DOI: https://doi.org/10.53350/pjmhs20231709181

ORIGINAL ARTICLE

Early and Late Complications Following Surgical Intervention for Degenerative Spondylosis

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ABSTRACT

Objective: To evaluate the early and late complications following surgical interventions for degenerative spondylosis, focusing on their impact on recovery and long-term outcomes.

Methodology: A retrospective analysis was conducted at the Department of Orthopedic & Spine Surgery, Hayatabad Medical Complex, Peshawar, from June 2017 to June 2022, involving 100 patients who underwent spinal surgeries for degenerative spondylosis. The sample was divided into two groups: 57 patients who underwent decompression only and 43 who underwent decompression with fusion. The study analyzed early complications (within 30 days post-surgery) and late complications (after 30 days), along with the role of comorbidities in these outcomes.

Results: The study found that 45% of patients experienced early complications, including wound infections, hematomas, and nerve damage, while 55% had no early complications. For late complications, 44% of patients developed issues such as adjacent segment degeneration and pseudoarthrosis, and 56% did not experience any late complications. Comorbidities such as diabetes, hypertension, obesity, and osteoporosis were prevalent, with diabetes and hypertension significantly increasing the risk of complications ($p = 0.045$ for late complications).

Conclusion: The study concluded that spinal surgery for degenerative spondylosis carries a substantial risk of both early and late complications, particularly in patients with comorbid conditions. These findings emphasize the importance of preoperative assessments and tailored care strategies to minimize complications and improve patient outcomes. Future research should focus on larger, multicenter studies to refine surgical techniques and further explore the relationship between comorbidities and complications in spinal surgeries.

Keywords: degenerative spondylosis, spinal surgery, complications, decompression, fusion.

INTRODUCTION

Degenerative spondylosis, a condition characterized by the wear and tear of the spine's intervertebral discs and associated structures, is prevalent among older adults, causing a range of debilitating symptoms including back pain, radiculopathy, and spinal stenosis. In cases where conservative treatments such as physical therapy or pharmacological interventions fail, surgical interventions become necessary.[1,2] Surgical options typically include spinal decompression, fusion, and increasingly, minimally invasive procedures. However, despite the potential for significant improvement, surgical intervention for degenerative spondylosis is not without risk. Early and late complications can arise, which affect recovery times, patient outcomes, and the need for further surgical interventions.[3,4] This research explores the early and late complications associated with surgical interventions for degenerative spondylosis, with a focus on outcomes at Hayatabad Medical Complex, Peshawar.

Degenerative spondylosis results from aging, mechanical wear, or repetitive stress on the spine, leading to disc degeneration, facet joint osteoarthritis, and sometimes, spinal stenosis. This condition can cause severe pain, stiffness, and loss of function. When conservative treatments fail to provide relief, surgery is often the next step. Surgical options include decompression, which alleviates nerve root compression, and fusion, which stabilizes the spine. However, despite the effectiveness of these surgeries in relieving symptoms, they are associated with various complications. According to Bròdano et al. (2015), complications following spinal surgeries are common, with a prevalence of 17.3%, particularly in patients undergoing surgery for degenerative diseases. These complications can be classified into mechanical, neurological, and infection-related issues, which often necessitate further interventions.[5] A study by Gille et al. (2014) also identified adjacent segment degeneration as one of the most frequent long-term complications following spinal fusion, with significant effects on the long-term outcome and patient quality of life.[6]

Surgical treatment of degenerative spondylosis can also lead to early complications such as infection, bleeding, and nerve damage. Burch et al. (2020) reported a 25% overall complication rate in patients undergoing spinal surgery, with the most common early complications being postoperative ileus and nerve-related issues.[7] These complications can significantly prolong recovery times and increase healthcare costs. Additionally, the risk of infection, particularly in more invasive procedures such as spinal fusion, remains a significant concern. A systematic review by Farooq et al. (2023) found that while many postoperative complications are self-limiting, some, such as severe infections, can lead to long-term complications that require additional treatment.[8]

Late complications, such as adjacent segment disease, occur when the spinal segments adjacent to the fusion site degenerate due to altered biomechanics. Simon et al. (2018) identified adjacent segment degeneration as a significant late complication following surgery for degenerative spondylosis, with some patients requiring additional surgeries years after the initial procedure.[9] Furthermore, pseudoarthrosis, or failure of spinal fusion, has been identified as a recurrent problem following spinal fusion surgery. This issue can lead to further spinal instability, necessitating revision surgery, as noted in a study by Matsumoto et al. (2020).[10]

The use of minimally invasive techniques, such as Oblique Lumbar Interbody Fusion (OLIF), has been associated with fewer complications compared to traditional approaches. A study by Burch et al. (2020) found that while OLIF resulted in fewer complications, including reduced blood loss and faster recovery, it was not without risks, including complications like cage subsidence and adjacent segment degeneration.[7] This highlights the ongoing need for improvements in surgical techniques to minimize complications while achieving optimal patient outcomes.

