Original research article

Pre-emptive intercostal nerve block effect on video-assisted thoracic lobectomy Patients recovery

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Abstract

Background and Objectives: It is questionable if pre-emptive intercostal nerve block (pre-ICNB) or post-ICNB has the same analgesic effects. For patients undergoing video-assisted thoracic surgery (VATS), the purpose of study is to assess the effectiveness of pre-emptive ICNB on perioperative outcomes.

Method: This study had an open-label, randomised design. The eligible patients scheduled for lobectomy for lung cancer were assigned to either the pre-ICNB group or the post-ICNB group. The present study involved the observation of postoperative pain assessment, patient rehabilitation, and opioid utilisation.

Result: The patient count was 86. Compared to the post-ICNB group, the pre-ICNB group had less concurrent hypertension (P = 0.023), less morphine MME use (P = 0.016), and faster extubation (P = 0.019). The pre-ICNB group had identical Bruggrmann Comfort Scale (BCS) scores in the postoperative 6 h, 12 h, 24 h, and 48 h ($p > 0.05$) and dynamic pain Numeric Rating Scale (NRS) scores in the PACU. The pre-ICNB and post-ICNB groups had identical Mini-mental state examination (MMSE) and Ramsay test outcomes, except for the postoperative 6-hour results (P = 0.048 and P = 0.019, respectively). After 1 month, pain assessment was similar to the ICBN group ($p > 0.05$).

Conclusion: Pre-ICNB reduces intra-operative opioid consumption, speeding PACU recovery, and manages perioperative pain as well as post-ICNB.

Keywords: Thoracic lobectomy, pre-emptive intercostal nerve block, anaesthesia, opioids

Introduction

Following video-assisted thoracic surgery (VATS), the level of postoperative discomfort continues to be considered moderate to severe. There exists a divergence of opinions regarding the most effective strategy to treating it. Local anaesthesia is an essential element of the VATS surgical analgesic regimen, and therefore, it is recommended that all patients have it [1, 2, 3].

The utilisation of thoracic epidural blockade (TEB), paravertebral blockade (PVB), serratus anterior plane block (SAPB), and intercostal nerve block and intravenous continuous nerve block as analgesic interventions in thoracic surgery has been widely postulated. Moreover, in cases when Transversus Abdominis Plane (TEB) or Paravertebral Block (PVB) procedures have not been performed, intercostal nerve block and intravenous continuous nerve block are said to be an alternative option that can be used alongside patient-controlled analgesia (PCA) therapy. However, it is commonly observed that a significant proportion of local analgesics are typically granted approval for postoperative usage by surgeons. The therapeutic approach of anti-nociceptive therapy encompasses the utilisation of pre-emptive analgesia. The aforementioned phenomenon has the potential to impede the modification of the afferent pathway, hence exacerbating postoperative pain. Crile introduced the concept of preemptive analgesia in the early 1900s, drawing from clinical observations. This approach aims to prevent intraoperative nociception and the formation of painful scars by addressing physiological changes that contribute to central sensitization and the amplification of pain signals [4, 5, 6]. Hence, the administration of preoperative local anaesthetic may yield more efficacy in mitigating surgical discomfort compared to the administration of postoperative local anaesthesia. Limited research has been conducted to assess the effects of pre- and post-intercostal nerve block and intravenous continuous nerve block on acute thoracic surgery (ATS). Additionally, several investigations have yielded contradictory results about the effectiveness, or lack thereof, of pre-emptive analgesia in managing post-thoracotomy pain syndrome (PTPS).

The study investigated the efficacy of pre-emptive intercostal nerve block and intravenous continuous nerve block in combination with intravenous patient-controlled analgesia (PCA) as a multimodal analgesic approach for patients undergoing thoracoscopic lobectomy. The outcomes assessed included postoperative pain scores, rehabilitation progress, intraoperative opioid usage, and the occurrence of early postoperative chronic pain, as reported in previous studies [7, 8, 9].

