OPEN ACCESS

Saudi Journal of Medical and Pharmaceutical Sciences

Abbreviated Key Title: Saudi J Med Pharm Sci
ISSN 2413-4929 (Print) | ISSN 2413-4910 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article **Neurosurgery**

Efficacy of Erector Spinae Plane Prolotherapy for Dorsal Pain Management: A Prospective Observational Study

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DOI: https://doi.org/10.36348/sjmps.2025.v11i09.003 | **Received:** 04.07.2025 | **Accepted:** 02.09.2025 | **Published:** 05.09.2025

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Abstract

Patient management of chronic and subacute dorsal pain may be difficult, especially in cases when the patient does not respond to traditional pharmacologic treatment. It has just come to light that the erector spinae plane block is a potentially useful interventional approach for the treatment of regional pain. In patients who were suffering from subacute and chronic dorsal pain, the purpose of this research was to determine whether or not erect spine plane prolotherapy was helpful in significantly lowering pain across a variety of thoracic levels. All of the patients who had undergone erect spine plane prolotherapy at thoracic levels T1–T12 were included in the prospective review that was carried out. Both subacute (pain that lasted for less than three months) and chronic (pain that lasted for more than three months) pain groups were assigned to patients. At baseline, on the first day, one week, and one month after the surgery, the Numeric Rating Scale (NRS) was used to evaluate the levels of pain experienced by the patients. In addition, the amount of injection and the block laterality (unilateral vs bilateral) were measured simultaneously. The majority of patients had chronic dorsal pain (n = 173), with T5–T8 and T1–T4 being the most commonly targeted levels. Bilateral erect spine plane prolotherapy were predominantly utilized in chronic cases. Both groups demonstrated substantial pain reduction. In the subacute group, mean NRS scores decreased from 8 at baseline to 2 at one month (75% improvement). Similarly, the chronic group experienced a reduction from 7 to 2 (71% improvement). Prolotherapy performed on the erect spine plane was able to offer considerable and long-lasting pain alleviation in patients suffering from subacute and chronic dorsal pain. The approach was successful at a number of different thoracic levels and has the potential to be a viable option for the therapy of long-term pain, particularly in chronic instances that need bilateral intervention.

Keywords: Erector Spinae Plane Block, Prolotherapy, Chronic Dorsal Pain, Subacute Dorsal Pain, Thoracic Pain.

1. INTRODUCTION

Erector spinae plane block, often known as ESPB, is a relatively new method of regional anaesthesia that was first published by Forero *et al.,* in 2016 for the purpose of treating thoracic neuropathic pain. Since that time, its use for postoperative analgesia has quickly grown across a wide range of surgical specialities, and it has been shown to be effective in surgeries that include the chest, abdomen, pelvis, and lower extremities. An injection of local anaesthetic is administered into the fascial plane, deep to the erector spinae muscle, during the block. This allows for the possibility of spreading the anaesthetic to the dorsal and ventral rami of the spinal nerves, so providing both somatic and visceral analgesia, which is comparable to the effects of neuraxial procedures [1-3]. The distribution of local anaesthetics has been shown to vary greatly depending on the depth of injection, the amount that is used, and the anatomical features of the patient, according to investigations that were conducted using radiographic and anatomical techniques. In spite of the fact that cadaveric models predict that quantities as little as 20 mL may spread over 4 to 7 dermatomes, real-world clinical experience reveals that the effectiveness of ESPB is largely reliant on the operator and is impacted by a large number of patient-specific factors [4,5]. However, despite the fact that its use is growing, there are still not many standardised procedures concerning the amount, concentration, and level of injection. Furthermore, the majority of the published research has been on the management of acute pain, with very little investigation into the usefulness of this approach for the treatment of chronic and subacute cases of pain syndromes. A major therapeutic issue is presented by chronic pain, especially in the dorsal and thoracolumbar areas. This kind of pain is often resistant to standard analgesics and physical therapy. There has

