High-Sensitivity C-Reactive Protein's Predictive Value for Immediate Post Operative Radicular Pain Following Per Operative Application of Steroid in Lumber Discectomy

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ABSTRACT

Background: Radicular pain leads to impairment; lumbar discectomy is performed after unsuccessful conservative treatment. hs-CRP serves as an inflammatory marker indicating results and pain following surgery. Steroids offer temporary relief. In Bangladesh, data on hs-CRP's ability to predict immediate postoperative radicular pain following perioperative steroid administration in lumbar discectomy is scarce, and this study investigates this relationship. **Methods:** A future study at Bangladesh Medical University, Dhaka, Bangladesh (2025) involving 60 patients undergoing lumbar discectomy randomized into steroid (n=30) and control (n=30) groups. The steroid group was given intraoperative periradicular steroids; hs-CRP was assessed pre-operation. VAS measured at 24 hours, 7 days, and 1 month. **Results:** initial pain alleviation, VAS variation, and hs-CRP predictive significance ($p<0.05$). **Results:** Sixty patients undergoing lumbar discectomy were equally assigned to steroid (n=30) and control (n=30) groups with comparable baseline characteristics. The steroid group displayed notably lower postoperative VAS scores at 24 hours, 7 days, and 1 month (all $p < 0.001$) and a decreased occurrence of immediate radicular pain (23.3% vs 50.0%, $p = 0.03$). Preoperative hs-CRP levels were considerably elevated in patients who experienced postoperative pain ($p < 0.001$) and exhibited strong predictive

capacity for pain (AUC = 0.81), with a threshold of 5.2 mg/L indicating 78.6% sensitivity and 74.1% specificity (OR: 3.9). **Conclusion:** The use of steroids during lumbar discectomy markedly decreases postoperative radicular pain and enhances VAS results. Preoperative hs-CRP serves as a reliable indicator of postoperative pain and could assist in risk assessment.
Keywords: Radicular Pain, Steroid, Lumber Discectomy, High-Sensitivity C-Reactive Protein.
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INTRODUCTION:

Radicular symptoms associated with low back pain represent a significant global health concern and a top contributor to disability. It happens when spinal nerve roots experience compression and inflammation, resulting in radiating leg pain, sensory issues, and functional restrictions that diminish quality of life and productivity [1,2]. Surgical intervention is deemed necessary when conservative treatment is ineffective or neurological deficits worsen. Lumbar discectomy is the prevalent surgery performed to alleviate nerve root pressure and enhance clinical results [3,4]. Radicular pain arises from both mechanical compression of the nerve root and inflammation. Cytokines that promote inflammation released from disc material can lead to nerve root swelling, increased sensitivity, and pain, highlighting inflammation's critical role in radiculopathy [5].

C-reactive protein (CRP) is a protein produced by the liver during the acute phase in response to inflammatory cytokines, particularly IL-6. High-sensitivity CRP (hs-CRP) identifies low-grade inflammation and is extensively utilized as a biomarker in cardiovascular, metabolic, and inflammatory diseases. Due to the involvement of inflammation in radiculopathy, hs-CRP is under investigation as a biomarker for the severity of the disease and surgical results in patients with lumbar spine issues [6,7].

Research worldwide indicates that the use of epidural steroids following lumbar spine surgeries enhances immediate postoperative pain management and short-term functional results when compared to placebo or other control methods. Nonetheless, systematic reviews and clinical trials indicate that these advantages are primarily short-lived, showing no notable long-term differences in pain alleviation or functional improvement between steroid and non-steroid groups [8,9].

A recent study conducted in Bangladesh regarding epidural steroid injection for prolapsed lumbar intervertebral disc (PLID) showed a notable decrease in pain and enhancement in functional results after treatment. Nonetheless, the advantages were more evident in the short term, showing a gradual decrease over time, indicating restricted long-term effectiveness in maintaining symptom relief [10].

In Bangladesh, there is minimal evidence assessing the function of high-sensitivity C-reactive protein (hs-CRP) as an indicator of acute postoperative radicular pain and its connection with perioperative steroid administration in lumbar discectomy patients. This study seeks to evaluate the predictive significance of hs-CRP for acute postoperative radicular pain after steroid administration during lumbar discectomy.