Material and Method

The present study represented a single-center prospective randomised controlled trial that was carried out in accordance with the guidelines of the Declaration of Helsinki. Patients between the ages of 18 and 70 who were diagnosed with lung cancer underwent elective anatomic lobectomy using video-assisted thoracoscopic surgery (VATS) from July 2022 to June 2023 and at Department of Cardiothoracic and Vascular Surgery, Guntur Medical College, Guntur, Andhra Pradesh, India. Based on the random identification (ID), the patients were categorised into two distinct groups: Group pre-ICNB, which received intercostal nerve block prior to lung resection, and Group post-ICNB, which received intercostal nerve block after the surgical procedure. The concealment of randomization was implemented to ensure that neither the patients, the researchers responsible for the postoperative follow-up, nor the statisticians involved in the study were aware of the randomization process.

Exclusion criteria

Alcoholism, chronic narcotic use, fibromyalgia, preoperative analgesics or sedatives, cardiac dysfunction (ejection fraction 50%), conversion to open thoracotomy, and serious surgery are all risk factors for complications during thoracic surgery.

Result

There were a total of 86 patients analysed; 40 were classified as pre-ICNB and 46 as post-ICNB. Incomplete clinical data of pulmonary function tests and loss of follow-up for 1 month following surgery led to the exclusion of 2 patients from the pre-ICNB group. Age, body mass index, gender, right-to-left systolic ratio, left ventricular ejection fraction, pulmonary function test scores, surgical site, tumour size, and location of removal were all comparable. Hypertension comorbidity was lower in the pre-ICNB group than in the post-ICNB group (P = 0.023).

Patients who underwent ICNB before 2008 were given lower doses of MMEs (83.0 vs. 101.67 mg), propofol (628 vs. 712 ugs), Dexmedetomidine (56.29 vs. 58.49 ugs), midazolam (2.86 vs. 2.84 mg), and cisatracurium (19.95 vs. 28.4 ugs). Both the duration of surgery (101.84 vs. 109.49 minutes, P = 0.284) and the duration of anaesthesia (177.89 vs. 182.37 minutes, P = 0.600) were same among groups.

Table 1: Frequency of nausea and vomiting

Variable	Pre-ICNB group (n = 40)	Post-ICNB group (n = 46)	*P* value
Post-op 6 h (n, %)			0.800
No	32 (80%)	38 (82.6%)	
Yes	8 (17.39%)	8 (17.39%)	
Post-op 12 h (n, %)			0.800
No	31 (77.5%)	37 (80.43%)	
Yes	9 (22.5%)	9 (19.56%)	
Post-op 24 h (n, %)			0.491
No	35 (87.5%)	40 (86.9%)	
Yes	5 (12.5%)	6 (13.04%)	
Post-op 48 h (n, %)			0.099
No	40 (100%)	41 (89.13%)	
Yes	0	5 (10.86%)	
Post-op, Post operative			

Table 2: The assessment of pain 1 m follow-up visits following surgery

Variable	Pre-ICNB group (n = 40)	Post-ICNB Group (n = 46)	P value
Type of pain (n, %)	16 (40%)	23 (50%)	0.278
None	3 (7.5%)	4 (8.69%)	
Dull pain	7 (17.5%)	6 (13.04%)	
Traction pain	14 (35%)	11 (23.09%)	
Pain at rest Pressing pain	0	2 (4.3%)	
Oral analgesics (n, %)	37 (92.5%)	43 (93.4%)	0.900
No Yes	3 (7.5%)	3 (6.5%)	
NRS of dynamic pain (n, %)	22 (55%)	28 (60.8%)	0.488
≤ 3	17 (42.5%)	18 (39.1%)	
4–6 ≥ 7	1 (2.5%)	2 (4.3%)	
Impact of pain on daily life (n, %)	36 (90%)	42 (91.3%)	0.851

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None	2 (5%)	4 (8.69%)	
Slight	2 (5%)	0	

