

COMPARATIVE EFFECTS OF ERECTOR SPINAE PLANE BLOCK AND FACET JOINT MEDIAL BRANCH BLOCK ON PAIN AND FUNCTIONAL DISABILITY IN PATIENTS WITH FACET-MEDIATED SPINAL PAIN

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Abstract

Background: Facet mediated spinal pain can cause significant pain and disability in the cervical and lumbar spine. Facet joint medial branch blocks (MBB) are established treatments for this pain. Erector Spinae Plane Blocks (ESPB) are more recent treatments for facet mediated pain, and provide more extensive local anesthesia due to their interfascial location.

Objective: To compare the effects of MBB and ESPB on pain and the disability of patients with facet mediated spinal pain.

Methods: In this randomized clinical study, 44 participants were randomly allocated to undergo either single ultrasound guided posterior cervical plexus block (ESPB; n = 22) or single fluoroscopically guided cervical median branch block (MBB; n = 22). Pain and functional disability of the neck and back were assessed. Pain was measured using Numeric Pain Rating Scale (NPRS) and functional disability was measured using Oswestry Disability Index (ODI) and Neck Disability Index (NDI). Assessments were performed at the time of block and 4 weeks and 12 weeks after block.

Results: Baseline demographic and clinical characteristics and outcome scores were comparable between groups. Both groups improved significantly over time. At 4 weeks, MBB produced lower NPRS (3.55 ± 0.86 vs 4.82 ± 0.96 ; $p < 0.001$), ODI ($30.09 \pm 5.97\%$ vs $36.73 \pm 6.25\%$; $p = 0.001$), and NDI ($27.73 \pm 4.24\%$ vs $35.73 \pm 4.06\%$; $p < 0.001$) than ESPB. At 12 weeks, the MBB group again had lower NPRS (2.23 ± 0.69 vs 3.59 ± 1.05 ; $p < 0.001$), ODI ($19.00 \pm 6.01\%$ vs $26.82 \pm 5.19\%$; $p < 0.001$), and NDI ($17.73 \pm 4.24\%$ vs $25.73 \pm 4.06\%$; $p < 0.001$). Both MBB and ESPB groups demonstrated clinically relevant improvements in pain and disability at 12 weeks. The MBB group, however, demonstrated greater improvements at both time points compared to the ESPB group.

1. Introduction

Chronic pain in the neck and lower back can be caused by facet joint pain in the spine and can limit a person's ability to function normally. The zygapophyseal joints (also known as the facet joints) help move and give stability to the spine. Changes and wear in the joints can cause the joints to become irritated, inflamed and sensitized, and can elicit a pain response. What a prevalent facet joint pain is varies, but it is considered to be pain as a discriminative symptom for the lower spinal region (Baroncini et al., 2021; Noh et al., 2025).

Because the pain that is generated from the facet joints is referred to as nociceptive pain, it can be difficult to differentiate from pain that is generated from other locations (i.e. muscle, ligaments, discs, etc.). Thus, pain from facet joints can be considered to be the source of the pain if other anatomic locations can be ruled out. There are multiple ways to block the medial branches of the dorsal rami. One way is to use a local anesthetic, under imaging guidance, to block the nerves (Ackers et al., 2025; Klessinger, 2013). One of the main advantages of this type of pain management is that it is very specific to the target joints. The other advantage is that, in some cases, it can permanently alleviate pain for long periods of time.

An erector spinae plane block (ESPB) uses ultrasound to guide local anesthetic between the erector spinae muscle and the vertebral transverse process (De Cassai et al., 2023). ESPBs can provide regional anesthesia for a number of procedures including thoracic and lumbar surgical procedures. Injectate spread from ESPBs provide dermatomal coverage over the back and provides analgesia for an extended period of time. Research has focused on the use of ESPBs for acute pain, post-surgical pain, and the treatment of chronic pain (Ata et al., 2024). The use of ESPBs for the treatment of chronic pain is gaining traction based on the positive results of studies focused on the use of ESPBs for chronic lumbar facet joint pain.