MATERIALS AND METHODS:

Study design and setting

This was a prospective interventional comparative study conducted in the Department of Neurosurgery, Bangladesh Medical University (BMU), Dhaka, Bangladesh. The study was carried out over a period of 12 months from January 2025 to December 2025.

Study population

A total of 60 patients undergoing lumbar discectomy for lumbar disc herniation with radicular symptoms were enrolled and divided equally into two groups: Group 1 (steroid group, n = 30), who received intraoperative periradicular steroid application, and Group 2 (control group, n = 30), who underwent surgery without steroid administration.

Inclusion criteria

Patients aged 18 years or older with clinically and radiologically confirmed lumbar disc herniation presenting with radicular pain and an indication for single-level lumbar discectomy were included in the study.

Exclusion criteria

Patients with previous lumbar spine surgery, multilevel disc disease, spinal infection, spinal tumor, spinal trauma, chronic steroid therapy, systemic inflammatory or autoimmune disease, or incomplete follow-up data were excluded.

Surgical procedure and intervention

All patients underwent standard lumbar discectomy using a posterior midline approach under general

anesthesia with a uniform surgical protocol. In the steroid group, after completion of disc removal and adequate nerve root decompression, intraoperative steroid was applied locally around the affected nerve root prior to wound closure. No steroid was administered in the control group.

Data collection

Preoperative demographic and clinical data were collected using a structured data collection form. Preoperative high-sensitivity C-reactive protein (hs-CRP) levels were measured from venous blood samples using standard laboratory methods. Postoperative radicular pain was assessed clinically within 24 hours of surgery. Pain intensity was evaluated using the Visual Analogue Scale (VAS), ranging from 0 (no pain) to 10 (worst pain), at 24 hours, 7 days, and 1 month postoperatively during follow-up visits.

Outcome measures

The primary outcome was the incidence of immediate postoperative radicular pain within 24 hours of surgery. Secondary outcomes included postoperative pain intensity measured by serial VAS scores and the predictive value of preoperative hs-CRP for postoperative radicular pain.

Statistical analysis

Statistical analysis was performed using appropriate statistical software. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequency and percentage. Independent sample t-test was used to compare continuous variables between groups, and Chi-square test or Fisher's exact test was used for categorical variables as appropriate. Receiver operating characteristic (ROC) curve analysis was performed to determine the predictive accuracy of preoperative hs-CRP for postoperative radicular pain. Odds ratio (OR) with 95% confidence interval (CI) was calculated. A p-value < 0.05 was considered statistically significant.

Ethical consideration

The study was approved by the Institutional Ethical Review Committee of Bangladesh Medical University (BMU). Written informed consent was obtained from all participants prior to enrollment. Patient confidentiality and ethical research standards were strictly maintained throughout the study.

RESULTS:

A total of 60 patients undergoing lumbar discectomy were included in this interventional comparative study and were equally allocated into two groups: Group 1 (intraoperative steroid group, n = 30) and Group 2 (non-steroid control group, n = 30). All patients were assessed for baseline demographic characteristics, preoperative high-sensitivity C-reactive protein (hs-CRP) levels, postoperative radicular pain, and serial Visual Analogue Scale (VAS) scores.

Baseline characteristics

Table 1 shows the mean age was comparable between the steroid group (42.8 ± 9.6 years) and the control group (44.1 ± 10.2 years). Male patients predominated in both groups (63.3% vs 60.0%). Preoperative pain intensity assessed by VAS was similar between groups (7.9 ± 1.1 vs 8.0 ± 1.0). No statistically significant differences were observed in any baseline variable, indicating adequate comparability between the groups.

Table 1: Baseline characteristics of the study groups

Variables	Group 1 (Steroid) n=30, n (%)	Group 2 (Non-steroid) n=30, n (%)	p-value
Age (years), mean ± SD	42.8 ± 9.6	44.1 ± 10.2	0.63
Male	19 (63.3)	18 (60.0)	0.79
Female	11 (36.7)	12 (40.0)	0.79
Preoperative VAS score	7.9 ± 1.1	8.0 ± 1.0	0.72

Postoperative pain outcome (VAS score)

Table 2 presents postoperative pain intensity showed a progressive reduction in both groups; however, patients receiving intraoperative steroid consistently demonstrated significantly lower VAS scores at all postoperative time points. At 24 hours postoperatively, mean VAS score was significantly lower in the steroid group compared with the control group (2.8 ± 1.0 vs 4.6 ± 1.2, $p < 0.001$). This difference remained significant at postoperative day 7 (1.9 ± 0.8 vs 3.2 ± 1.0, $p < 0.001$) and at one-month follow-up (1.2 ± 0.6 vs 2.4 ± 0.9, $p < 0.001$), demonstrating sustained superior pain control in the steroid group.

