

The Effect of Erector Spinae Plane Block on Chronic Thoracic Pain

Dr Kifah Suhail Abed¹, Dr. lyad Abbas Salman²

¹MBChB, FIBMS (anesthesia and Intensive care), FIBMS (Pain Medicine Subspecialty), Specialist of Anesthesia and Pain Medicine, Women and children's teaching hospital, Samawah, Iraq

²MBChB, DA, FIBMS(anesthesia and Intensive care), CABA&IC, FIPP, Chairman of the Scientific Council of Anesthesia and Intensive Care, Baghdad, Iraq

Abstract: Background: Chronic thoracic pain is a debilitating condition and presents a challenge for clinicians in managing it with oral and topical medications. The erector spinae plane block, first introduced by Forero in 2016 as an interprosthesis closure in the management of chronic thoracic pain, offers promising solutions as part of a multidisciplinary approach for patients with chronic pain from various etiologies. Aim of the study: To investigate the effect of the erector spinae plane block in patients with chronic thoracic pain from various etiologies. Methods: An interventional study was conducted at the Pain Management Clinic of Ghazi Al-Hariri Specialized Surgery Hospital/Medical City, Baghdad, Iraq, over a 15-month period from September 1, 2018, to December 1, 2019. It included 30 patients with chronic thoracic pain who were scheduled for nerve-level closure of the erector spinae muscle to alleviate their pain. Patients were followed up by telephone for one week after each procedure and reviewed at the clinic two weeks later to assess response, the need for further injections, and adjustments to their pain management plan. The outcome measures included pain relief assessment using a numerical pain rating scale. Results: In this study, the most common pain type was burning (30%), followed by tingling or pins-and-needles (23.3%). Pain scores decreased significantly at all time points. Patients who used pain relief had more severe pain scores three days and one week after nerve block of the erector spinae muscle. There was a statistically significant correlation between gender and pain relief factors. Conclusion: Nerve block of the erector spinae muscle in chronic thoracic pain has proven effective in improving pain in these patients and establishes itself as a useful intervention when the success of conventional treatments is limited.

Keywords: Chronic pain, Erector spinae plane block, Pain Management

1. Introduction

Thoracic pain symptoms are relatively rare, comprising an estimated 5% of the patients referred to an outpatient pain clinic.¹ Thoracic pain symptoms are significant, but the number of publications on the etiology of thoracic pain is limited. Patients with thoracic pain should always be thoroughly examined because important underlying pathology could be the cause of the symptoms. Diagnoses such as angina pectoris, herpes zoster infection, thoracic disc herniations, pulmonary tumors or pleural tumors, and aneurysms can also give rise to prolonged thoracic pain of unknown origin.² Chronic thoracic pain after surgical interventions, such as thoracotomy, mastectomy, and coronary artery bypass surgery are relatively often the cause of thoracic pain³ Referred pain from internal organs often results in diffuse thoracic pain and can be caused by pulmonary embolisms, esophageal carcinoma, achalasia, or pancreatic diseases. The diagnosis in thoracic pain is difficult and often "spine related". The cause of this pain may come from the nerve endings of the periosteum, nervi intercostales, ligaments, intervertebral discs, and facet joints.⁴ Consequently, thoracic pain syndromes of spinal origin are commonly seen in medical practice, spinal osteoporotic fractures need to be ruled out in these patients These types of

pain are often nociceptive. Postoperative pain frequently appears after thoracotomies, sternotomies, and mastectomies; and often causes neuropathic pain.

Pain of the thoracic region is a frequently encountered complaint for specialists in pain management, often generated from disorders of the viscera contained within the thoracic cavity. Diagnosis of these syndromes is difficult because the vague quality of the visceral pain makes it difficult to distinguish visceral pain from a referred pain that may coexist.

The diagnostic dilemma is further complicated by the fact that efferent somatosensory and efferent visceral impulses of both the somatosensory and autonomic nervous systems impinge on the spinal cord at the same place, approximately within the levels of T1 to T7 (viscerosomatic convergence).

Acute angina (heart T1 to T4) may, therefore, be experienced as epigastric discomfort, left shoulder or arm pain, left chest pain, or right sided chest and arm pain. although many acute thoracic pain syndromes exist.

Table 1 lists some of the common acute pain states encountered in the thoracic region.⁵ Thoracic pain can be categorized as visceral, musculoskeletal, myofascial, neurogenic, and other.