One advantage of ESPBs is the ease of performance and the use of ultrasound for guidance. An interfascial block such as an ESPB can address pain generated from the facet

joint, but evidence suggests that a medial branch block (MBB) provides more benefit for pain generated from the facet joint (Ackers et al., 2025; Ata et al., 2024; De Cassai et al., 2023; Noh et al., 2025). MBBs, like ESPBs, provide improvement in pain and function for patients. Direct comparisons of ESPBs vs. MBBs are lacking.

Pain intensity and the level of functionality impaired by pain should be evaluated to gauge the impact of treatment for spinal pain conditions. The Numeric Pain Rating Scale (NPRS) assesses the intensity of pain, but to evaluate functionality, the Oswestry Disability Index (for low back pain) and the Neck Disability Index (for neck pain) should be used. Monitoring patients for changes in pain and disability at multiple points in time can show whether pain and disability improve and whether early improvements persist.

Pain management and rehabilitation are the areas where this knowledge is likely to be most valuable. This is because changes in symptoms after various treatments should result in changes in patient functionality, and the reasons that led to the choice of one treatment over the other may vary. Therefore, the current randomized clinical trial evaluated the effect of ultrasound-guided nerve blocks (ESPB) on pain and disability when compared to fluoroscopy-guided nerve blocks (MBB) on pain and disability at 12 and 24 weeks, respectively, after the interventions. The authors predicted that MBB would result in greater improvements in pain and disability when compared to ESPB. The authors also evaluated changes in pain using the NPRS and disability using region-specific measures to determine the effects of ESPB and MBB on pain and disability.

2. Materials and Methods

2.1 Study design and setting

This study was conducted at Bashir Neurospine Institute, Lahore, Pakistan and has a duration of 4 months. Forty-four adults (age 25-65) with chronic (> 3 months) spinal pain were recruited and randomized into either ESPB (n = 22) or MBB (n = 22) groups. Sample size was computed using OpenEpi (3.0). To compare the two means, a 85% power and 95% confidence level were set. the computed sample

was 36. Considering an average 20% loss to follow up, sample size was increased to 44.

2.2 Eligibility criteria

Participants aged between 25-65 years, having spinal pain of more than 3 months, with features suggestive of facet mediated pain, and with evidence of facet joint pathology on diagnostic studies, were included in the study. Participants with spinal pain with neurological deficit and/or radiculopathy, with pathology at the level of interest, coagulation disorders, infection at the site of planned procedures, pregnancy, and/or allergy to local anesthetics and/or corticosteroids were excluded.

2.3 Randomization and blinding

Participants were randomized to either study group after baseline assessment. Sealed envelopes were used for group assignment and 22 participants were assigned to each group. Blinding of the participants and assessors was not possible because ESPB is performed under ultrasound guidance and MBB is performed under fluoroscopy.

2.4 Interventions

Participants in the ESPB group underwent a single ultrasound-guided bilateral nerve block at the symptomatic level. After positioning the needle in the appropriate fascial plane between the erector spinae muscle and the transverse process, 20 mL of 0.25% bupivacaine was deposit on each side.

Members of the MBB group underwent a single fluoroscopically placed medial branch block at the affected level. After placement of the fluoroscopic image in the medial branch view, 0.25% bupivacaine in a volume of 0.5 mL was injected at the branch. The branch was blocked at multiple levels if fluoroscopically viewed as necessary. The members of both groups were observed for 30 to 60 minutes after blockade.

2.5 Outcome measures

Numerical Rating Scale (NRS) scores, where 0=no pain and 10=worst pain, were used to measure pain level. To measure function, members of the ESPB group completed the Oswestry Disability Index (ODI) and members of the MBB group completed the Neck

Disability Index (NDI). Both the ODI and NDI are measured on a 100 point scale. A higher score is indicative of greater disability. All outcome measures were collected at the initial visit and repeated at 4 and 12 weeks.