not been sufficient research conducted in the literature to investigate whether or not ESPB has the ability to produce long-lasting analgesia in situations like these, particularly when paired with regenerative techniques like prolotherapy [6]. This prospective observational research presents our experience with ultrasound guided erect spine plane prolotherapy (US-ESPP) at Alsdr Teaching Hospital. The study was conducted in order to gather preliminary data. The innovative use of this treatment for persistent dorsal pain! To be more specific, our objective is to assess the clinical efficacy, safety profile, and analgesic effectiveness of extracorporeal membrane pressure (ESPP) in patients who have been treated for subacute and chronic dorsal pain, with a particular focus on those patients who have received supplementary prolotherapy.

Rationale for exploring its use in chronic pain and with prolotherapy

In the area of the thoraces, chronic pain, especially of musculoskeletal or neuropathic origin, often continues to be resistant to traditional pharmaceutical care and physical therapy. When it comes to chronic dorsal pain, the processes that cause it typically entail persistent nociceptive input from deep muscular, fascial, or paraspinal structures. These tissues are notoriously difficult to address successfully with superficial therapies. As a result of its capacity to provide multi-dermatomal somatic and visceral analgesia, US-ESPP has the potential to be an effective therapeutic option for the treatment of disorders of this kind [7,8]. In recent years, prolotherapy, which is an injection-based regenerative treatment that drives tissue regeneration by hyperosmolar dextrose or other proliferant solutions, has gained momentum in the treatment of chronic painful ligamentous and fascial conditions. Prolotherapy may be able to benefit from more accurate targeting and greater dispersion along affected planes when it is administered using an interfacial technique such as ESPP. On the other hand, there is a paucity of research that has been conducted to far on the subject of combining ESPB with prolotherapy for the treatment of pain disorders [9-12]. By examining the results of patients who had ESPP for subacute and chronic dorsal pain, with a subgroup getting supplementary prolotherapy, the amis of this research is to fill this vacuum in the literature. We hypothesise that the combination of ESPB with prolotherapy may give increased and prolonged analgesia by combining the immediate neuronal blockage of ESPB with the long-term regenerating benefits of prolotherapy.

Study Aim and Hypothesis

This research aims to examine the effectiveness and safety of US-ESPP in the treatment of subacute and chronic dorsal pain, with a special emphasis on instances where ESPB was paired with prolotherapy. The study will be conducted in the United States. Our objective is to further characterise the therapeutic potential of this approach beyond its recognised function in postoperative pain management. This will be accomplished by conducting a prospective analysis of patient outcomes, analgesic needs, and complication rates. It is hypothesised that the use of US-ESPP in patients suffering from subacute and chronic pain, particularly in conjunction with adjunctive prolotherapy, can lead to significant and sustained reductions in pain intensity, while causing minimal adverse effects. This would make it a viable and minimally invasive alternative for patients who are experiencing refractory dorsal musculoskeletal pain.

2. MATERIALS AND METHODS

2.1. Study Design

This research was supposed to be an examination of data that was obtained in a prospective manner. An examination of the medical records and procedural charts of patients who had undergone US-ESPP at Alsdr Teaching Hospital during the months of January 2022 and June 2025 was also carried out. At the beginning, all of the patient data, which included demographic information, pain scores, block features, and analgesic needs, was first captured in real time during clinical treatment in the postoperative recovery unit, inpatient wards, and pain management service. Following that, these data were collated and analysed in order to assess the efficacy and safety of US-ESPP, especially in patients who were being treated for chronic dorsal pain, with or without concomitant prolotherapy.

2.2. Setting and Ethical Approval

This research was carried out at Alsdr Teaching Hospital, which is a tertiary care facility that comes equipped with a pain management and functional neurosurgery unit specifically designed for patients. All of the procedures were carried out in compliance with the ethical standards outlined in the Declaration of Helsinki, and the protocol for the research was approved by the Institutional Review Board (IRB) of Alsdr Teaching Hospital. Written informed permission for the US-ESPP technique and data usage was acquired from all patients at the time of treatment.