Table 1: Common thoracic pain

Visceral	Musculoskeletal	Neurogenic	Miscellaneous
Thorax	Bony origin Rib/sternum	Herpes zoster Acute post herpetic Neuralgia	Vascular Angina Pulmonary infarct Aortic
Lung/Trachea ✓ Pneumonia ✓ Pleurisy ✓ Carcinoma (pan cost)	Costochondritis (Tietze's syndrome) Vertebrae Disk disease Facet syndrome Compression fracture: Osteoporosis (steroids) Degenerative joint disease Bone metastases		
Heart ✓ Myocarditis ✓ Mediastinitis ✓ Angina	Soft tissues Muscle ligaments Breast	Causalgia (CRPS) Post trauma post-surgery	Infectious diseases
Esophagus ✓ Carcinoma ✓ Esophagitis	Post trauma Post-surgery	Myelopathies Demyelination Spinal cord injury	Metastatic disease

The erector spinae plane block (ESPB) was firstly described in September 2016 by Forero et al⁶ in the context of chronic thoracic neuropathic pain and pain management during thoracoscopic surgery. The ESPB has emerged as a valuable regional anesthesia technique for a range of thoracic, abdominal, and other procedures.

It is an ultrasound-guided inter fascial plane block first described in 2016 to successfully treat severe thoracic neuropathic pain.⁶ In ESB, the local anesthetic is injected using ultrasound guidance superficial to a thoracic transverse process and deep to erector spinae muscle group. In 2017, ESB has been described in case reports in multiple clinical scenarios including to manage acute postoperative pain following elective laparoscopic enteral hernia repair, thoracic surgery, breast surgery with reconstruction and bariatric surgery.

Erector spinae block has also been used for management for rib fractures. Post thoracotomy pain syndrome and chronic shoulder pain.

Aim of study

To study the effect of erector spinae plane block in chronic thoracic pain patients that suffer from chronic pain due to different etiologies.

Patients and Methods

This was a cross sectional interventional experimental study that conducted in the Pain Management Clinic at Ghazi Al-Hariri surgical specialty hospital / Medical city, Baghdad, Iraq during a period of 15 months from 1st of September 2018 to 1st of December 2019.

Administrative approvals were granted from the Council of Iraqi Board of Anesthesia and Intensive care.

All patients were verbally informed about the study and they were asked the permission to be part of the study. All personal information was kept anonymous. Data were exclusively used for the sake of this study.

The study included 30 patients suffering from chronic thoracic pain and scheduled for erector spinae plane block to relieve pain. A detailed history was taken from each patient; a clinical examination was performed before medical intervention.

Exclusion criteria

- Patient refusal to participate.
- Hypersensitivity or allergic to local anesthesia.
- Infection in the region of the puncture site.
- History of coagulation disorder.
- Previous erector spinae plane block within one month.

After signing the informed consent, authorizing the procedure, insertion of the peripheral venous access # 22 gauge needle cannula in the right upper limb, and use of basic monitoring.

The patient is prone or lateral decubitus position or sitting depends on which is more comfortable to the patient.

Under sterile technique, the transverse process corresponding to level desired was identified through ultrasonography (General Electric machine) with a lineal 10 MHz transducer; the skin was infiltrated with 1% lidocaine, the 100 mm BRAUN block echogenic needle inserted using an in-plane, cranial-to-caudal approach to contact the bony shadow of the TP with the tip deep to the fascial plane of the erector spinae muscle.

The correct location of the needle tip is confirmed by injecting 0.5–1 cc of normal saline 0.9% and observing fluid spread elevating the erector spinae muscle off the tip of the TP. Once the fascial plane is recognized and after test aspiration and test injections, an injection of 15-20 mL total volume dilution for the hemithorax in the deep interfascial plane of the erector muscles of the spine was administered (0.5% lidocaine: methylprednisolone 40 mg).

The patients were assessed for pain using numerical pain rating scale (NRS) at the clinic thirty minutes after the block and then by mobile phone throughout a week period for the following time periods at six hours, one day, three days and one week to

be reviewed at the clinic two weeks later to evaluate the analgesic response as well as the need for further injections and modification to the overall analgesic plan.

Outcome measures included assessment of pain relief by numeric pain rating scale (NRS).

Data tabulation, input and coding was done by the use of IBM® SPSS® (Statistical Package for the Social Sciences) Statistics Version 23. Chi-square test was used to investigate the association between categorical variables. Normal distribution of numerical variables was tested by Anderson–Darling test, and for data they did not follow the normal distribution, Wilcoxon Signed Ranks Test was used to compared between baseline values of pain score and the following values at each timeline. Mann Whitney U test was used to test the difference between pain duration and pain scores according to gender and use of analgesia. P-value less than 0.05 was considered significant throughout data analysis.

2. Results

This study included thirty patients who had erector spine plane block for chronic thoracic pain, their mean age was 55.7 ± 13.41 years and 18 (60%) males.

Table 2: Distribution of the study group according to age and gender.

Variables		Number	%
Age	Mean	55.73	SD
	SD	13.41	
Gender	Male	18	60.0
	Female	12	40.0

There were no statistically significant association between past medical history or causes of pain with gender, as shown in Table (3).

