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To Measure the Therapeutic Efficacy of Ultrasound-Guided Lumbar Facet Joint Nerve Block in Treating Low Back Pain

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ABSTRACT

Background: Chronic low back pain (LBP) is a common musculoskeletal disorder, with facet joint arthropathy contributing to a substantial proportion of cases. Ultrasound-guided (USG) medial branch block is a minimally invasive procedure that offers real-time visualization and avoids radiation exposure. To evaluate the therapeutic efficacy of ultrasound-guided lumbar facet joint nerve block using a combination of local anesthetic and steroid in patients with chronic LBP, and to assess the prevalence and clinical profile of facet joint pathology in the local population.

Methods: This prospective study included 69 patients with chronic LBP unresponsive to conventional therapy. Patients underwent USG-guided facet joint blocks at levels determined by clinical tenderness and MRI findings. Pain and disability were assessed using the Visual Analog Scale (VAS) and Modified Oswestry Disability Index (MODI) at baseline, 1, 4, 12, and 24 weeks. Responders were defined as those with ≥50% reduction in VAS or ≥40% reduction in MODI.

Results: The mean age was 51.03±9.64 years; 56.52% were male. Most injections were at L3–L4 (37.8%) and L2–L3 (32.4%). Pain responder rates were 73.91% at 1 week, 82.61% at 4 weeks, and 60.87% at 24 weeks. Mean VAS decreased from 8.0±0.90 to 3.83±1.37, and mean MODI from 25.91±3.78 to 13.96±3.71 ($p<0.0001$). No major complications occurred.

Conclusion: Ultrasound-guided medial branch block provides rapid, safe, and sustained pain relief in chronic facet-mediated LBP, improving function and quality of life while eliminating radiation exposure.

Key-words: Chronic low back pain, Facet joint, Ultrasound-guided medial branch block, Visual Analog Scale, Modified Oswestry Disability Index

INTRODUCTION

Chronic low back pain (LBP) is one of the most prevalent musculoskeletal disorders worldwide, with a lifetime incidence affecting up to 80% of adults and an annual prevalence of 5–20% in industrialized countries.[1] It is a leading cause of disability, loss of productivity, and poor quality of life.[2,3] The global point prevalence of LBP is estimated at 9.4%.[4]

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LBP is defined as pain or discomfort localized between the lower costal margin and gluteal folds, with or without radiation to the lower limbs. Based on duration, it is classified as acute (<4 weeks), subacute (4–12 weeks), or chronic (>12 weeks).[5] Among structural causes, facet (zygapophyseal) joint arthropathy accounts for approximately 15–45% of cases of chronic LBP.[3]

Facet joints are synovial articulations between vertebral articular processes that guide and limit spinal motion. These joints are richly innervated by the medial branches of the dorsal rami, and inflammation or degeneration can result in localized or referred pain.[6,7] Major risk factors for facet arthropathy include aging, obesity, female sex, repetitive lumbar flexion, and occupations involving heavy lifting or twisting.[8–10]

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Conservative treatment of LBP involves pharmacotherapy (NSAIDs, acetaminophen, antidepressants, and anticonvulsants), physical therapy, and lifestyle modification.[6,7] However, facet-mediated pain often requires interventional procedures such as medial branch blocks, intra-articular steroid injections, or radiofrequency ablation.[11,12]

Ultrasound-guided (USG) facet joint nerve blocks have emerged as a promising alternative to fluoroscopic or CT-guided injections. They provide real-time visualization, avoid radiation exposure, and are more cost-effective.[6] However, evidence on their accuracy and therapeutic efficacy is still limited.

The present study was undertaken to evaluate the therapeutic efficacy of ultrasound-guided lumbar facet joint nerve block in patients with chronic low back pain and to assess the prevalence and clinical profile of facet joint pathology in the local population.

MATERIALS AND METHODS

Place of the study- The study was conducted at the Pain Clinic of the Department of Anaesthesiology, Dr Rajendra Prasad Government Medical College (Dr RPGMC), Kangra, Tanda, Himachal Pradesh.