2.6 Statistical analysis

Variables were coded in SPSS. Mean and standard deviation were computed for continuous variables, and frequency and percentage were computed for categorical variables. The Shapiro-Wilk test was performed to check normality. Comparison of baseline variables was performed to determine group differences. Analysis of variance (ANOVA) was conducted to determine group differences on Numerical Pain Rating Scale (NPRS) and Oswestry Disability Index (ODI), and Repeated Measures ANOVA was performed to assess within-group differences and changes over time. Pair wise comparison was performed to compare baseline, 4 week and 12 week values. Statistical significance was set at $p < 0.05$. As NPRS and some components of ODI were not normally distributed, results were reported in accordance to the original thesis, and potential lack of normality was accounted for while drawing conclusions.

2.7 Ethical considerations

Prior to initiating the study, ethical clearance was obtained from the Research Review Board/Ethical Committee of The Superior University, Lahore. Written informed consent was obtained from all participants. Participants were provided information about their right to refuse to participate and withdraw at any time. Potential risks and benefits of the procedures were explained. Ethics approval/reference number [to be provided at time of journal submission].

3. Results

3.1 Participant characteristics and baseline comparability

The study was composed of 22 participants in each of two groups, for a total of 44. There were 31 (70.5%) women and 13 (29.5%) men. Baseline differences among the groups were not statistically significant for age, duration of spinal pain, weight, height, or BMI. The groups

also had comparable baseline scores for NPRS, ODI, and NDI. The absence of differences at baseline allows conclusions regarding

differences at the end of the study, given that the study was designed to assess the effects of the treatment on the groups.

Table 1. Baseline demographic, clinical, and outcome characteristics.

Variable	ESPB (n=22)	MBB (n=22)	p-value
Age (years)	36.41 ± 6.86	40.05 ± 9.18	0.144
Duration of spinal pain (months)	15.32 ± 6.67	17.00 ± 7.98	0.452
Weight (kg)	73.26 ± 10.59	73.56 ± 12.05	0.931
Height (cm)	166.77 ± 8.50	167.00 ± 8.74	0.931
BMI (kg/m ²)	25.80 ± 2.87	26.23 ± 2.67	0.604
Baseline NPRS	7.59 ± 0.67	7.55 ± 0.86	0.845
Baseline ODI (%)	52.27 ± 8.47	52.91 ± 6.44	0.780
Baseline NDI (%)	50.82 ± 4.69	51.82 ± 4.40	0.470

3.2 Primary objective: pain intensity

The pain component of the study goal was achieved as both groups showed reduction in pain levels. Mean Numerical Pain Rating Scale (NPRS) in the Enhanced Sinfonino pain Blockade (ESPB) group at baseline was 7.59 ± 0.67. It reduced to 4.82 ± 0.96 at 4 weeks and 3.59 ± 1.05 at 12 weeks. In the Multiple Blockade group (MBB), NPRS reduced from 7.55 ± 0.86 to 3.55 ± 0.86 and 2.23 ± 0.69 at the same time points respectively. The difference was not significant at baseline (mean difference 0.05, -0.42 to 0.51, $p = 0.845$). It was in favor of the MBB group at 4 weeks (mean difference 1.27, 0.72 to 1.83, $p < 0.001$) and 12 weeks (mean difference 1.36, 0.82 to 1.91, $p < 0.001$). The difference was significant for both groups at all time points ($p < 0.001$).

decreased in the ESPB group from 52.27±8.47% at baseline to 36.73±6.25% at 4 weeks and 26.82±5.19% at 12 weeks. In the MBB group, ODI decreased from 52.91±6.44% to 30.09±5.97% and 19.00±6.01%. Between-group differences favored MBB at 4 weeks (6.64 percentage points, 95% CI 2.92 to 10.35; $p=0.001$) and 12 weeks (7.82 percentage points, 95% CI 4.40 to 11.23; $p<0.001$).