Table 3: MMEs and surgical recovery are contrasted

Variable	Pre-ICNB Group (n = 40)	Post-ICNB group (n = 46)	P value
MMEs (mg)	84.8±30.83	100.80±36.71	0.016
Duration of surgery (min)	101.84±25.37	109.49±36.54	0.284
Duration of anesthesia (time)	178.89±35.39	182.37±40.52	0.600
Extubation time (min)[b]	21 (15, 31.25)	28 (20, 35)	0.019
Concious time (min)[b]	11 (5, 13.25)	12 (5, 15)	0.391
Duration of PACU (min)	77.99±21.63	80.28±29.34	0.694
Remedial analgesia in the wards (n, %)			0.623
No	15 (37.5%)	18 (39%)	
Yes	25 (65.8%)	28 (60.5%)	
Frequency of pressing PCA[b]	4 (2, 7)	4 (2, 6)	0.614
Chest-tube duration (h)	41.59±12.38	42.86±9.35	0.617
Time to flatus (h)	17.68±8.45	15.88±8.26	0.351
Drinking time (h)	11.99±4.95	10.74±5.36	0.337
Postoperative ambulation time (h)	21.85±7.46	23.17±7.98	0.409
Day of discharge (h)	56.69±12.0	60.35±12.40	0.184

Discussion

In this study, the benefits of preemptive ICNB were compared to those of post-operative ICNB in patients undergoing VATS lobectomy. With the pre-ICNB method, the MME dosage might be lowered, facilitating an earlier extubation in the PACU. Postoperative pain NRS of dynamic pain and BCS scores were comparable between pre- and post-ICNB patients, and the patients recovered equally in the ward. Sedation assessment scores were similar between the pre-ICNB and post-ICNB groups, with the exception of the MMSE score and the incidence of fidgeting in the postoperative six hours. In addition, there was no evidence of long-term postoperative pain during the month of observation [10, 11].

Although VATS is safer, less anaesthetic is used, and recovery time is quicker than thoracotomy, there may be a strong correlation between the two in terms of postoperative discomfort. Adequate preoperative analgesia can reduce postoperative morbidity and mortality after thoracic surgery by reducing the occurrence of persistent discomfort. It is widely accepted that localised analgesic therapies are an important part of multimodal analgesia. Pain can be alleviated more effectively than with just systemic opioids, and they can help minimise opioid consumption, which helps to lessen opioid-related negative effects.

This finding suggests that the pre-ICNB practise of using much less intraoperative analgesic drugs contributed to earlier extubation in the PACU and a more rapid recovery. The results of this study are similar to those of Ponholzer's, who found that using ICNB before surgery reduced intraoperative opioid drug use by 22 percent. Limiting intraoperative analgesia has been shown to improve hemodynamic stability in older or difficult patients, lessen the likelihood of postoperative pneumonia and atelectasis in those undergoing thoracic surgery, and lessen the need for ICU hospitalisation [12, 13]. In addition, the negative effects of opioids used to manage postoperative pain and ways to reduce their use require particular consideration in light of the current surge of opioid use. Patient satisfaction and the rising cost of hospital medical services may be affected by pre-ICNB, which is an important phase of rehabilitation. Time spent recovering in the hospital after surgery, under anaesthesia, and recovering from surgery after ICNB implementation were all about the same. As a result, pre-ICNB may be preferable as a local analgesic alternative for pain control after VATS [14, 15].