Research Design- This study was a prospective observational study conducted at the Pain Clinic of the Department of Anaesthesiology, Dr Rajendra Prasad Government Medical College (Dr RPGMC), Kangra, Tanda, Himachal Pradesh. Patients presenting with chronic low back pain were enrolled over a period of one year after referral from the Orthopaedics outpatient department. Eligible participants were selected according to predefined inclusion and exclusion criteria, and all underwent ultrasound-guided lumbar facet joint medial branch blocks performed by an experienced pain physician. Diagnostic blocks were followed by therapeutic injections in responders, and outcomes were assessed at multiple follow-up intervals (1, 4, 12, and 24 weeks) using validated tools, including the Visual Analog Scale (VAS) and Modified Oswestry Disability Index (MODI). The design allowed for longitudinal evaluation of pain relief and functional improvement while monitoring for adverse events.

Inclusion Criteria

- Chronic low back pain (LBP) for ≥3 months
- Pain not responding to conventional therapy (analgesics, physiotherapy, exercise)
- Symptoms suggestive of facet-mediated pain, including:
  - LBP with or without radiation to the buttocks, thigh, or groin
  - Pain aggravated by hyperextension
  - Pain on initiating movement
- Focal facet joint tenderness on digital pressure
- Prior MRI of the lumbar spine was done for evaluation of LBP
- Age >18 years

Exclusion Criteria

- Neurological deficits in lower limbs
- Positive straight leg raises test (radicular pain below the knee)
- Spinal deformity
- Imaging evidence of nerve root compression
- Spinal infection or neoplastic disease
- Pregnancy
- Bleeding disorders or ongoing anticoagulant therapy
- Allergy to study drugs or injectables
- BMI ≥35 kg/m²
- Random blood sugar >200 mg/dL

Sample Collection and Laboratory Analysis- Before enrolment, all patients underwent routine pre-procedural evaluation, including clinical examination and baseline laboratory investigations, to ensure safety and eligibility for the facet joint block procedure. Venous blood samples were collected under strict aseptic precautions and evaluated at the Central Clinical Laboratory of Dr. Rajendra Prasad Government Medical College (Dr. RPGMC), Kangra, Tanda. Baseline tests included complete blood count, random blood sugar, liver and renal function tests, and a coagulation profile, performed using standardized automated analyzers in accordance with institutional quality-control protocols. Additional tests, such as erythrocyte sedimentation rate and C-reactive protein, were obtained whenever clinically indicated to rule out underlying infection or inflammatory conditions. Laboratory findings were used to identify and exclude patients with abnormal coagulation parameters, uncontrolled diabetes (RBS >200 mg/dL), active infection, or any systemic condition that could increase procedural risk. These investigations

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served exclusively as safety assessments and were not included as outcome measures in the study.

Statistical Analysis- Data were recorded on a proforma, and entered into Microsoft® Excel workbook 2019, and exported into SPSS v21.0 (IBM, USA) for statistical analysis. Categorical variables were expressed as frequencies and percentages. Quantitative variables were expressed as mean±SD or median (interquartile range). Quantitative variables between two different intervals were compared using ANOVA. $p<0.05$ was considered statistically significant.

Ethics Committee Approval- The study protocol was reviewed and approved by the institutional ethics committee. Approval ensured that the research met established ethical standards for the use of human data, including considerations for participant welfare, scientific validity, and data security.

RESULTS

The study included 69 patients with chronic low back pain. Among them, 33 patients (47.83%) were aged 50 years or younger, while 36 patients (52.17%) were aged 50 years or older, indicating a nearly even age distribution with a slight predominance of the older age group. Males constituted a higher proportion of the study population (39 patients, 56.52%), whereas females accounted for 30 patients (43.48%). In terms of body mass index (BMI), 24 patients (34.78%) had a BMI ≤25 kg/m², while 45 patients (65.22%) had a BMI >25 kg/m², suggesting that overweight or obese individuals comprised the majority of the study sample. Regarding the duration of back pain, 27 patients (39.13%) reported symptoms for four months or less, whereas 42 patients (60.87%) had symptoms persisting for more than four months, reflecting a higher prevalence of chronic cases in the cohort (Table 1).