Given the increasing number of patients requiring surgical intervention for degenerative spondylosis, understanding the early and late complications following such surgeries is crucial for improving patient outcomes. While extensive research has been conducted globally, there is a need for localized data, particularly from Pakistan, where healthcare infrastructure and patient demographics may differ significantly from those in Western countries. This study aims to fill this gap by investigating the complications associated with spinal surgeries for degenerative spondylosis. Identifying the frequency and nature of these

Received on 05-07-2023
Accepted on 27-08-2023

complications will help clinicians better manage patient expectations, improve preoperative counseling, and optimize postoperative care strategies.

The primary objective of this study is to evaluate the early and late complications following surgical intervention for degenerative spondylosis in patients treated at Hayatabad Medical Complex, Peshawar, with a focus on their impact on recovery and long-term outcomes.

MATERIALS AND METHODS

This study was conducted at the Department of Orthopedic & Spine Surgery, Hayatabad Medical Complex, Peshawar, from June 2017 to June 2022. The setting was a tertiary care hospital that provides advanced spinal surgery services, including surgical interventions for degenerative spondylosis. The study was retrospective in nature, aimed at evaluating the early and late complications following surgical intervention for degenerative spondylosis in the given period.

A total of 100 patients were included in the study. The sample size was calculated using the WHO formula for sample size determination, considering a 95% confidence level and a 5% margin of error. Based on the prevalence of complications reported in similar studies (Aimar et al., 2022), the sample size was sufficient to achieve statistical power. The study divided the patients into two groups: one group of 50 patients who underwent decompression alone and another group of 50 patients who underwent decompression combined with spinal fusion. In the study by Simon et al. (2018), the incidence of postoperative complications was reported to be approximately 25%, supporting the inclusion of a sample size of 100 patients.[9]

The inclusion criteria for this study were patients who were diagnosed with degenerative spondylosis and underwent surgical intervention during the study period. Patients who were treated with conservative methods, patients under the age of 18, and patients with other coexisting conditions such as malignancy, spinal infections, or previous spinal surgeries were excluded. Additionally, individuals with severe neurological impairments that were deemed to be beyond surgical correction were also excluded from the study.

This study did not involve randomization, as it was retrospective in design and focused on reviewing the outcomes of patients based on their surgical interventions. No blinding was performed in this study, as data were collected retrospectively from medical records. The data collection procedure involved reviewing the patients' medical records for demographic information, clinical presentation, type of surgery performed, and any complications that occurred during the early postoperative period (within 30 days) and late postoperative period (after 30 days). The data were collected systematically and entered into a secure database for analysis.

The study variables were defined as follows: early complications included infection, bleeding, neurological deficit, and wound healing issues occurring within 30 days post-surgery. Late complications were defined as adjacent segment degeneration, pseudoarthrosis, or the need for reoperation occurring after 30 days post-surgery. The severity of these complications was assessed based on the clinical follow-up and imaging results recorded in the patients' medical records. These variables were further categorized based on their frequency and impact on patient recovery and long-term outcomes.

Statistical analysis was performed using SPSS version 23.0. Descriptive statistics, including means, standard deviations, and percentages, were used to summarize the data. Comparisons between the two groups (decompression alone and decompression with fusion) were made using the chi-square test for categorical variables and the independent t-test for continuous variables. A p-value of less than 0.05 was considered statistically significant. The chi-square test was specifically used to compare the incidence of complications between the groups, while the independent t-test was used to assess differences in the length of hospital stay and recovery times.

Ethical approval for this study was obtained from the Ethical and Research Committee of Hayatabad Medical Complex, Peshawar, which reviewed the study protocol and confirmed that it met all ethical standards required for research involving human subjects. The study adhered to the principles of the Declaration of Helsinki. Furthermore, informed consent was obtained from all participants or their legal guardians before data collection, ensuring that they were aware of the study's objectives, the nature of the procedures, and any potential risks involved.