NDI for the ESPB group, for cervical-related disability, improved from 50.82±4.69% at baseline to 35.73±4.06% at week 4, and further to 25.73±4.06% at week 12. The MBB group improved from 51.82±4.40% to 27.73±4.24% at week 4 and to 17.73±4.24% at week 12. The difference between the two groups was 8.00% at week 4 and week 12 (95% CI 5.47 to 10.53, $p<0.001$). ODI and NDI were significantly improved within the two groups, ($p<0.001$).

3.3 Primary objective: functional disability

Functional disability also improved in both groups. For lumbar-related disability, ODI

Table 2. Between-group comparisons for pain and disability outcomes.

Outcome	Time	ESPB Mean ± SD	MBB Mean ± SD	Mean difference	95% CI	p-value
NPRS	Baseline	7.59 ± 0.67	7.55 ± 0.86	0.05	-0.42 to 0.51	0.845
NPRS	4 weeks	4.82 ± 0.96	3.55 ± 0.86	1.27	0.72 to 1.83	<0.001
NPRS	12 weeks	3.59 ± 1.05	2.23 ± 0.69	1.36	0.82 to 1.91	<0.001
ODI (%)	Baseline	52.27 ± 8.47	52.91 ± 6.44	-0.64	-5.22 to 3.95	0.780
ODI (%)	4 weeks	36.73 ± 6.25	30.09 ± 5.97	6.64	2.92 to 10.35	0.001

ODI (%)	12 weeks	26.82 ± 5.19	19.00 ± 6.01	7.82	4.40 to 11.23	<0.001
NDI (%)	Baseline	50.82 ± 4.69	51.82 ± 4.40	-1.00	-3.77 to 1.77	0.470
NDI (%)	4 weeks	35.73 ± 4.06	27.73 ± 4.24	8.00	5.47 to 10.53	<0.001
NDI (%)	12 weeks	25.73 ± 4.06	17.73 ± 4.24	8.00	5.47 to 10.53	<0.001

3.4 Magnitude and maintenance of within-group improvement

Members of the ESPB group recorded mean reductions of 4.00 NPRS points, 25.455 ODI percentage points, and 25.091 NDI percentage points at 12 weeks compared to baseline. The reductions for the MBB group were 5.318

NPRS points, 33.909 ODI percentage points, and 34.091 NDI percentage points at 12 weeks when compared to baseline. All of the repeated-measures tests showed group members improved from baseline and were statistically significant ($p < 0.001$).

Table 3. Within-group outcome trajectories and baseline-to-12-week change.

Group / outcome	Baseline	4 weeks	12 weeks	Baseline-to-12-week change
ESPB NPRS	7.59 ± 0.67	4.82 ± 0.96	3.59 ± 1.05	4.000
MBB NPRS	7.55 ± 0.86	3.55 ± 0.86	2.23 ± 0.69	5.318
ESPB ODI (%)	52.27 ± 8.47	36.73 ± 6.25	26.82 ± 5.19	25.455
MBB ODI (%)	52.91 ± 6.44	30.09 ± 5.97	19.00 ± 6.01	33.909
ESPB NDI (%)	50.82 ± 4.69	35.73 ± 4.06	25.73 ± 4.06	25.091
MBB NDI (%)	51.82 ± 4.40	27.73 ± 4.24	17.73 ± 4.24	34.091

3.5 Hypothesis testing

The study hypothesized that the MBB group would be superior to the ESPB group in the reduction of pain and the increase in function. The two groups did not differ from one another at baseline for any of the three measures. At 4 and 12 weeks, the MBB group demonstrated greater reduction in pain (ODI and NDI) and function (NDI) compared to the ESPB group. The results from the study support the study hypotheses and do not support the null hypothesis.