Table 2: Comparison of preoperative and postoperative VAS scores

Time Point	Group 1 (Steroid) Mean ± SD	Group 2 (Non-steroid) Mean ± SD	p-value
Preoperative	7.9 ± 1.1	8.0 ± 1.0	0.72
24 hours postoperative	2.8 ± 1.0	4.6 ± 1.2	<0.001
Postoperative Day 7	1.9 ± 0.8	3.2 ± 1.0	<0.001
Postoperative 1 month	1.2 ± 0.6	2.4 ± 0.9	<0.001

Incidence of immediate postoperative radicular pain

Table 3 shows radicular pain occurred in 23.3% of patients in the steroid group compared with 50.0% in the control group. This difference was statistically

significant (p = 0.03), indicating a lower incidence of early postoperative radicular pain among patients receiving intraoperative steroid.

Table 3: Incidence of immediate postoperative radicular pain

Group	Radicular pain present n (%), n (%)	Radicular pain absent n (%), n (%)	p-value
Group 1 (Steroid)	7 (23.3)	23 (76.7)	0.03
Group 2 (Non-steroid)	15 (50.0)	15 (50.0)	0.03

Preoperative hs-CRP and postoperative pain status

Table 4 presents preoperative hs-CRP levels were significantly higher in patients who developed postoperative radicular pain compared to those who remained pain-free (6.8 ± 2.1 mg/L vs 3.4 ± 1.5 mg/L, p < 0.001). This finding suggests a strong association between systemic inflammatory status and the development of early postoperative radicular pain following lumbar discectomy.

Table 4: Comparison of preoperative hs-CRP levels according to pain status

Pain Status	hs-CRP (mg/L), Mean ± SD	p-value
Pain present	6.8 ± 2.1	<0.001
Pain absent	3.4 ± 1.5	<0.001

Predictive performance of hs-CRP

Table 5 shows ROC curve analysis demonstrated good discriminatory ability with an area under the curve (AUC) of 0.81 (95% CI: 0.70–0.92). At an optimal cut-off value of 5.2 mg/L, hs-CRP showed a sensitivity of 78.6% and specificity of 74.1% for predicting postoperative radicular pain. Patients with hs-CRP levels ≥ 5.2 mg/L had a significantly higher risk of developing postoperative radicular pain (OR: 3.9, 95% CI: 1.5–10.2).

Table 5: Diagnostic performance of hs-CRP for predicting postoperative radicular pain

Parameter	Value
Area Under Curve (AUC)	0.81 (95% CI: 0.70–0.92)
Cut-off value	5.2 mg/L
Sensitivity	78.6%
Specificity	74.1%
Odds Ratio (OR)	3.9 (95% CI: 1.5–10.2)

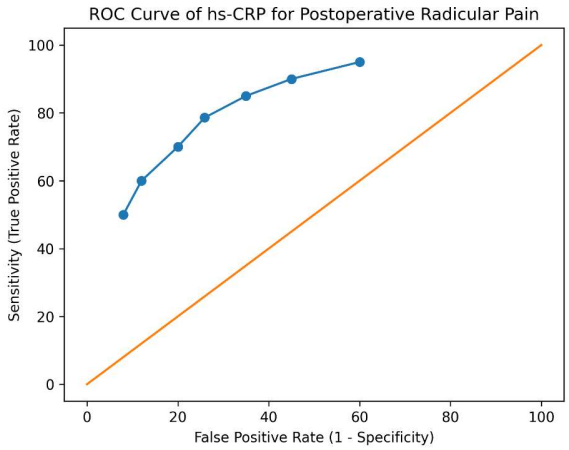

Figure I: ROC Curve of hs-CRP for Prediction of Postoperative Radicular Pain

Figure I present the receiver operating characteristic (ROC) curve demonstrated good predictive performance of preoperative hs-CRP for immediate postoperative radicular pain, with an area under the curve (AUC) of 0.81. At the optimal cut-off value of 5.2 mg/L, hs-CRP demonstrated a sensitivity of 78.6% and specificity of 74.1%, indicating moderate-to-good discriminatory ability.