2.3. Indications for ESPB

Out of the 182 patients had US-ESPP included in the study, 173 (95.1%) chronic dorsal pain while remaining 9 patients (4.9%) specifically for subacute dorsal pain, primarily due to musculoskeletal or neuropathic etiologies unresponsive to conventional medical and physical therapy. Type of dorsal pain includes: Inter-scapular pain, Scapulothoracic pain, Myofascial upper back pain and indefinite pain.

Table Distribution of ESPB Levels by Duration of Pain

ESPB Level	Subacute Pain	Chronic Pain
T1–T4	3	68
T5–T8	6	97
T9–T12	0	8
Bilateral	2	112
Unilateral	7	61

Note: Subacute pain was defined as lasting less than 3 months, while chronic pain exceeded this duration.

2.4. Patient Inclusion and Exclusion Criteria

All patients who underwent US-ESPP were included in the study if they met the following criteria: age ≥ 18 years, refractory's dorsal pain and history of persistent pain 4 weeks localized to the thoracic. Exclusion criteria were: (1) pain with organic causes, (2) postoperative pain, (3) coagulopathy or ongoing anticoagulant therapy at the time of ESPP, (4) infection at the injection site,(5) history of severe psychiatric illness interfering with pain assessment and (6) Referred dorsal pain.

3. ESPP Technique

Under the most stringent of aseptic circumstances, every single ESPP operation was carried out. When the surgery was being performed, the patient was positioned in the prone position. The thoracic-level ESPP was performed with the assistance of a high-frequency linear ultrasound probe. In a parasagittal position, the transverse processes and the erector spinae muscle were shown to be present. Depending on the operator's choice and the anatomical access available, the needle, which was between 80 and 100 millimetres in length and 22 gauge, was advanced using either an out-of-plane approach (Fig. 1) or an in-plane technique (Fig. 2). Following the verification of the right insertion of the needle in the fascial plane, which was deep to the erector spinae muscle and superficial to the transverse process, a hydrodissection was carried out using one to two millilitres of saline in order to confirm the complete separation of the fascial plane. Following confirmation, the injectate was gradually supplied with a volume of 20 millilitres each side, a local anaesthetic (LA) of 5 millilitres, 10 millilitres of normal saline, and 5 millilitres of 20% hyperosmolar dextrose while continuous ultrasound visualisation was being performed.

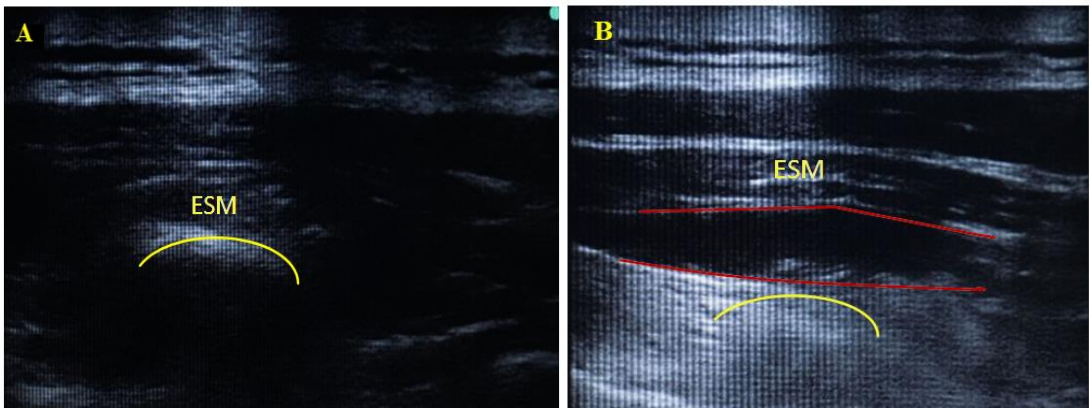

Fig. 1: Out-of-plane ultrasound. (A) before injection, Showing contact erector spinae muscle (ESM) to transverse processes (TP). (B) Showing cranio-caudal hydrodissection erector spinae muscle (ESM) from transverse processes (TP)