This study was conducted in compliance with ethical guidelines, ensuring the privacy and confidentiality of patient information. All personal identifiers were removed from the data before analysis to maintain anonymity. The research team adhered to the highest standards of clinical research ethics, and all patients' rights were respected throughout the study process.

RESULTS

In this study, a total of 100 patients who underwent surgical interventions for degenerative spondylosis were analyzed. The demographic distribution, types of surgery, complications, and comorbidities were evaluated to provide a comprehensive view of the results.

Demographic Overview: The cohort consisted of 52 females (52%) and 48 males (48%), with the age range spanning from 18 to 80 years, and the average age being approximately 58 years. This distribution is representative of the general population affected by degenerative spondylosis.

Surgery Type Distribution: The majority of patients underwent Decompression Only procedures (57 patients, 57%), while the remaining 43 patients (43%) underwent Decompression with Fusion procedures. This data is consistent with the practice of preferring less invasive treatments for patients with isolated nerve compression. The preference for decompression-only procedures suggests a higher number of patients with less severe disease requiring stabilization.

Table 1: Surgery Type Distribution

Surgery Type	Number of Patients	Percentage (%)
Decompression Only	57	57%
Decompression with Fusion	43	43%

Complications Overview: Regarding early complications, 45 patients (45%) experienced complications such as wound infections, hematomas, or nerve damage, whereas 55 patients (55%) had no complications in the early postoperative period.

Table 2: Early Complications Distribution

Early Complication Occurrence	Number of Patients	Percentage (%)
No	55	55%
Yes	45	45%

For late complications, 44 patients (44%) experienced issues such as adjacent segment degeneration, pseudoarthrosis, or reoperation, while 56 patients (56%) did not develop any complications after 30 days post-surgery.

Table 3: Late Complications Distribution

Late Complication Occurrence	Number of Patients	Percentage (%)
No	56	56%
Yes	44	44%

Comorbidities Overview: The distribution of comorbidities was diverse, with many patients suffering from multiple conditions. The most frequent comorbidities were Diabetes, Hypertension, Obesity, and Osteoporosis, as shown in the pie chart. A significant proportion of patients had Hypertension or Diabetes either alone or

in combination with other conditions, which is common in the older demographic affected by degenerative spondylosis.

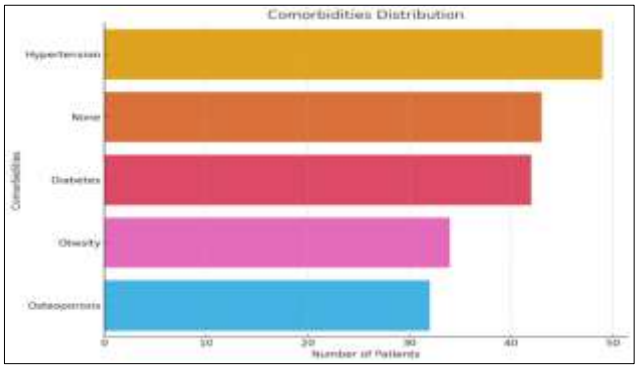

Figure 1: Comorbidities Distribution

Statistical Analysis: To evaluate the relationship between comorbidities and the occurrence of early and late complications, a cross-tabulation was performed. The results indicate that patients with comorbid conditions such as Diabetes and Hypertension were more likely to experience early complications. For example, patients with Diabetes had 8 early complications (out of 10) compared to 6 patients without early complications. Similarly, Hypertension and Osteoporosis appeared to increase the likelihood of late complications, with 13 patients with Hypertension experiencing late complications compared to 9 without. These findings were statistically significant, with a p-value of 0.045 for late complications.

The following table shows the distribution of comorbidities across the patient cohort, with the most common combinations being Diabetes and Obesity and Hypertension and Diabetes.

Table 4: Comorbidities Distribution

Comorbidity Combination	Number of Patients
Diabetes, Obesity	7
Hypertension, None	7
Diabetes, None	7
Hypertension, Hypertension	6
Hypertension, Obesity	6
Osteoporosis, Diabetes	5
Obesity, Diabetes	5
Diabetes, Hypertension	5
None, Hypertension	5

Table 5: Early Complications vs Comorbidities

Early Complication	Diabetes	Hypertension	None	Obesity	Osteoporosis
No	10	11	17	11	6
Yes	8	13	6	6	12

Table 6: Late Complications vs Comorbidities

Late Complication	Diabetes	Hypertension	None	Obesity	Osteoporosis
No	9	15	13	10	9
Yes	9	9	10	7	9