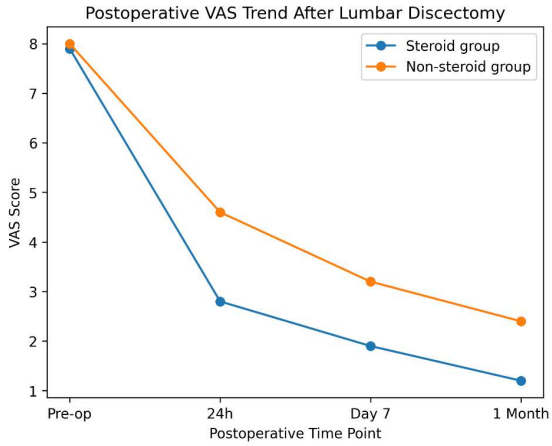

Figure II: Postoperative VAS Trend in Steroid and Non-Steroid Groups

Figure II shows both groups demonstrated a progressive reduction in pain scores over time; however, patients in the steroid group consistently exhibited lower VAS scores compared to the non-steroid group at all postoperative time points. At 24 hours, Day-7, and 1 month follow-up, the steroid group showed significantly better pain control, indicating that intraoperative steroid application effectively reduces immediate and short-term postoperative radicular pain after lumbar discectomy.

DISCUSSION:

Baseline traits were similar across steroid and non-steroid groups, such as age, gender distribution, and

preoperative VAS scores, reflecting effective group matching and minimizing selection bias. This baseline uniformity enables dependable comparison of postoperative results, aligning with findings that standardized patient selection in lumbar discectomy enhances outcome evaluation and research validity in clinical and outpatient surgical environments [11].

Postoperative VAS scores demonstrated a notable and lasting decrease in pain for the steroid group in contrast to the non-steroid group at every time point, suggesting improved early and short-term pain management with the use of intraoperative steroids. This result aligns with evidence indicating that postoperative results after lumbar discectomy are affected by patient-specific and biological variables, such as initial pain and inflammation levels, which notably impact recovery and pain alleviation after the procedure [12].

Postoperative radicular pain right after surgery was notably reduced in the steroid group versus the non-steroid group, suggesting that intraoperative steroids minimize initial nerve root irritation. This provides evidence that radicular and back pain might continue following lumbar discectomy because of remaining inflammation and neural sensitization instead of just mechanical compression [13].

Preoperative hs-CRP levels were notably elevated in patients experiencing postoperative radicular pain, suggesting a strong link between systemic inflammation and the onset of pain following lumbar discectomy. This observation is consistent with data showing that increased hs-CRP is associated with acute postoperative radicular pain in lumbar disc surgery, reinforcing its function as a predictive inflammatory biomarker [14].

hs-CRP demonstrated strong predictive capability for postoperative radicular pain with satisfactory sensitivity and specificity, highlighting its significance in risk assessment. This provides evidence that CRP serves as a significant inflammatory marker for informing clinical decisions in sciatica and evaluating disease activity and treatment effectiveness [15].

ROC analysis indicated that hs-CRP possesses strong predictive capability for postoperative radicular pain, demonstrating adequate sensitivity and specificity, highlighting its value in risk assessment. This provides evidence that CRP serves as a significant inflammatory marker in sciatica for directing management choices and forecasting treatment response. Postoperative VAS trends indicated much less pain in the steroid group at every time point, aligning with studies that show intraoperative steroids diminish early postoperative radicular pain via anti-inflammatory properties [15-17].

In summary, the use of steroids during surgery greatly alleviates postoperative radicular pain, and preoperative hs-CRP is an effective indicator of early postoperative pain after lumbar discectomy.

CONCLUSION:

Administration of periradicular steroids during lumbar discectomy effectively decreases immediate and short-term postoperative radicular pain and enhances VAS results without altering baseline comparability. Preoperative hs-CRP serves as an effective predictor of postoperative radicular pain with high diagnostic accuracy, indicating its possible utility in risk stratification and perioperative care.

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