4. Discussion

The study was designed to compare pain and function following ultrasound-guided interfascial block (ESPB) and medial branch block (MBB) to assess which would be more effective in managing patients with spinal facet joint pain. The primary outcome of the study was to evaluate the magnitude of pain reduction in both the intervention groups and the secondary outcome was to evaluate the

disability and function of the groups. Pain and disability improved in both groups. At both 4 and 12 weeks after the interventions, MBB outperformed ESPB based on pain, disability and function measures. MBB represents a more direct method to Block the targeted structures and explains why it was more effective than ESPB in the first 12 weeks post intervention.

The changes in pain level are clinically relevant. At Week 12, pain level was reduced 4.00 (from baseline) and 5.318 (from Week 12 baseline) after ESPB and MBB, respectively. The between-group difference became apparent at Week 4 and was maintained at Week 12. Ata et al. showed reduced pain level after ESPB, and it is plausible that spread of local anesthetic to the erector spinae plane blocks nociceptive input from the posterior spinal structures (Ata et al., 2024). However, the greater decrease in pain level after MBB is also biologically plausible. As described above, the medial branch blockade is near the Facet Joints. Thus,

anesthetic deposits near the medial branch blocks nociceptive input from the facet joints.

The current evidence for this result includes a body of literature describing medial branch interventions. A number of systematic reviews and clinical studies have described pain relief from facet joint nerve blocks (Manchikanti et al., 2024). Ackers and colleagues have reported improvement in chronic low back pain from lumbar medial branch blocks that was sustained over the length of the follow up period. Similarly, pain relieving effects from medial branch blocks have been reported to be sustained over time (Ackers et al., 2025). Liu and colleagues have described pain relief from medial branch nerve blocks and attributed it to denervation of the medial branch nerves (Liu et al., 2021). The current study is the first to compare directly MBB against ESPB and to exclude other options that are part of the “usual care” practice. Results from this study suggest that pain reduction from ESPB is superior to that from MBB.

The disability assessment provides additional evidence of the beneficial effect of the procedures beyond pain. Decreases in ODI were 25.455 and 33.909 units after ESPB and MBB, respectively. The same trends were seen for NDI. Improvements observed at later assessments were largely attributable to procedures performed at those times. Improvements in ODI reported by Ata et al. after ESPB suggest that improvement in function can be expected after procedures that create a more reasonable analgesic effect (Ata et al., 2024). The greater improvement in NDI and ODI after MBB compared to ESPB provides evidence that greater suppression of facet-mediated nociception allows more complete restorative function in those patients in whom facet joints are the major pain generating structure.

This chapter emphasizes findings of the NDI due to a paucity of literature, directly comparable to the current study, for ESPB and MBB in the context of cervical facet-mediated pain. Mean NDI at Week 12 was 17.73% and 25.73% post-MBB and post-ESPB respectively. The between group difference was 8 points in favor of MBB. Improvement in both the lumbar and the cervical disability measures

increases the likelihood that the effect of MBB over ESPB was apparent throughout the whole area of interest. The nature of disability measures is such that different patient populations may benefit from each intervention. The current study did not randomize the intervention based on patient's lumbar vs. cervical disability; therefore generalization of disability outcome measures may be limited.

Trends over time may further clarify the disability outcome measures. Both groups, post-procedure, showed continued improvement at 12 weeks. A single intervention may account for the persisting pain signal blockade and improved functional ability. It is possible that patients may have improved due to other, as yet unidentified, concurrent and coincidental factors. Improvement beyond the acute phase of the intervention may have occurred due to other, as yet, unidentified factors. Hence, in the absence of other concurrent explanatory factors and interventions, improvement may be related to the intervention.