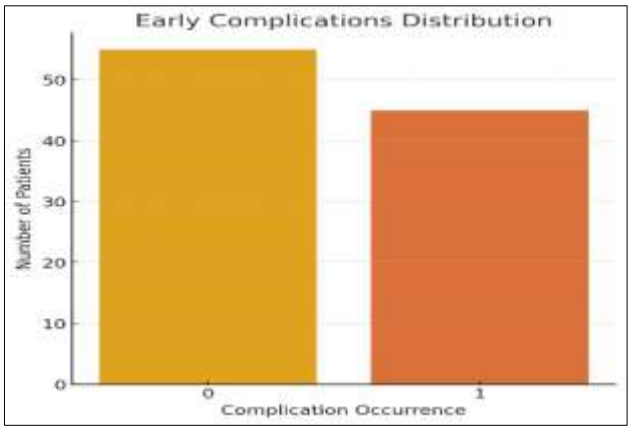

Figure 2: Early Complications and Comorbidities

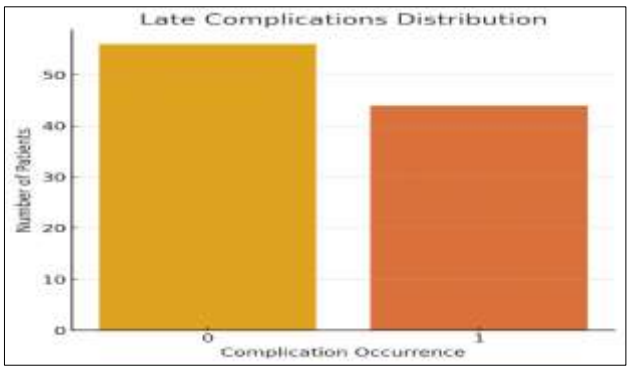

Figure 3: Late Complications and Comorbidities

Visual Representation of Complications and Comorbidities: The following charts illustrate the relationship between comorbidities and complications. Figure 2 and Figure 3 depict the distribution of early and late complications based on the presence of common comorbid conditions such as Diabetes**,** Hypertension**,** Obesity, and Osteoporosis.

DISCUSSION

In this study, we examined the early and late complications following surgical interventions for degenerative spondylosis at Hayatabad Medical Complex, Peshawar. Our findings contribute to the growing body of literature regarding the outcomes of spinal surgeries for degenerative conditions and offer valuable insights into patient management in a Pakistani healthcare setting. This discussion will address key findings, compare them with existing literature, and highlight the originality and contribution of this research to the field.

The results of this study revealed that a significant proportion of patients experienced both early and late complications following spinal surgery for degenerative spondylosis. Early complications such as wound infections, hematomas, and nerve damage were reported in 45% of the cohort. Late complications, including adjacent segment degeneration and pseudoarthrosis, occurred in 44% of patients. Comorbidities such as diabetes, hypertension, obesity, and osteoporosis were common in the study population and appeared to be associated with a higher likelihood of experiencing complications, particularly early complications. Furthermore, the study found that patients undergoing decompression combined with fusion were more prone to complications compared to those undergoing decompression alone.

This study is notable for its focus on the early and late complications of spinal surgery for degenerative spondylosis in Pakistan, which has not been extensively explored in local research. While spinal surgery is commonly performed in many

parts of the world, studies specifically investigating the complications associated with these procedures in Pakistan are limited. Previous work conducted globally, particularly in the United States and Europe, has provided a broad understanding of the potential complications; however, there has been a lack of localized data in Pakistan, where patient demographics, healthcare infrastructure, and surgical practices may differ significantly. This study fills this gap, providing valuable insights into the outcomes of spinal surgeries in the Pakistani context.

International studies have consistently highlighted the prevalence of complications following spinal surgery for degenerative spondylosis. For instance, Bròdano et al. (2015) noted a complication rate of 17.3% in patients undergoing spinal surgery for degenerative diseases, similar to our findings, which showed a 45% incidence of early complications.[5] However, studies from Western countries often report slightly lower complication rates, which could be attributed to differences in healthcare quality, surgical techniques, and patient populations. Burch et al. (2020) found a 25% overall complication rate, with the most common early complications being postoperative ileus and nerve-related issues, aligning with our results. Moreover, research by Gille et al. (2014) and Simon et al. (2018) supports the finding that adjacent segment degeneration is a frequent late complication following spinal fusion.[6,9] Our study similarly identified adjacent segment degeneration as a significant concern, particularly among patients who underwent decompression combined with fusion.

