ORIGINAL ARTICLE

Frequency of surgical site infection in patients undergoing lumbar microdiscectomy

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ABSTRACT

Background: Lumbar microdiscectomy is a common minimally invasive procedure for disc herniation, but SSI is a major complication, especially in LMICs where incidence may be higher due to systemic factors.

Material and Methods: This prospective study of 100 adult patients who underwent lumbar microdiscectomy for lumbar disc herniation at Lady Reading Hospital, Peshawar, Pakistan, from 10 July 2025 to 10 January 2026. Inclusion criteria were patients aged 18–75 years with symptoms >6 weeks; exclusions included prior surgery at the same site, instrumentation, pre-existing infection, severe immunodeficiency, or pregnancy. SSI was defined according to CDC criteria within 30 days postoperatively, with initial clinical assessment performed at 10 days based on wound redness, VAS >4 or cloudy drainage. Data on demographics, comorbidities, and socioeconomic factors were collected. Analysis was performed using frequencies, means/medians, and chi-square or Fisher's exact test.

Results: 13 (13%) of 100 patients had SSI. The mean age was 46.2 ± 12.8 years; 62% were male. The mean BMI was 28.4 ± 5.1 kg/m2; 38% were obese (BMI > 30). SSI was significantly associated with comorbidities, including Obesity (23.7% vs. 6.5%, p=0.012), diabetes (31.8% vs. 7.7%, p=0.003), smoking (22.9% vs. 7.7%, p=0.028), and rural residence (18.9% vs. 4.8%, p=0.032).

Conclusions: The 13% SSI rate in this LMIC group exceeds high-resource series (1-3%) but aligns with regional posterior spine surgery data. Risk factors are Obesity, diabetes, smoking, and rural residence. Enhance perioperative and infection-control practices to reduce SSI in resource-limited settings.

Keywords: Disc herniation, Lumbar microdiscectomy, Spine surgery, Surgical site infection.

BACKGROUND

Lumbar spine surgery treats debilitating conditions like degenerative disc disease, herniation, spinal stenosis, and spondylolisthesis that severely impact quality of life.[1,2] Low back pain (LBP) is considered to be one of the most prevalent causes of disability globally, with its prevalence of about 7.5% of the global population and a significant burden on socioeconomic status.[1] The development of surgical procedures, especially the minimally invasive lumbar surgeries, including microdiscectomy, has contributed to better patient outcomes by preventing tissue trauma, postoperative pain and length of stay compared to the traditional open surgeries.[3,4] These methods have gained more popularity because of their safety profile and quicker recovery rates.

In spite of these developments, surgical site infection (SSI) is a severe postoperative complication that is linked to longer hospital stay, higher healthcare expenses, and reoperation.[5-7] SSIs can be either superficial or deep infections, such as epidural abscess and sepsis, and are manifested by wound erythema, swelling, purulent discharge, and fever.[6] The reported SSI rates after minimally invasive lumbar discectomy in high-resource countries are between 1-3 per cent, but higher rates have been reported in developing countries, with up to 16 per cent in posterior spine surgery.[5,8] A number of patient-related conditions, such as Obesity, diabetes mellitus, smoking, malnutrition, and immunosuppression, have been found to be significant contributors to poor wound healing and high chances of infection.[9-12] Moreover, the burden of SSI in low- and middle-income countries (LMICs) is further augmented by operative and environmental factors including long operative time, violation of aseptic technique, and inadequate healthcare resources.[10,11]

In LMIC settings, additional challenges, such as limited infection-control infrastructure, delayed follow-up, and variability in perioperative antibiotic practices, may further increase the SSI burden. However, local data on SSI incidence and associated risk factors following non-instrumented lumbar microdiscectomy remain scarce. Therefore, this study aimed to determine the frequency of SSI and identify its associated risk factors in patients undergoing lumbar microdiscectomy in a tertiary care neurosurgical unit.

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MATERIAL AND METHODS

The study was a prospective observational study conducted at the Department of Neurosurgery, Lady Reading Hospital, Peshawar, Pakistan, a tertiary care center serving urban and rural populations, between 10 July 2025 and 10 January 2026. One hundred adult patients who had lumbar microdiscectomy were recruited in a non-probability consecutive sampling method. The sample size was determined with an anticipated rate of 15% of the surgical site infection (SSI) and a 95 percent confidence interval and a margin of error of 7 percent.

They were patients between 18 and 75 years of age with lumbar disc herniation confirmed by MRI (less than 25% circumferential displacement) and symptoms persisting longer than 6 weeks who had elective microdiscectomy. Patients who had undergone lumbar surgery at the same level within 12 months prior, and those who needed instrumentation or fusion, pre-existing spinal infection, severe immunodeficiency, or pregnancy were excluded. The Institutional Ethical Review Board of Lady Reading Hospital granted ethical approval vide letter number LRH/206/MTI on 20 May 2025, and informed consent was taken before all the participants were included in the study.