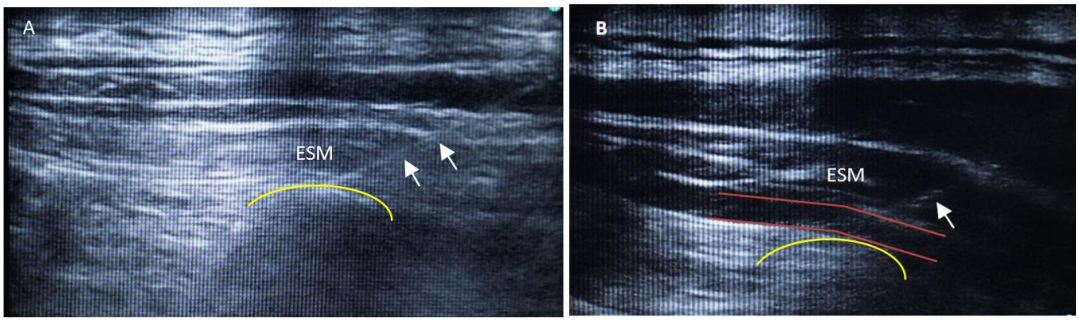

Fig. 2: In-plane (arrow) ultrasound before injection. (A) :Showing contact erector spinae muscle (ESM) to transverse processes (TP). (B) :Showing cranio-caudal hydrodissection erector spinae muscle (ESM) from transverse processes (TP)

For bilateral applications, the maximum total volume is equal to forty millilitres. The typical LA solution was composed of 2 millilitres of bupivacaine with a concentration of 0.25%, and it was supplemented with 3 millilitres of lidocaine at a concentration of 1%. When all was said and done, the final concentration of dextrose was 12.5%, bupivacaine was 0.025%, and lidocaine was 0.15%. For the purpose of prolotherapy-augmented ESPB, it is often recommended to use lower doses of LA. This is done to prevent fully masking the pain, which may interfere with the evaluation of the regeneration response. For thoracic operations, US-ESPP was delivered to cover the whole dorsal area, beginning at T1 and continuing until T12. There were instances in which bi-level injections were used in order to improve cranio-caudal spread. When the patient complains, the injection may be administered to either one or both sides.

3.1. Data Analysis Methods

In order to conduct the analysis, IBM SPSS Statistics for Windows, Version 26.0 (IBM Corporation, Armonk, New York) was used. For the purpose of providing a concise summary of patient demographics, ESPP features, and analgesic results, descriptive statistics were used. The continuous variables, such as age, NRS scores, and analgesic intake, were reported as either the mean plus or minus the standard deviation (SD) or the median with interquartile range (IQR), depending on the distribution that was evaluated using the Shapiro–Wilk test statistical technique. Frequencies and percentages were used to convey categorical data such as gender, block success rate, and complication rate, among others. At the beginning of the study, as well as at predetermined intervals (Day 1, Day 7, and Day 30), pain intensity ratings were recorded. These values were determined by utilising the Numeric Rating Scale (NRSM). If the data were normally distributed, paired t-tests were used to analyse the changes in NRS scores over time. If the data were not normally distributed, the Wilcoxon signed-rank test was used to analyse differences in NRS scores. When the p-value was less than 0.05, it was deemed to be statistically significant.

4. RESULTS

4.1. Patient Demographics

The study population consisted of 182 patients, with a mean age of 51.6 ± 13.2 years (ranging from 21 to 79 years). There were 98 men and 84 females in the research population. The average body mass index (BMI) was 27.4 kg/m2 with a standard deviation of 3.9 kg/m2. The majority of patients were identified as having a physical state that was defined as class II by the American Society of Anaesthesiologists (ASA) (n = 104, 57.1%), followed by class I (n = 48, 26.4%) and class III (n = 30, 16.5%). Hypertension (38.5% of patients), diabetes mellitus (22.5%), or both (14.2%) were among the comorbidities that were present in the majority of patients. US-ESPP was conducted for a variety of reasons, with 173 (95.1%) of them being for the treatment of chronic pain and 9 (4.9%) being for the treatment of subacute dorsal musculoskeletal pain..

