

Original Article

Predicting Outcomes in Posterior Lumbar Interbody Fusion Surgery Using the Kaplan-Feinstein Comorbidity Index

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Objective:

This study evaluates the predictive value of the Kaplan-Feinstein Comorbidity Index (KFI) in determining outcomes of posterior lumbar interbody fusion (PLIF) surgery.

Methods: A retrospective analysis was conducted on 68 patients who underwent PLIF surgery performed by a single surgeon at a private hospital between 2022 and 2024. The male-to-female ratio was 3:2, with a minimum follow-up of one year. The KFI was applied to assess comorbidity burden.

Results:

Higher KFI scores correlated with poorer postoperative outcomes. Diabetes mellitus and ischemic heart disease emerged as significant predictors of adverse surgical outcomes.

Conclusion:

The KFI is a valuable tool for risk stratification in PLIF surgery. Patients with diabetes and ischemic heart disease may require closer perioperative management to optimize outcomes.

Introduction

Posterior lumbar interbody fusion (PLIF) is widely performed to treat degenerative spinal disorders, spondylolisthesis, and spinal instability [1,2]. Despite technological advancements in surgical techniques and implants, postoperative complications remain a significant concern, especially in patients with multiple comorbidities [3-5].

Several comorbidity indices, including the Charlson Comorbidity Index (CCI) and Elixhauser Comorbidity Index, have been used to predict surgical risk, still the Kaplan-Feinstein Comorbidity Index (KFI) provides a more detailed assessment of chronic conditions, particularly cardiovascular and metabolic disorders [6-10].

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Patients with diabetes mellitus and ischemic heart disease undergoing spinal surgery are at higher risk of complications such as infection, prolonged hospitalization, and nonunion [11-14]. Previous studies have demonstrated that diabetes is associated with impaired bone healing, increased infection risk, and prolonged recovery time [15-18]. Similarly, ischemic heart disease has been linked to poor perioperative cardiac function, leading to an increased risk of adverse surgical outcomes [19-22]. Despite these findings, the specific impact of comorbidities on PLIF outcomes remains underexplored [23-25]. This study aims to evaluate the prognostic utility of the KFI in predicting postoperative complications in PLIF surgery. Furthermore, we investigate the influence of specific comorbidities, particularly diabetes mellitus and ischemic heart disease, on surgical outcomes.

Methods

A retrospective cohort study was conducted on 68 patients who underwent PLIF surgery at a private hospital between 2022 and 2024. Patients were followed for a minimum of 12 months postoperatively.

Inclusion criteria:

- Adults aged 22-64 years undergoing PLIF for degenerative disc disease, spondylolisthesis, or spinal stenosis
- Minimum follow-up period of 12 months

Exclusion criteria:

- Previous lumbar fusion surgery
- Active infection or malignancy

Comorbidity Assessment:

The Kaplan-Feinstein Comorbidity Index (KFI) was applied to all patients to assess comorbidity burden [26,27]. Primary outcome measures included postoperative complications, reoperation rates, and hospital length of stay. Kaplan-Meier survival analysis was performed to determine operation-free survival.

Results

A total of 68 patients were analyzed, with a male-to-female ratio of 3:2 and a mean age of 54.2 ± 8.7 years. Diabetes mellitus (32%) and ischemic heart disease (22%) were the most prevalent comorbidities. Patients with KFI ≥4 had significantly higher postoperative complication rates and lower reoperation-free survival (p=0.02).

Table 1. Patient Characteristics and KFI Morbidity

Characteristic	n (%) or Mean ± SD
Age (years)	54.2 ± 8.7
Male/Female Ratio	3:2
BMI (kg/m ²)	27.6 ± 4.2
Diabetes Mellitus	22 (32%)
Hypertension	28 (41%)
Ischemic Heart Disease	15 (22%)
Chronic Kidney Disease	9 (13%)
KFI Score (Mean)	3.8 ± 1.4
Postoperative Complications	21 (31%)
Reoperation Rate	7 (10%)

Figure 1 : Pie chart displaying the distribution of comorbidities in PLIF patients

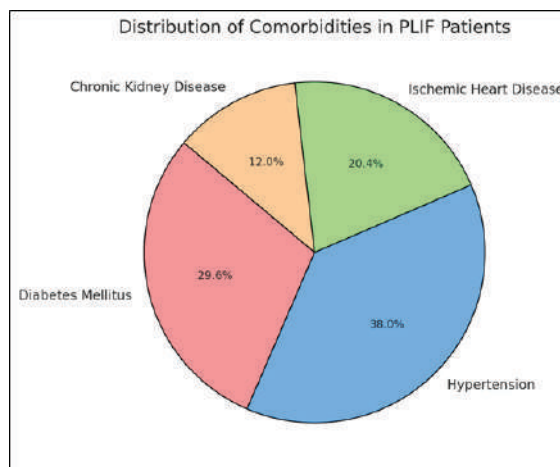


Figure 2 : Kaplan-Meier Survival Curve for KFI and Outcomes

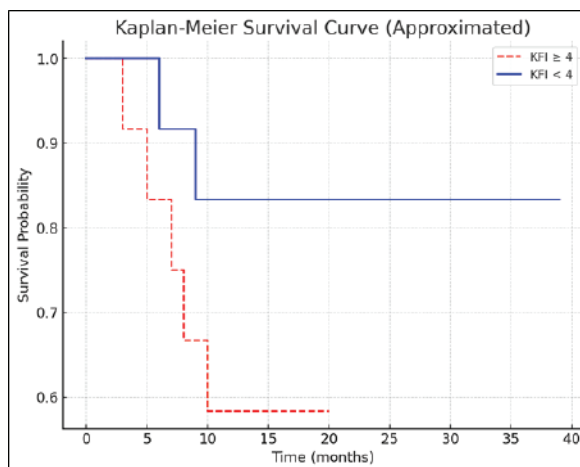


Figure 3 : Multiple logistic regression chart displaying the odds ratios (with 95% confidence intervals) for predictors of postoperative complications