Table 3: Distribution of past medical history and the cause of pain according to gender.

Variables		Male		Female		P-value
		No.	%	No.	%	
Hypertension	No	13	72.2	9	75.0	0.999*
	Yes	5	27.8	3	25.0	
Diabetes	No	14	77.8	9	75.0	0.999*
	Yes	4	22.2	3	25.0	
Malignancy	No	8	44.4	7	58.3	0.465
	Yes	10	55.6	5	41.7	
Herpes zoster	No	16	88.9	9	75.0	0.364*
	Yes	2	11.1	3	25.0	
Cause of pain	Malignancy	10	55.6	5	41.7	0.999*
	Spine surgery/disc prolapse	6	33.3	2	16.7	
	PHN	2	11.1	5	41.7	

Chi-square test, *: Fisher exact test

There were statistically significant differences between baseline pain score and each of the following scores done at different timelines, as shown in Table (4), and Figure (1).

Table 4: Comparison between baseline pain score and each time interval.

Time	Pain score		P-value compared to baseline
	Mean	SD	
Baseline	9.43	1.14	-
At 30 minutes	2.83	2.27	<0.001
At 6 hours	2.17	2.14	<0.001
At 1 day	2.52	2.12	<0.001
At 3 days	3.45	2.40	<0.001
At 1 week	4.00	2.83	<0.001

Wilcoxon Signed Ranks Test

Figure 1: Illustrated that pain scores significantly decreased (P-value < 0.001) after erector spine plane block at all-time intervals.

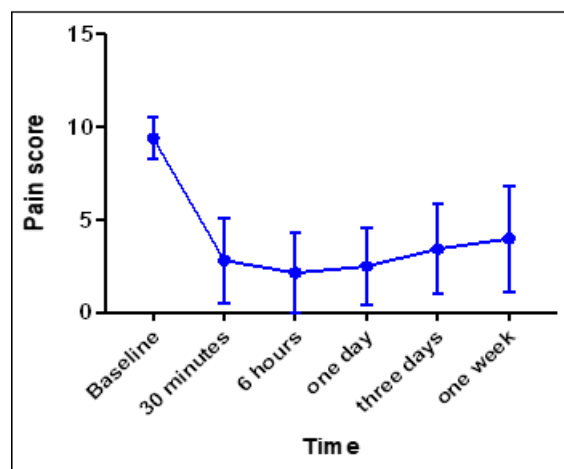


Figure 1: Distribution of mean pain scores levels according to time of intervention.

The mean duration of pain had no statically significant difference between genders, in addition the pain scores before and after the block showed so statically significant differences between genders, as shown in Table (5) and Figure (2).

Table 5: Distribution of pain criteria according to genders

Variables	Male		Female		P-value
	Mean	SD	Mean	SD	
Duration of pain in months	2.74	10.17	2.75	12.85	0.305
Severity of pain	9.33	1.328	9.58	0.793	0.851
Pain scores					
Thirty min	2.78	2.439	2.91	2.071	0.707
Six hrs.	2.00	2.058	2.45	2.339	0.580
One day	2.50	2.007	2.55	2.382	0.947
Three days	3.67	1.940	3.09	3.081	0.550
One week	4.00	2.196	4.00	3.768	0.947

Mann Whitney U test, *: Significant (P- Value < 0.05)

Figure 2 shows that the most frequent nature of pain was burning sensation (30%), followed by pricking needle sensation (23.3%), and 13.3% for both sudden electric shock and pain on application of cold or heat.

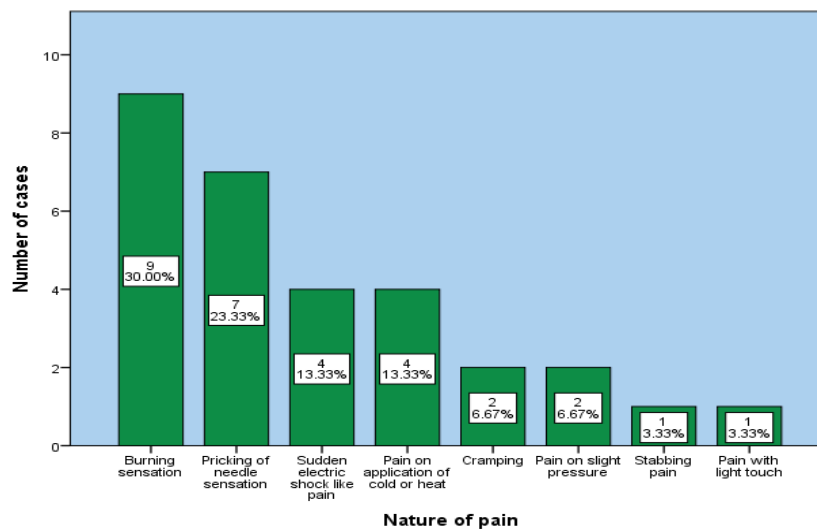


Figure 2: Nature of pain

Patients who used analgesia had significantly more severe pain scores three days and one week after erector spinae plane block, while other variables showed no statistically significant difference between the two groups, as shown in Table (6).