4.2. Pain Management Study

A significant and long-lasting decrease in the level of pain was seen in each and every patient who received ESPB for the treatment of chronic and subacute dorsal pain. The mean score on the Numeric Rating Scale (NRS) before to the surgery was 7.1 with a standard deviation of 0.8, as shown in table (1). The mean NRS score saw a considerable decrease to 1.2 ± 0.6 on the first day after the start of the US-ESPP. At seven days and thirty days after the surgery, the NRS scores were 1.4 ± 0.7 and 2.0 ± 1.0, respectively, indicating that this analgesic effect was mostly maintained. During the follow-up period, every single patient reported a subjective improvement in their functional mobility and daily activity levels. Furthermore, not a single patient needed rescue analgesia during the observation period of 72 hours.

Table 1: comparison mean NRS ± SD and p-values versus baseline

Timepoint	Mean NRS ± SD	p-value vs. Baseline
Pre-Procedure	7.1 ± 0.8	–
Day 1	1.2 ± 0.6	<0.0001
Day 7	1.4 ± 0.7	<0.0001
Day 30	2.0 ± 1.0	<0.0001

5. COMPLICATIONS

During the course of the research, the technique was well tolerated by the participants. Among the 183 patients who had prolotherapy via ESPP, there were thirteen incidences of minor dizziness that occurred after the surgery and resolved on their own. The following serious risks were not reported: pneumothorax, systemic toxicity of the local anaesthetic, infection at the injection site, neurological impairments, and other similar disorders. There were no patients who needed hospitalisation or intervention as a result of adverse events that were connected to the operation.

6. DISCUSSION

This prospective research reveals that the use of prolotherapy in the form of ultrasound-guided erector spinae plane block (ESPB) might result in a considerable decrease in pain in patients who suffer from chronic spine-related pain, especially when the procedure is performed at thoracic levels. In addition to providing

immediate analgesia, the use of dextrose as a proliferant agent in concert with local anaesthetics proved to give a persistent improvement in pain ratings throughout the course of a one-month follow-up period. Patients reported a constant decrease in their numerical rating scale (NRS) pain levels, with little side effects and no severe consequences. This highlights the potential for this procedure to be safe, effective, and cost-effective in clinical practice [13-16]. It is believed that the pain relief that is generated by US-ESPP (prolotherapy via the erector spinae plane block) as an interfascial injection is accomplished by a number of different mechanisms, including both mechanical and metabolic processes [17-21]:

The fundamental mechanism of prolotherapy, which is the stimulation of the local healing response The solutions used in prolotherapy, which are often hypertonic dextrose, have the ability to irritate the skin and cause a localised inflammatory reaction. Consequently, this encourages the proliferation of fibroblasts, the deposition of collagen, and the remodelling of tissue. When this healing cascade is injected into the interfascial plane, which is located between the erector spinae muscle and the transverse processes, it has the potential to assist in stabilising and repairing chronic soft tissue injuries, particularly those that occur in the spinal ligaments and fascia.

Neuromodulation of the Dorsal Rami and Nearby Nerves. There are branches of the dorsal rami of spinal neurones that run through the fascial plane, which is the target of the ESPB. This plane is deep to the erector spinae muscle. When injected prolotherapy solutions are administered, they have the potential to mechanically separate fascial layers, therefore reducing nerve entrapment or irritation, and reduce aberrant nerve signalling, which is implicated in central sensitisation and neuropathic pain. Low-grade dextrose has been shown to have an anti-inflammatory effect. In particular, repeated administrations of dextrose (10–25%) have the potential to lower neurogenic inflammation and down regulate specific pain-related ion channels, such as TRPV1. This has been observed in persistent neuropathic pain and myofascial pain disorders.