Potential data were gathered, such as demographic (age, gender, body mass index, residence, education, income, and profession), clinical (duration of the symptoms), and comorbid (diabetes mellitus and smoking status) variables. All surgeries were conducted in a standardized way, which includes prone positioning, prophylactic intravenous cefazolin (1 g) 30 minutes before incision, antiseptic preparation of the skin, midline incision (2.54 cm), microscope-assisted discectomy, irrigation and layered wound closure. Only consultants with over 3 years of post-fellowship experience performed all surgeries. SSI was defined according to CDC criteria as an infection occurring within 30 days postoperatively.[13]

The first clinical evaluation of surgical site infection was performed 10 days after surgery at the first follow-up in the OPD, followed by a second assessment at the end of 4 weeks after surgery, based on wound redness, a Visual Analogue Scale (VAS) pain score greater than 4, and cloudy or purulent discharge. Data analysis was done using SPSS version 26. When normally distributed, continuous variables such as age and BMI were expressed as mean ± standard deviation (SD), and when non-normally distributed, the median with interquartile range (IQR) was used to express the symptom duration. The Shapiro-Wilk test was used to determine the normality of the data. Categorical variables, such as gender, obesity, diabetes mellitus, smoking status, and residence, were provided in the form of frequencies and percentages. Independent sample t-test was used to compare normally distributed continuous variables and Mann-Whitney U test was used to compare non-normally distributed variables. Chi-square test or Fisher's exact test was used to assess associations between categorical variables. A p-value of ≤ 0.05 was considered statistically significant.

Variables with $p < 0.10$ in univariate analysis were entered into a multivariate logistic regression model to identify independent predictors. Adjusted odds ratios (aOR) with 95% confidence intervals were reported.

RESULTS

A total of 100 patients were included. The mean age was 46.2 ± 12.8 years, and 62% were male. The mean BMI was 28.4 ± 5.1 kg/m², with 38% classified as obese. Diabetes was present in 22%, smoking in 35%, and 58% resided in rural areas. Table-I.

Thirteen patients (13%; 95% CI: 7.1–21.2) developed SSI. All infections were superficial, presenting with erythema, pain (VAS >4), and cloudy drainage; none required reoperation or progressed to deep infection (Figure-I).

SSI rates varied significantly by patient factors (Table-II). Obesity was associated with a nearly fourfold increase (23.7% vs. 6.5%, p=0.012). Diabetes conferred the highest risk (31.8% vs. 7.7%, p=0.003), followed by smoking (22.9% vs. 7.7%, p=0.028) and rural residence (18.9% vs. 4.8%, p=0.032). No SSI occurred in patients with BMI <25 or absent modifiable comorbidities. Table-III.

On multivariate logistic regression analysis, diabetes mellitus (aOR 3.9, 95% CI 1.3–11.5, p=0.015) and Obesity (aOR 3.2, 95% CI 1.1–9.4, p=0.032) remained independent predictors of surgical site infection. Smoking (aOR 2.1, p=0.18) and rural residence (aOR 2.6, p=0.11) were not statistically significant after adjustment.

Table-I: Baseline demographic and clinical characteristics (n=100)

Characteristic	Value
Age (years)	46.2 ± 12.8
Male gender	62 (62%)
Body mass index (kg/m²)	28.4 ± 5.1
Obesity (BMI ≥30 kg/m²)	38 (38%)
Diabetes mellitus	22 (22%)
Current smoking	35 (35%)
Rural residence	58 (58%)
Low socioeconomic status,	65 (65%)
Symptom duration (weeks)	12 (8–20)

Table-II: Stratification of surgical site infection by risk factors.

Risk Factor	SSI Present (n = 13) n (%)	SSI Absent (n = 87) n (%)	p-value
Obesity (BMI ≥30)	9 (69.2%)	29 (33.3%)	0.012
Diabetes mellitus	7 (53.8%)	15 (17.2%)	0.003
Current smoking	8 (61.5%)	27 (31.0%)	0.028
Rural residence	11 (84.6%)	47 (54.0%)	0.032
Urban residence	2 (15.4%)	40 (46.0%)	
Age ≥50 years	6 (46.2%)	33 (37.9%)	0.498
Age <50 years	7 (53.8%)	54 (62.1%)	

Table-III. Multivariate Logistic Regression Analysis of Risk Factors for SSI

Variable	Adjusted OR (aOR)	95% CI	p-value
Diabetes mellitus	3.9	1.3 – 11.5	0.015
Obesity	3.2	1.1 – 9.4	0.032
Smoking	2.1	0.7 – 6.5	0.18
Rural residence	2.6	0.8 – 8.7	0.11

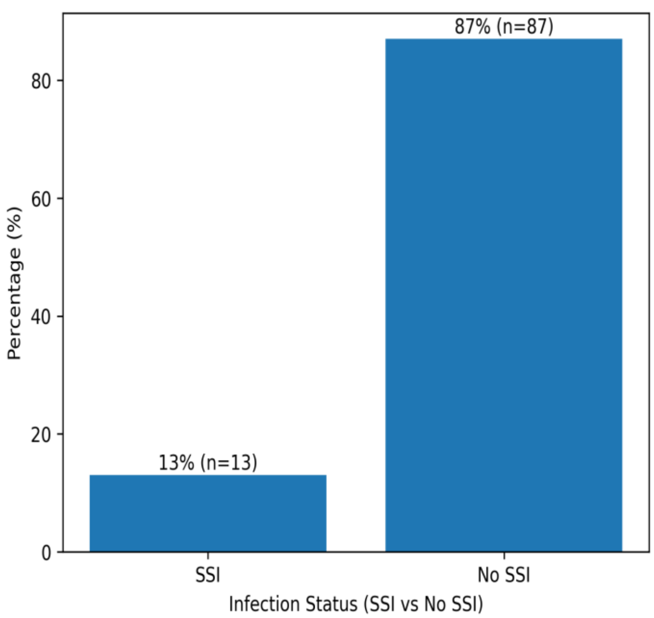

Figure-I: Bar chart showing overall SSI frequency (13%) compared to no SSI (87%).

