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Research Paper

# The Effects of Underlying Comorbidities on Surgical Outcome in Patients With Spondylolisthesis Undergoing Surgical Treatment

**Zohair Reihanian[1,2], Hamid Behzadnia[2], Babak Alijani[1,2], Seyfollah Jafari[2], Shahrokh Yousefzadeh-Chabok[1,2], Mostafa Ramezani-Shamami[2*]**

*1. Guilan Road Trauma Research Center, Guilan University of Medical Sciences, Rasht, Iran*
*2. Department of Neurosurgery, School of Medicine, Guilan University of Medical Sciences, Rasht, Iran*

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## ABSTRACT

**Background and Aim:** In patients with spondylolisthesis, both conservative and surgical approaches are considered based on the stage of the disease. However, in addition to the technical characteristics of the surgery and the stage of the disease, the underlying characteristics of the patients may also affect the therapeutic prognosis. In this regard, some studies have indicated that the surgical prognosis is worse in diabetic and hypertensive patients and also preoperative medical treatments, such as anticoagulants may be effective in the prognosis of the disease. The aim of this study was to evaluate the role of underlying risk factors, such as diabetes mellitus, hypertension, and anticoagulant conditions (such as aspirin) in worsening outcomes after surgery in patients with spondylolisthesis.

**Methods and Materials/Patients:** This cross-sectional study was conducted on 130 patients suffering from spondylolisthesis and scheduled for surgery. According to baseline characteristics, 65 patients with a history of diabetes mellitus, hypertension, and receiving aspirin were categorized as the case group, and 65 sex- and age-matched individuals without such comorbidities as the control group. Preoperative and postoperative radicular pain intensity, wound healing, and discharge from the surgical site were considered the study outcomes.

**Results:** The two groups with and without comorbidities were matched for gender, mean age, mean body mass index, and time of operation. Preoperative pain intensity was similar in the groups, but those with comorbidities experienced higher radicular pain severity postoperatively. We showed no difference in the rate of surgical site discharging, but the lack of wound healing was significantly higher in those with comorbidities.

**Conclusion:** In patients with spondylolisthesis and candidates for surgical treatment, a history of diabetes mellitus, hypertension, and aspirin can be associated with a worse prognosis, including no improvement in pain and lack of wound healing.

*** Corresponding Author:**
***Mostafa Ramezani-Shamami, MD.***
***Address:*** *Department of Neurosurgery, School of Medicine, Guilan University of Medical Sciences, Rasht, Iran*
***Tel:*** *+98 (903) 2075159*
***E-mail:*** *mostafa.shamami1992@gmail.com*

## Highlights

- The prognosis of postoperative recovery in patients with diabetes and hypertension and in aspirin users is worse.

- No pain improvement was observed in patients with spondylolisthesis who used aspirin and those who had underlying diseases, such as diabetes and hypertension.

- Wound healing is not favorable in diabetic patients, those suffering from hypertension, and aspirin users who are a candidate for spondylolisthesis surgery.

## Plain Language Summary

Conservative and surgical approaches are considered for surgery considering the stage of spondylolisthesis. Technical characteristics of the surgery and the stage of the disease and importantly, the underlying characteristics of the patients can affect the prognosis. The surgical prognosis is usually worse in diabetic and hypertensive patients. Preoperative medical treatments can also affect the prognosis of the disease. This cross-sectional study was conducted on 130 patients suffering from spondylolisthesis and scheduled for surgery. According to baseline characteristics, 65 patients with a history of diabetes mellitus, hypertension, and receiving aspirin were categorized as the case group, and 65 sex- and age-matched individuals without such comorbidities as the control group. Preoperative and postoperative radicular pain intensity, wound healing, and discharge from the surgical site were considered as the study outcomes. Preoperative pain intensity was similar in the groups, but those with comorbidities experienced higher radicular pain severity postoperatively. There was no difference in the rate of surgical site discharging, but the lack of wound healing was significantly higher in those with comorbidities. In patients with spondylolisthesis and candidates for surgical treatment, a history of diabetes mellitus, hypertension, and aspirin use are associated with a worse prognosis, including no improvement in pain and lack of wound healing.