Preventative ICNB has been shown to provide similar pain reduction during surgery as TEB. Surgeons typically accept the ICNB to block after the procedure due to the pharmacodynamics of local anaesthetics. Lidocaine and ropivacaine are commonly used to block intercostal nerves because of its ease of use and low cost. Blockages often only last between 6 and 8 hours. The preoperative block should take into account the anticipated duration of analgesia. Despite the study's limitations, it's possible that the pain relief provided by the pre-ICNB deployment method is comparable to that provided by the post-ICNB method. It led to comparable NRS scores of dynamic pain in the PACU, postoperative 6 to 48 h, and BCS scores in the postoperative 6 to 48 h, as well as comparable requirement for pushing the PCA pump and remedial therapy on the ward, as compared to those in the post-ICNB group. This proved that pre-ICNB can have the same analgesic impact as post-ICNB and can meet analgesic requirements for 48 hours after surgery. It might be argued that this is a better option than the post-ICNB. For the most benefit, thoracic surgeons should consider shifting to the preventative ICNB [16, 17].

Although TEB is generally effective in reducing pain, it can be difficult to implement, may take a while, and may even have undesirable effects. For this reason, the necessity of epidural anaesthesia for minimally invasive thoracoscopic surgery is still up for debate. In addition to ICNB, PVB, and serratus anterior plane blocks, there are more alternatives. The surgeon can perform VATS on the PVB, however

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there aren't many reports of this happening. The intercostal catheter is a novel and promising option for postoperative analgesia. Catheter infections and poor analgesia due to catheter displacement are still causes for concern, and using the technique takes some experience. Because there is no learning curve and no need for ultrasonography, ICNB procedures can be performed with ease by thoracic surgeons. It takes less than 5 minutes to complete under direct eyesight, and it doesn't lead to paravertebral analgesia or epidural anaesthesia from a hematoma, nerve injury, or pneumothorax. Compared to other types of blocks, such as TEB or PVB, ICNB has been shown to be less intrusive. ICNB may be better suited for ultimate minimally invasive sole-port thoracoscopic surgery compared to other pain control approaches that call for obviously invasive and complex procedures [18, 19].

We were able to block more drugs at once for the intercostal regions than anyone else. To begin, local blocks were performed at the manipulating and observation ports in addition to the intercostal nerve block to increase the analgesic effect. Furthermore, each coastline town is relatively little. If more of a drug is injected, it will likely leak out and have less of an effect. As a result, the volume injected into each intercostal space was often only 2–3 millilitres. In conclusion, although the operation ports are located at the 6th and 4th intercostal sites, there is a cross-link between the upper and lower intercostal nerves, and the visceral nerves of the lung have a broad range of innervation. Therefore, inhibiting a few intercostal nerves above or below the surgical ports will increase the analgesic effect. Medications used in the intercostal block were also unique compared to other results. Intercostal blocks with lidocaine and ropivacaine have been shown to reduce the need for initial increases in intravenous opioids and to preserve better hemodynamic stability [20, 21].

Chronic postoperative pain following thoracic surgery is common and potentially life-threatening. The incidence rates vary from 9-80% following thoracotomies and 5-33.3% following VATS. Using regional anaesthesia as a preventative analgesic can decrease the number of patients who experience persistent pain after surgery. Two of the earlier randomised controlled trials suggest that TEA can help prevent PTPS from occurring. Two multimodal therapy prospective randomised studies found that preemptive analgesia, which included intercostal nerve blocks, did not improve PTPS. There was no difference in pain characteristics, oral analgesic use, or quality of life scores between the pre- and post-ICNB groups at the 1-month follow-up of this trial. This result was similar to that shown with Ozyalcin, another medication used to evaluate PTPS at the one month mark. Chronic pain could be diagnosed sooner and confounding factors like amnesia, anxiety, and depression could be ruled out with a one-month follow-up. However, not all patients will meet the criteria for chronic pain following thoracotomy, which is commonly described as pain that recurs or persists for at least 2 months after the surgical surgery [21, 22].

Conclusion

When combined with PCA as multimodal analgesia, pre-emptive ICNB is an effective method for reducing opioid consumption and speeding up extubation in the PACU after VATS. Pre-emptive ICNB has the same pain alleviation and similar analgesic-related adverse effects as post-ICNB. Surgeons should consider modifying their routines to implement this simple and secure pre-emptive ICNB.

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