DISCUSSION

This study demonstrated an SSI rate of 13%, which is substantially higher than the 1–3% reported in high-resource settings but consistent with data from LMIC environments. All infections were superficial and managed conservatively, suggesting early detection and adequate postoperative care. This is much higher than the rates reported in high-resource environments for minimally invasive lumbar discectomy, with modern series reporting an SSI incidence of 0.5-3%[6], but comparable to the broader range reported in posterior thoracolumbar and lumbar spine surgery. A meta-analysis of 27 studies showed a pooled incidence of SSI of 3.1% following spine surgery, 1.4% superficial, and 1.7% deep SSI.[7]

Obesity (BMI 30) was also a significant risk factor with an infection rate of 23.7 versus 6.5 in non-obese patients (p=0.012). This fourfold growth is consistent with the current literature: a study of 109 patients undergoing spinal surgery found Obesity to be a risk factor associated with substantial economic losses,[7] and another study found subcutaneous fat thickness to be a predictor, with adjusted odds ratios greater than 2.5.[12]

It was found to be most correlated with diabetes mellitus (31.8% SSI rate, p=0.003), which is consistent with systematic reviews showing a 2-5-fold increase in odds of diabetic spine patients because of glycemic effects on healing.[10] Diabetes was confirmed as a predictor of deep SSI in a meta-analysis of risk factors following open anterior lumbar fusion.[11]

Our non-instrumented microdiscectomy rate was 13 percent compared to instrumented procedures (SSI rates of 5-12 percent in optimized settings), which means that LMICs are still at risk of SSI even with the implementation of a minimally invasive procedure.[14] Implant contamination is a cause of SSI, which is demonstrated in a systematic review.[15] Vancomycin intraoperative has been effective in preventing SSI in spinal surgery with a meta-analysis indicating lower rates of infection.[16,17] Intraoperative vancomycin powder is an important preventive intervention, and recent reviews suggest that it should be used routinely in spine surgery as a component of multifaceted bundles, which is a significant reduction in SSI rates when used in combination with preoperative optimization and strict aseptic technique.[18] Deep surgical site infections are mostly identified in the early postoperative period, with research indicating that most of the cases are diagnosed within 30-90 days, and thus close observation is necessary during this high-risk period.[19] Prophylaxis, such as timely systemic antibiotics, irrigation, and careful wound care, such as layered closure and drain care, is still necessary to reduce SSI.[20] Specific interventions, such as preoperative glycemic control, smoking cessation, nutritional optimization, and adjunctive local antimicrobials, can significantly alter the risk of SSI and enhance the outcomes of both instrumented and non-instrumented operations.

In multivariate analysis, diabetes mellitus and obesity remained independent predictors of surgical site infection, consistent with existing literature demonstrating impaired wound healing and increased susceptibility to infection in these populations. Smoking and rural residence lost statistical significance after adjustment, suggesting that their effects may be mediated through other clinical or socioeconomic variables.

The strengths of our study include prospective design, standardized method, consecutive sampling, and socioeconomic detail, which are not typical of the regional literature. The study has limitations, including being single-center, a relatively small sample size, and limited follow-up. The 10-day follow-up may have underestimated the incidence of SSI compared with the usual 30-day surveillance. Also, the lack of microbiological data limits the ability to draw pathogen-specific conclusions.

CONCLUSION

In this LMIC cohort, SSI occurred in 13 per cent of lumbar microdiscectomy patients, with the most significant predictors being obesity, diabetes, smoking, and rural residence. These findings suggest that risk stratification and prevention can enhance outcomes in resource-limited settings.

CONFLICT OF INTEREST

None

GRANT SUPPORT & FINANCIAL DISCLOSURE

Declared none

AUTHOR CONTRIBUTION

Adnan Khan: Substantial contributions to study design, acquisition of data, manuscript drafting or reviewing it critical for important intellectual content, has given final approval of the version to be published.
Farooq Azam: Substantial contributions to acquisition of data, manuscript drafting or reviewing it critical for important intellectual content, has given final approval of the version to be published.
Muhammad Nawaz Khan: Substantial contributions to analysis and interpretation of data, critical review, has given final approval of the version to be published.
Muhammad Sohaib Khan: Substantial contributions to concept, study design, critical review, has given final approval of the version to be published.
Syed Shayan Shah: Critical review, has given final approval of the version to be published, substantial contributions to acquisition of data.
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