## 1. Introduction

Patients with spondylolisthesis often do not require surgical treatment and most of the patients can be treated and improved through conservative therapies [1, 2]. In cases requiring surgical intervention, the optimal choice of patients based on the stage of the disease and the presence of underlying comorbidities can lead to the desired outcome of surgery [3]. Those resistant to conservative management or with the progressive disease require surgical intervention; however, there is disagreement about the type of surgical treatment. Nonetheless, there is a greater tendency to use internal fixation of the vertebrae [4]. Overall, it should be noted that therapeutic messages, in addition to the stage of the lesion and its grade, also depend on several other factors, such as the patient's underlying condition [5, 6]. In other words, exposure to underlying comorbidities, such as inflammatory and degenerative disorders may increase the likelihood of a poorer postsurgical prognosis [7]. In this regard, the role of progressive and chronic underlying disorders, such as diabetes mellitus, hypertension, or coagulative disorders has been investigated [8, 9]. However, we know very little about how such underlying disorders affect the outcome of conservative or surgical treatments. Understanding the factors affecting the results of surgery can help to improve the results, and in this case, the underlying diseases, especially chronic cases, as well as the chronically drugs used are very important. The aim of this study was to evaluate the role of underlying risk factors, such as diabetes mellitus, hypertension, and anticoagulant conditions (such as aspirin) in worsening outcomes after surgery in patients with spondylolisthesis.

## 2. Methods and Materials/Patients

This cross-sectional study was conducted on 130 patients suffering from spondylolisthesis and scheduled for surgery. According to baseline characteristics, 65 patients with a history of diabetes mellitus, hypertension, and receiving aspirin were categorized as the case group, and 65 sex- and age-matched individuals without such comorbidities as the control group. The exclusion criteria were bleeding diseases or underlying diseases other than diabetes and hypertension (such as hemophilia, etc.) and the use of drugs that affect blood coagulation. Initially, the records of these patients were

followed up from the hospital registration system. The studied background information, including age, gender, Body Mass Index (BMI), and duration of surgery was collected by reviewing the patients' hospital recorded files. Furthermore, the outcomes studied included 1) severity of preoperative and postoperative radicular pain based on the Visual Analogue Scale (VAS) scoring system (ranging from 0 as *no pain* to 10 as *the most severe pain* could be described), 2) discharge from the surgical site, and 3) wound healing that was determined based on interviews with patients and physical examination of the surgical site.

For statistical analysis, the results were presented as Mean±SD for quantitative variables and were summarized by frequency (percentage) for categorical variables. Continuous variables were compared using a t-test or Mann-Whitney test whenever the data did not appear to have normal distribution or when the assumption of equal variances was violated across the study groups. P-values of ≤0.05 were considered statistically significant. For the statistical analysis, the SPSS software version 23 for windows (IBM, Armonk, New York) was used.

## 3. Results

The two groups with and without comorbidities were matched for baseline characteristics, including gender, mean age, mean BMI, and time of operation (Table 1). In the case and control groups, the Mean±SD score of preoperative pain score was 7.28±1.18 and 7.26±0.85, respectively with no significant difference between the two groups (P=0.932). However, the Mean±SD postoperative VAS pain score was 5.26±0.85 and 2.97±0.96, respectively, which in the case group was significantly higher than the control group (P=0.001). In the case and control groups, the frequency of discharge from the operation site was 12.3% and 4.6%, respectively, which was not statistically significant despite the numerical difference (P=0.115). Meanwhile, the rate of non-healing wounds at the site of surgery was significantly higher in the case group than in the control group (20.0 versus 6.2%, P=0.019). In a multivariate logistic regression model and in the presence of underlying factors, including sex, age, BMI, and duration of surgery, the presence of risk factors for diabetes, hypertension, and aspirin use was found to be potential risk factors for the non-healing wound after surgery (OR=0.241, P=0.020) (Table 2), also, in the multivariate linear regression analysis, the presence of such risk factors could predict postoperative pain intensity (beta=-2.309, P=0.001) (Table 3).

## 4. Discussion

In patients with spondylolisthesis, both conservative and surgical approaches are considered based on the stage of the disease. However, in addition to the technical characteristics of the surgery and the stage of the disease, the underlying characteristics of the patients may also affect the therapeutic prognosis. In this regard, some studies have indicated that the surgical prognosis is worse in diabetic and hypertensive patients and also preoperative medical treatments, such as anticoagulants may be effective in the prognosis of the disease. We compared the clinical outcome of patients undergoing surgery in two groups of patients who were diabetic/hypertensive/aspirin user and patients without these risk factors. In this study, three main outcomes were considered, including the improvement of patients' pain, healing of the patient's wound, and secretion of fluid from the surgical site. In this regard, we showed that, firstly, the presence of underlying risk factors for diabetes mellitus, hypertension, and aspirin use (in patients with high coagulation diseases) not only delays wound healing but also improves radicular pain intensity due to spondylolisthesis in patients with risk factors. Although many studies have been performed on the results of various conservative and surgical interventions in patients with spondylolisthesis, few studies have been conducted to indicate which underlying risk factors can affect the prognosis of this surgery.