An expansive field of analgesia is thought to be an advantage of ESPB; however, the myofascial and paraspinal pain caused by referral is not considered broad. In the case of a well-defined group/population of pain caused by facet joints, a broad field of analgesia may be less beneficial than targeting neurons directly. This hypothesis is supported by the present study; however, it does not confirm this. The study did not examine the effects of local anesthetics beyond the field of view of the procedure, as well as the activity of adjacent muscles, the response to a diagnostic block, and so on. Thus, other factors could be the reason for the better effect of MBB than ESPB in the present study.

The present findings must also be evaluated considering the possibility of the procedures. ESPB can be performed using US, which has a shallow depth of view, while MBB requires fluoroscopy. Considering all of the above, the authors of this study believe that MBB is more effective than ESPB. However, the present study does not mean ESPB is worthless.

This study has a number of potential methodological flaws. Recruitment from a single site reduces generalizability. While small

sample sizes are common, recruitment in this study was consecutive, which may have introduced participant selection bias. The assessment of treatment outcome was not blinded. It is possible that participants reported outcomes based on their expectations. The largest concern is that, based on results from the Shapiro-Wilk test, the distribution of NPRS at all time points was not normal. The Shapiro-Wilk test also suggested that the distributions of ODI at the two time points were also not normal. Parametric tests were used in this study to compare the two groups and to analyze repeated measures. It is possible that the parameters of the groups being compared were equal; however, violating the assumptions of a statistical test creates a major concern. Therefore, the parameters of the groups being compared should be evaluated with care, and non-parametric tests should be used to evaluate the data.

The strengths of this study are valuable. It used a randomized control design, and participants were assessed at two time points post intervention. The use of region specific disability measures was also valuable. Results from the assessment of pain and related disability were consistent. Considering the results were consistent across multiple measures of disability and symptoms, and related expectations, there may be value in the assessment of a control group in future studies to validate these results. There are also opportunities for the assessment of adverse events and quality of life.

5. Conclusion

The present analysis evaluated the efficacy of the ultrasound-guided erector spinae block (ESB) and fluoroscopic-guided medial branch block (MBB) over 12 weeks. Both interventions improved pain and function. Lower scores in pain, disability and other outcome measures were recorded in the MBB group, at both 4 and 12 weeks. Therefore, the alternative hypothesis was accepted for the sample. The study also answered the research question. Since the sample was small and single-center, and a number of the study measures were subjective, it is warranted that larger studies, with longer duration, substantiate the findings.

6. Limitations

This study was conducted at a single site and included 22 participants per group. The study employed consecutive, non-probability sampling prior to random assignment. Neither participant nor assessor blinded methods were implemented. The outcome measures (NPRS, ODI and NDI) were self-reported. Electrical stimulation perceived benefit (ESPB) and manual benefit (MBB) differed in terms of the type of imaging and the expertise of the operator. The follow-up period was 12 weeks. At all assessments, NPRS was non-normally distributed and ODI was normality. As such, the current analysis relies on parametric methods to evaluate the outcomes of the study. Because of these inconsistencies, a non-parametric and/or sensitivity analysis on the study data would be beneficial.

7. Clinical Implications and Future Research

The present study shows that, among patients who require an interventional procedure for facet-mediated spinal pain, a better short- to medium-term improvement is seen after MBB as compared to ESPB. However, in the absence of fluoroscopy, ESPB, as an ultrasound-guided procedure, may be preferable to MBB, if a broader regional analgesia approach is required and is justified. It would be beneficial to perform larger and well-designed studies to evaluate the potential benefits of lumbar and cervical ESPB and to analyze the post-procedural requirements, adverse effects, and analgesic needs. The economic impact of the procedures should also be evaluated. Furthermore, it would be of interest to identify clinical and other variables that may predict a positive response to the procedures.

Declarations

Ethics approval and consent to participate:

The relevant Research Review Board/Ethical Committee of The Superior University, Lahore, reviewed and approved the research protocol. Written informed consent was obtained from all subjects. Provide the official approval number in the manuscript.

Consent for publication: Not applicable.

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Trial registration:

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