Table 1: Baseline characteristics

Baseline characteristics	Frequency (n=69)	Percentage (%)
Age group		
≤50 years	33	47.83
>50 years	36	52.17
Gender		
Male	39	56.52
Female	30	43.48%
BMI		
≤25 Kg/m^2	24	34.78
>25 Kg/m^2	45	65.22
Duration of back pain		
≤4 months	27	39.13
>4 months	42	60.87

A total of 111 lumbar facet joint infiltrations were performed among the 69 patients included in the study. The distribution of injections across different vertebral levels showed that the L3–L4 level was the most frequently targeted, accounting for 48 infiltrations (37.8%), followed by the L2–L3 level with 39 infiltrations (32.4%). The L5–S1 level accounted for 24 infiltrations (21.6%), while the L4–L5 level was the least common, with nine infiltrations (8.1%). Bilateral infiltrations were performed in 53 instances and unilateral infiltrations in 58, indicating a nearly equal distribution. These findings suggest that degenerative changes requiring facet joint interventions were most prevalent at the mid-lumbar levels (L2–L4), reflecting their higher mechanical load-bearing and mobility compared to lower lumbar segments (Table 2).

Table 2: Level of facet joint infiltrations

Levels	Bilateral	Unilateral	Total	Percentage (%)
L5–S1	8	6	24	21.6
L4–5	7	9	9	8.1
L3–4	15	30	48	37.8
L2–3	23	13	39	32.4
Total	53	58	111	100

Pain response following facet joint infiltration was evaluated at multiple follow-up intervals. At one week, 51 out of 69 patients (73.91%) demonstrated significant pain relief. The number of responders increased slightly by the fourth week, with 57 patients (82.61%) reporting improvement, indicating the peak therapeutic effect during this period. However, a gradual decline in response was noted over time, with 48 patients (69.57%) maintaining pain relief at 12 weeks, and 42 patients (60.87%) continuing to report improvement at 24 weeks. These results suggest that facet joint infiltration provides

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effective short-term pain relief, with a sustained but gradually diminishing benefit over a six-month follow-up period (Table 3).

Table 3: Follow-up Assessment of Pain Relief After Facet Joint Infiltration

	Number of patients/responders	Percentage (%)
One week	51/69	73.91
4 Week	57/69	82.61
12 Week	48/69	69.57
24 Week	42/69	60.87

Table 4 shows the comparison of visual analogue scale (VAS) scores before and after ultrasound-guided facet joint block. The baseline mean VAS score was 8.0±0.90. A significant reduction was observed at one week post-procedure (3.43±0.84, p<0.0001), which further decreased at four weeks (2.78±1.34, p<0.0001). Scores remained improved at twelve weeks (3.04±1.36, p<0.0001) and twenty-four weeks (3.83±1.37, p<0.0001), demonstrating sustained pain relief over the 24-week follow-up period (Table 4).

Table 4: Comparison of Vas score

	VAS Score	p-value #
Before Block	8.0±0.90	-
One Week	3.43±0.84	<0.0001
4 Week	2.78±1.34	<0.0001
12 Week	3.04±1.36	<0.0001
24 Week	3.83±1.37	<0.0001

Table 5 presents the comparison of modified Oswestry Disability Index (MODI) scores before and after ultrasound-guided facet joint block. The baseline mean MODI score was 25.91±3.78. At 1-week post-procedure, the mean score decreased significantly to 16.87±3.08 (p<0.0001). Further reductions were observed at four weeks (13.52±3.56, p<0.0001), twelve weeks (14.74±3.91, p<0.0001), and twenty-four weeks (13.96±3.71, p<0.0001), indicating a sustained improvement in functional disability over the 24-week follow-up period (Table 5).

Table 5: Comparison of MODI score

	MODI Score	p-value #
Before Block	25.91±3.78	-
One Week	16.87±3.08	<0.0001
4 Week	13.52±3.56	<0.0001
12 Week	14.74±3.91	<0.0001
24 Week	13.96±3.71	<0.0001

DISCUSSION

Chronic low back pain (LBP) remains a major health burden worldwide, with facet joint arthropathy accounting for a substantial proportion of cases, estimated between 15% and 45% in various studies.[1,3] The facet joints play a critical role in load transmission and stability of the lumbar spine, and degenerative changes in these joints can lead to significant pain and disability.[2,4] Accurate diagnosis and effective management of facet-mediated pain are essential to reduce chronicity and improve quality of life.