The results of these studies have been very contradictory. Khan et al. in contrast to our study observed no difference between the diabetic and non-diabetic groups in terms of clinical outcomes. Similarly, no difference was observed between the two groups in terms of the need for reoperation or postoperative complications [10] and a history of diabetes had no effect on exacerbation of poor prognosis. Oster et al. reported that a history of diabetes or smoking did not affect the prognosis of surgery in these patients [11]. However, Nagata et al. reported worse ODI (Oswestry Disability Index) scores and lower quality of life in diabetic patients than non-diabetic patients within one year after surgery [12]. In the study by Moazzeni et al., diabetic and non-diabetic patients who performed fusion one year after surgery showed a significant difference. Diabetic patients had a much higher pain score than non-diabetics within one year after surgery [13]. In addition, in an analytical study by

**Table 1.** Baseline characteristics and prognosis of patients

| Characteristics | No. (%) / Mean±SD | | P |
|---|---|---|---|
| | Experimental Group | Control Group | |
| Male gender | 25(38.5) | 29(44.6) | 0.477 |
| Mean age (y) | 59.75±5.64 | 60.15±6.13 | 0.699 |
| Mean body mass index (kg/m$^2$) | 26.34±1.66 | 26.25±1.59 | 0.092 |
| Mean operation time (min) | 185.51±13.20 | 186.69±13.75 | 0.617 |
| Mean preoperative pain score | 7.28±1.18 | 7.26±0.85 | 0.932 |
| Mean postoperative pain score | 5.26±0.85 | 2.97±0.96 | 0.001 |
| Secretion of fluid from surgical site | 8(12.3) | 3(4.6) | 0.115 |
| Lack of wound healing | 13(20.0) | 4(6.2) | 0.019 |

**Table 2.** Difference in wound healing between the two groups in the multivariate logistic regression model and in the presence of underlying factors

| Characteristics | P | Odds Ratio | Lower | Upper |
|---|---|---|---|---|
| Risk factor | 0.020 | 0.241 | 0.073 | 0.801 |
| Gender | 0.651 | 0.778 | 0.262 | 2.307 |
| Age | 0.166 | 1.068 | 0.973 | 1.173 |
| Body mass index | 0.748 | 1.055 | 0.761 | 1.464 |
| Operation time | 0.581 | 1.011 | 0.972 | 1.052 |

**Table 3.** Difference in postoperative pain score between the two groups in the multivariate linear regression model and in the presence of underlying factors

| Characteristics | P | Beta | Lower Limit | Upper Limit |
|---|---|---|---|---|
| Risk factor | 0.001 | -2.309 | -2.626 | -1.992 |
| Gender | 0.877 | 0.026 | -0.300 | 0.652 |
| Age | 0.062 | 0.026 | -0.001 | 0.054 |
| Body mass index | 0.912 | 0.006 | -0.093 | 0.104 |
| Operation time | 0.222 | 0.007 | -0.005 | 0.019 |

Freedman et al., diabetic patients were at higher risk for side effects and adverse postoperative outcomes for spondylolisthesis due to older age and higher BMI [14].

In a review study by Luo et al., length of hospital stay, mortality, and risk of venous thrombosis were higher in diabetic patients with spondylolisthesis [15].

Regarding the effect of underlying risk factors on surgical outcomes in patients with spondylolisthesis, due to the high susceptibility of diabetic and hypertensive patients to exacerbation of inflammatory responses, they are less prone to pain relief after surgery or lack of wound healing. This is especially true for diabetics. Therefore, the worse outcome of surgery in patients with these risk factors will be completely predictable.

## 5. Conclusion

In patients with spondylolisthesis and candidates for surgical treatment, a history of diabetes mellitus, hypertension, and aspirin use can be associated with a worse prognosis, including no improvement in pain and delayed wound healing.

### Limitations

This study had a small sample size because those with bleeding disorders, including patients with hemophilia and thalassemia or underlying diseases other than diabetes and hypertension, and also those using drugs affecting blood coagulation, such as warfarin and heparin, were excluded from the study. Considering the persistent pain among the diabetics, the comparison of pain was performed using VAS score in patients with and without diabetes and hypertension. Furthermore, the required data considering the outcomes of aspirin in the patients were not available in the hospital records; therefore, we could not evaluate this variable. Prospective studies are recommended to consider this important outcome in patients.

## Ethical Considerations

### Compliance with ethical guidelines

This article was approved by the Ethical Research Comitee of Guilan University of Medical Sciences, Rasht (Code: IR.GUMS.REC.1400.592).

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### Authors' contributions

Conceptualization and design: Zohair Reihanian; Data collection: Mostafa Ramezani-Shamami; Data analysis and interpretation: Babak Alijani; Drafting the article: All authors; Critically revising the article: Seyfollah Jafari; Approving the final version of the manuscript: All authors.

### Conflict of interest

The authors declared no conflict of interest.

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