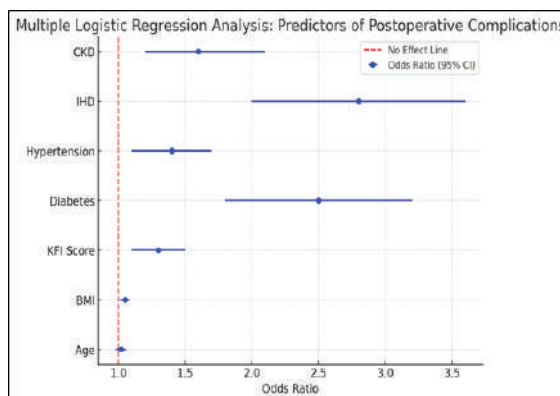
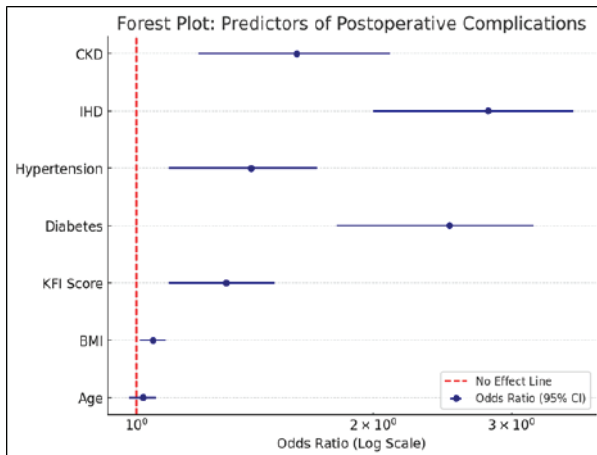


Figure 4 : Forest plot displaying the odds ratios with 95% confidence intervals on a log scale



Discussion

Our findings demonstrate that higher KFI scores correlate with poorer PLIF outcomes, reinforcing the importance of comorbidity assessment in preoperative planning. Patients with KFI ≥ 4 had significantly higher complication rates and lower reoperation-free survival, aligning with previous research on comorbidity indices in spinal surgery [28-30].

Diabetes mellitus and ischemic heart disease emerged as the strongest predictors of adverse outcomes. Diabetes has been associated with increased infection rates and impaired fusion due to poor bone metabolism and microvascular dysfunction [31-34]. Similarly, ischemic heart disease contributes to perioperative cardiac complications, reducing overall functional recovery [35-37].

Compared to the Charlson and Elixhauser indices, the KFI provides a more detailed stratification of cardiovascular and metabolic comorbidities [38-40]. Future research should focus on integrating KFI into preoperative screening to identify high-risk patients and optimize their perioperative management.

Comorbidity Indices:

The Kaplan-Feinstein Comorbidity Index offers a more detailed stratification of chronic conditions, particularly cardiovascular and metabolic diseases, compared to traditional indices such as the Charlson Comorbidity Index (CCI) and Elixhauser Comorbidity Index.

Unlike the CCI, which primarily assigns weighted scores to broad disease categories, the KFI allows for a more nuanced assessment of disease severity, which may better reflect the actual surgical risk in PLIF patients.

Clinical Implications

Given the predictive value of the KFI, incorporating it into routine preoperative assessment can help in risk stratification and individualized patient counseling.

Patients with a high KFI score, particularly those with diabetes and IHD, may benefit from:

Preoperative Optimization:

- Intensive glycemic control for diabetic patients
- Preoperative cardiac risk assessment and cardiology consultation for patients with IHD
- Optimization of nutritional and bone health status
- Enhanced Perioperative Care:
- Stringent infection control measures
- Intraoperative hemodynamic monitoring in high-risk cardiovascular patients
- Early mobilization strategies to reduce complications associated with prolonged hospitalization

Future Directions:

To confirm the effectiveness of the KFI in multi-center settings and bigger cohorts, more prospective research is required. Furthermore, combining comorbidity indices with machine learning techniques could enhance risk prediction models for patients with PLIF.

Conclusion

The predictive value of the Kaplan-Feinstein Comorbidity Index (KFI) in forecasting postoperative results after posterior lumbar interbody fusion (PLIF) surgery is demonstrated in this study. The significance of comorbidity assessment in surgical planning was further supported by the significantly greater complication rates and shorter reoperation-free survival rates of patients with higher KFI scores (≥ 4). Ischemic heart disease and diabetes mellitus were found to be significant predictors of unfavorable outcomes, indicating that high-risk patients can profit from better perioperative care. PLIF surgery patient selection and after treatment may be enhanced by including KFI into preoperative risk classification.

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