Table 6: Distribution of pain criteria according to use of analgesia

Variables	No analgesic used		Under analgesia		P-value
	Mean	SD	Mean	SD	
Duration of pain in months	5.05	8.67	7.55	10.19	0.353
Severity of pain	9.27	1.28	9.88	0.354	0.226
Pain scores					
Thirty min	2.71	2.15	3.13	2.69	0.805
Six hrs.	2.05	1.96	2.50	2.67	0.746
One day	2.10	1.97	3.63	2.20	0.100
Three days	2.71	2.00	5.38	2.39	0.010*
One week	3.05	2.56	6.50	1.85	0.002*
Mann Whitney U test, *: significant (p-value <0.05)					

3. Discussion

Our study included thirty patients suffering from chronic thoracic pain caused by different etiologies including post-surgical chronic pain syndrome, cancer pain, post herpetic neuralgia and others, those patients tried different treatment modalities and it were not satisfactory, probably because pain management should be customized individually according to each patient, and typically involves a multidisciplinary approach involving systemic analgesics, undergoing interventional techniques, and coordinating additional care like physio-therapy, psycho-therapy and post procedural rehabilitation.⁷

Erector spinae plane (ESP) block was used for patients and they had significant improvement in their pain scores 30-min after the block and extended for the one-week endpoint of this study. This was in comparison to results of Tulgar et al in Turkey (2019) who investigated 180 patients whom undergone ESP for different indications, and five of them had chronic pain, and

their pain scores decreased from 7.11 to 1.22 at the first hour, and 2.0 at the third day after the procedure⁸, they used LA included 0.4%-0.5% lidocaine in addition to bupivacaine and used as part of a multimodal analgesia plan. Although ESP block is a novel procedure that was first described for the treatment of chronic thoracic neuropathic pain⁸, it is gaining widespread popularity and increasing number of indications, this success could be attributed to the extensive cutaneous sensory block as it affects either the dorsal rami or both the dorsal and ventral rami of the spinal nerves⁹, in addition the its effect of blocking the sympathetic pathways¹⁰, which is related to some causes of chronic pain like spinal surgery¹¹ and PNH¹². In the current study, there were no statistically significant association between past medical history or causes of pain with gender, and the mean duration of pain and the pain scores before and after the block did not have a statically significant differences between genders, This was in comparison to results of Altiparmak et al in Turkey 2019, who studies the effect of ESP block after cholecystectomy, and reported no significant gender difference in postoperative pain¹³. A recent study that explored gender differences regarding pain had reported that both genders feel the same pain regarding severity, but women behavior is more positive regarding pain contentment, and lower apprehension regarding mobilization.¹⁴

In our study, we used mobile numbers to follow up with participants. Many population-based studies of chronic pain that reported higher response rates have used telephone interviews¹⁵. This approach may increase the response rate, but the representativeness of the findings may be questioned because not everyone has a phone, and sometimes they do not pick up unknown numbers.¹⁶ In the current study, those who required analgesia had higher pain scores, which suggests that the ESP block may offer transient relief coupled with optimizing other aspects of analgesic managements. Prolonging the therapeutic benefits may include repeating the ESP block at regular intervals and continuous local anesthetic infusion via an indwelling catheter¹⁷, the ultrasound-guided ESP block is a simple novel technique that involve injecting local anesthetic

(with or without steroids) into a paraspinal tissue plane distant from the pleura and neuraxis, in order to minimize the risk of complications related to injury to these structures. By ultrasound the tips of the transverse processes and the erector spinae muscle (ESM) are easily visualized, providing guidance for the anesthetic agents for spreading deep (anterior) to ESM.¹⁸

The ESP had a significant advantage due to its simplicity and safety, because the anatomy by sonography is easily recognizable, besides, there are no structures at risk of needle injury in the immediate vicinity¹⁹. It keeps proving itself as a useful intervention in managing thoracic neuropathic pain where the success of more conventional therapies is limited.²⁰

4. Conclusion

In conclusion, this cross sectional study for effect of erector spinae plane block in chronic thoracic pain showed effectiveness of this intervention in improving pain in these patients and it demonstrates potential as a valuable intervention when more conventional therapies had limited success.

5. Limitations of the Study

- Difficulty in attending patients for direct assessment in all time intervals; thus, patients were followed up via mobile phone contact.
- Patients we dealt with have severe pain
- Definition of pain includes emotional factors.
- Educational status and explanation of pain scoring.
- Unfamiliarity with the NRS due to infrequent use.
- Small sample size due to limited duration of study, so we hope to include more patients.

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