Fascial Plane Hydrodissection. As a result of injecting a relatively significant volume into the ESP, adherent fascial layers may be separated, which results in the release of tension and pressure. Improved mobility, decreased nociceptor sensitisation in the fascia, and alleviation of referred pain patterns are all possible outcomes of this treatment, particularly in cases of persistent thoracic pain. 5. The enhancement of the biomechanical support. Prolotherapy has the potential to improve the structural support surrounding the spine by facilitating the restoration of damaged tissue. When the posterior ligamentous complex is stabilised, aberrant mobility and mechanical stress, both of which may contribute to the perpetuation of pain, are suppressed.

6.1. Comparison with Previously Published Studies

ESPB has been the subject of substantial research for the treatment of acute postoperative pain, especially in the context of thoracic and abdominal procedures; nevertheless, its applicability in the treatment of chronic and subacute pain is still comparatively not well understood. Both Forero et al. and Tulgar et al. conducted research that demonstrated the effectiveness of ESPB in the management of neuropathic and radicular pain. However, the majority of these studies were on thoracic levels or perioperative situations specifically. Prolotherapy, which is essentially a regenerative method that tries to modify inflammatory responses and promote tissue regeneration, was included into our research, which expands on the data that has been presented since it included patients who have been experiencing pain for an extended period of time. [21-24]. It is important to note that past research has often focused on ESPB measurement at higher levels (for example, T5–T8) for thoracic pain or lumbar ESPB measurement at L2–L3 for postoperative analgesia. Our focused application of ESPB encompass entire dorsal level, on the other hand, is innovative and has shown promising effects in patients who suffer from pain connected to lower cervical and higher lumber levels. It is suggested by this that distal dorsal ESPB may have a broader distribution and reach nerve roots that are important to cervical and lumbar radiculopathy or facetogenic pain. This is a hypothesis that requires more anatomical and clinical confirmation [25-27].

6.2. Novelty of Application

The use of prolotherpy ESPB for the treatment of chronic pain, in particular in a population that has not had surgery, is a significant addition to this research. This is one of the first publications that we are aware of that explicitly applies prolotherapy-enhanced ESPB at the dorsal level for the treatment of chronic and subacute dorsal pain with favourable results. This not only adds a less invasive method for refractory dorsal pain, but it also broadens the potential value of ESPB outside the conventional setting of perioperative care.

6.3. Limitations

This study lacks a number of important components. To begin, there was a restricted number of participants in the sample. In the second place, there was no long-term follow-up that lasted more than one month, which hinders our capacity to assess the effectiveness of the treatment over time.

6.4. Future Directions

It is recommended that future research concentrate on prospective, randomised controlled studies in order to more accurately evaluate the effectiveness of prolotherapy-augmented ESPB for the treatment of chronic pain. Standardisation of the volume and concentration of the LA, in addition to the solution used for prolotherapy, will be essential in order to guarantee repeatability and maximise the level of results

achieved. The advantages that were seen in this research need to be followed up on over a longer period of time in order to evaluate whether or not they are maintained over time. The spread of injectate at lower lumbar levels, such as L4, may be further clarified using imaging investigations, such as contrast-guided cadaveric models or magnetic resonance imaging (MRI), which may further link this spread with clinical results.

7. CONCLUSION

The use of US-ESPP has been shown to be effective in the management of a wide range of pain problems, including both acute and chronic musculoskeletal diseases. The results of our study lend credence to the possibility that ESPB might play a role in the treatment of chronic pain, especially when paired with prolotherapy, as a method that is not only less expensive but also less intrusive. This includes the possibility of innovative applications at the dorsal level. On the other hand, as US-ESPP continues to extend into the treatment of chronic pain, doctors need to exercise caution about the variety in method, which includes the injection level, volume, and drug composition. This underscores the need of standardised procedures among healthcare professionals. It is necessary to conduct further prospective studies in order to corroborate these preliminary results and better understand the function that ESPB plays in the treatment of chronic pain.

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