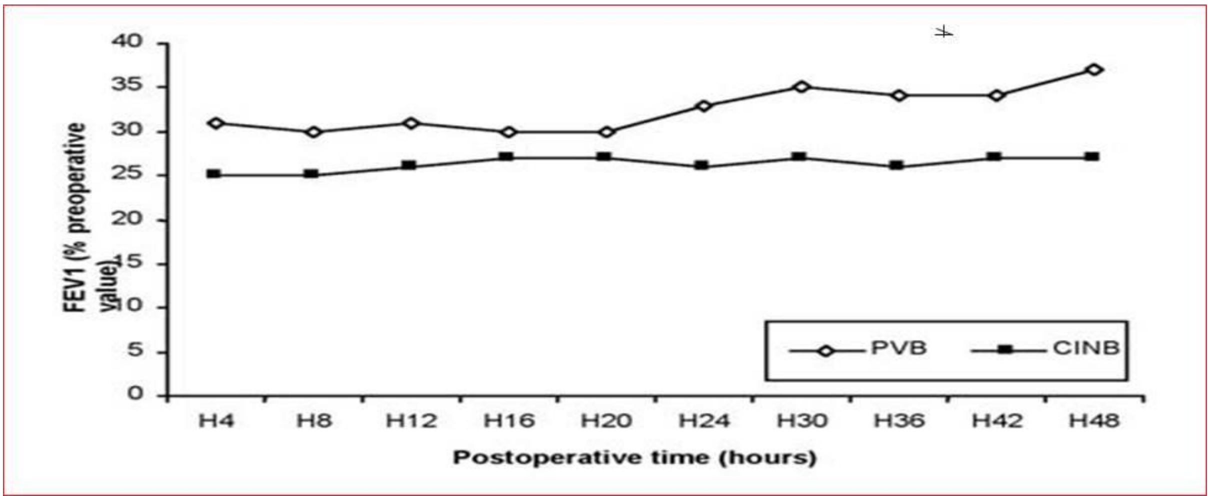


Cumulative morphine consumption was lower in the paravertebral block group during the study period but did not reach the statistical significance (35.7 ±17 vs 41 ±21 mg) as per **Graph – 3**. Time courses of forced expiratory volume in 1 second (fev1) expressed as percentages of the preoperative value was as per **Graph – 4**.

Graph - 3: Cumulative morphine consumption in the two groups. No statistical difference between the two groups.



Graph – 4: Time courses of forced expiratory volume in 1 second (fev1) expressed as percentages of the preoperative value. Asterisks (*) denote a significant difference between the groups (p < 0.05).



Discussion

The paravertebral block generally has a low incidence of adverse effects. In a multiple-centered, prospective study, Lönnqvist, et al. found an overall failure rate of 10.1%. The frequency of complication was: hypotension 4.6%; vascular puncture 3.8%; pleural puncture 1.1%; and pneumothorax 0.5% [7]. 21 Some cases of total spinal block 27 and a post-puncture headache 23 have been described. In our study, no complication has been noted. Furthermore, extrapleural adhesions and scar tissue following a previous thoracotomy can make paravertebral space location more difficult. In our study, the insertion of the catheter was possible in all patients [8]. Because of these complications and techniques difficulties, the continuous intercostal nerve block has been considered in our institution as a further option. The blockage of intercostal nerves interrupts C-fibers afferent transmission to impulse to the spinal cord. A single intercostal injection of local anesthetic can provide analgesia for up to 6 hours [9]. 24 To achieve a longer duration of analgesia and to obtain multiple dermatomes analgesia, a continuous extrapleural intercostal nerve block has been developed by Sabanathan [11]. In our study, it was possible to insert the catheter in all the cases except in one patient who had kyphoscoliosis. There was no complication related directly to catheter insertion, which is in agreement with the previous study. Continuous intercostal nerve block analgesia is by direct penetration of local anesthetic into the intercostal nerve. It could be expected that the rami communicantes or the dorsal ramus are not blocked [12]. Lavand'homme, et al. have reported back or shoulder pain in patients who had intercostal nerve block for pain after postero-lateral thoracotomy probably because of failure to block these structures [13]. In our study, pain scores at rest were similar in the two groups; however, pain scores on coughing were lower in the paravertebral group with the difference being significant at 42 and 48 hours. Opiate requirements were similar in the two groups. No patient had back or shoulder pain. Both lumbar and thoracic epidural catheters can be used for postoperative thoracotomy pain management [14]. Despite the theoretical advantage of delivering smaller amounts of drug to provide analgesia along thoracic dermatomes only, the superiority of thoracic epidural analgesia over lumbar epidural analgesia has been called into question [15]. In their meta-analysis of eight studies comparing thoracic versus lumbar epidural opioid administration in thoracotomy patients, Ballantyne and associates found few positive findings. Guinard and associates found that thoracic epidural analgesia improved pulmonary function and shortened hospital stay without differences in the quality of analgesia. In other studies, no significant differences in analgesia and pulmonary function were seen; however, less opioid was required in patients receiving thoracic epidural analgesia [[16]. Grant and associates found that patients receiving thoracic epidural morphine required less morphine than patients receiving lumbar epidural morphine to attain similar degrees of analgesia without any intergroup differences in postoperative pulmonary function [17]. Sabanathan S et.al found no differences in pain scores or the incidence of side effects when administering fentanyl through thoracic or lumbar epidural catheters, but patients in the lumbar epidural group required a higher infusion rate [18]. In another study, thoracic epidural analgesia was associated with an increased incidence of ventilatory depression. As a result of limited evidence confirming the benefits of thoracic versus lumbar epidural analgesia, some authors have expressed caution in using thoracic epidural analgesia on a routine basis [19, 20].

Conclusion

Thoracic epidural analgesia or nerve blocks are so far considered as the best option but one needs to consider personnel and equipment resources available. A combination of local anesthetics along with opioids can be given to reduce the agony of the patient and early discharge from the hospital.

Acknowledgments

Authors would like to thank the Cardiothoracic Surgery Department Faculty, Govt. Mohan Kumaramangalam Medical College, Salem for their humble support to complete the research work.

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