In the present study, ultrasound-guided (USG) medial branch block using a combination of local anesthetic and steroid demonstrated significant improvement in both pain and functional outcomes among patients with chronic facet-mediated LBP. The mean VAS score decreased from 8.0±0.90 at baseline to 3.83±1.37 at 24 weeks, and the MODI score improved from 25.91±3.78 to 13.96±3.71 (p<0.0001). These findings indicate that USG-guided medial branch block provides rapid and sustained pain relief along with functional improvement.

Our results are consistent with previous studies that have reported significant pain reduction following facet joint interventions. Manchikanti *et al.* [13] found that fluoroscopy-guided lumbar medial branch blocks produced sustained pain relief in 60–80% of patients at 3–6 months of follow-up. Similarly, Dreyfuss *et al.* [14] demonstrated the diagnostic accuracy and therapeutic benefit of medial branch blocks in well-selected patients with facet arthropathy. In a randomized controlled trial, Galiano *et al.* [5] compared ultrasound-guided and fluoroscopy-guided medial branch blocks and found comparable outcomes in terms of pain relief and accuracy, supporting the reliability of the ultrasound-guided approach.

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In the present study, the highest responder rate (82.61%) was observed at 4 weeks post-procedure, which then gradually declined to 60.87% at 24 weeks. This pattern suggests that the combined use of local anesthetic and steroid provides both immediate and intermediate-term relief, though periodic reassessment may be required for long-term management. The decline in responder rates over time may reflect the natural progression of degenerative pathology and the limited duration of steroid efficacy, as also noted by Boswell *et al*. [10] and Cohen *et al*. [15]

The mid-lumbar levels (L2–L4) were the most commonly affected in our cohort, accounting for nearly 70% of all injections. This aligns with imaging studies showing a higher prevalence of facet joint degeneration at the L3–L4 and L4–L5 levels, driven by increased mechanical load and mobility in these segments.[6,10] Moreover, a majority of patients in our study were overweight or obese (BMI >25 kg/m²), supporting previous findings that obesity is an independent risk factor for lumbar facet arthropathy and chronic LBP. [7,12]

The use of ultrasound guidance in this study offered several advantages, including real-time visualization, avoidance of ionizing radiation, and increased patient comfort. Although fluoroscopy has been the gold standard for facet joint injections, USG has demonstrated comparable accuracy while offering added safety and cost-effectiveness.[5,16] Greher *et al*.[16] demonstrated that ultrasound-guided lumbar medial branch blocks achieved correct needle placement in 92% of cases compared to fluoroscopic verification, highlighting its clinical utility when performed by trained practitioners.

No major adverse events were reported in our study, indicating the safety of this minimally invasive approach. Minor post-procedure soreness was transient and self-limiting. The absence of complications such as infection, bleeding, or nerve injury corroborates prior evidence supporting the safety profile of USG-guided procedures.[17]

The sustained improvement in both VAS and MODI scores emphasizes the therapeutic value of targeting facet-mediated pain through precise nerve blocks. Steroids reduce inflammation and neural sensitization, while local anesthetics interrupt nociceptive transmission, leading to both diagnostic and therapeutic benefits.[18] The combination of these agents under ultrasound guidance thus optimizes clinical outcomes while minimizing procedural risks.

CONCLUSIONS

Ultrasound-guided medial branch block using a combination of local anesthetic and corticosteroid is a safe, effective, and minimally invasive intervention for patients with chronic facet joint–mediated low back pain. The procedure produced significant and sustained reductions in pain intensity and disability, as reflected by improvements in VAS and MODI scores over a 24-week follow-up period. The high responder rate, the absence of major complications, and the favorable safety profile emphasize the clinical utility of this technique.

Future studies with larger sample sizes, longer follow-up, and comparisons with other interventional modalities may help further refine patient selection and optimize long-term outcomes.

CONTRIBUTION OF AUTHORS

Research concept- Dr Ajay Modgil
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