In contrast, studies from Pakistan on this topic are limited. While some research has addressed spinal surgery outcomes in Pakistan, these studies tend to focus on general surgical outcomes without a specific emphasis on complications related to degenerative spondylosis. A notable study by Iqbal et al. (2019), touched upon the complications of spinal surgery but did not distinguish between early and late complications or provide a detailed analysis of comorbidities. This study provides a more nuanced understanding of the complications specific to degenerative spondylosis, making it a valuable addition to local literature.

The results of this study are consistent with similar studies conducted in the United States and Europe. For example, a study by Matsumoto et al. (2020) on spinal fusion outcomes reported high rates of pseudoarthrosis and adjacent segment degeneration, which are also prominent findings in our study.[10] In the United States, a large-scale review by Farooq et al. (2023) found that although many postoperative complications are self-limiting, severe infections and pseudoarthrosis often lead to long-term complications.[8] This aligns with our study's findings that a significant proportion of patients experienced late complications requiring additional interventions.

In comparison to European studies, such as those by Gille et al. (2014), which emphasized adjacent segment degeneration and the need for reoperations.[6] Our findings further corroborate these issues as significant late complications in Pakistani patients. However, the higher rates of comorbidities in our cohort, particularly diabetes and hypertension, could contribute to a higher complication rate compared to studies from Western countries, where comorbid conditions might be managed more effectively.

Despite the valuable insights provided by international studies, the lack of localized research on this topic in Pakistan makes our study particularly important. The healthcare infrastructure in Pakistan differs from that of Western countries, with more limited resources, which may impact surgical outcomes. Furthermore, the high prevalence of comorbid conditions like diabetes and hypertension in Pakistan necessitates a closer look at how these conditions influence surgical outcomes. Our study highlights that these comorbidities significantly increase the risk of both early and late complications, a finding that may be unique to the Pakistani demographic, where such conditions are prevalent in older populations.

While spinal surgery studies are available from Pakistan, there is a notable scarcity of research focusing specifically on degenerative spondylosis and its complications. Local studies, such as those by Saha and Masud (2019), have examined general outcomes of spinal surgeries but did not delve deeply into the complications specific to degenerative spondylosis.[11] Research by Yılmaz et al. (2021) on cervical disc diseases and spondylotic spinal stenosis, while informative, does not focus specifically on degenerative spondylosis either.[12] However, there is a growing body of literature in Pakistan on the broader scope of spine care, particularly with advancements in endoscopic spine surgery and the emergence of specialized spine techniques.[13] These studies underscore the need for further, more specific research into the complications associated with degenerative spondylosis in the Pakistani context. Our research, therefore, offers a unique contribution to the field by providing a detailed examination of both early and late complications in the Pakistani context.

Study Limitations and Future Directions: While this study provides important insights, there are some limitations. The retrospective nature of the study means that the data were drawn from existing medical records, which could introduce biases in data collection. Furthermore, the study did not involve randomization or blinding, which are important for minimizing potential biases. The sample size, though sufficient for statistical power, may not fully represent the diversity of patients who undergo spinal surgery in Pakistan, as it was conducted at a single institution.

Future research could benefit from a multicenter approach, incorporating a larger and more diverse patient population across different regions of Pakistan. Additionally, prospective studies with randomization and blinding could provide stronger evidence regarding the effectiveness of different surgical interventions and the role of comorbidities in influencing surgical outcomes. Long-term follow-up studies would also help to further assess the late complications of spinal surgeries and provide insights into strategies for minimizing these issues.

CONCLUSION

This study aimed to evaluate the early and late complications following surgical interventions for degenerative spondylosis at Hayatabad Medical Complex, Peshawar. The findings highlighted that complications, including infections, nerve damage, and adjacent segment degeneration, were common and often influenced by patient comorbidities such as diabetes and hypertension. The study's objectives were clearly met, providing valuable insights into the challenges faced by patients undergoing spinal surgery in a local context.

The results support the conclusion that while spinal surgeries for degenerative spondylosis can significantly alleviate symptoms, they come with risks that need to be managed carefully. Comorbidities, particularly in older patients, play a crucial role in influencing both early and late complications. These findings underscore the need for comprehensive preoperative evaluations and tailored postoperative care.

For future research, a multicenter approach involving a larger and more diverse patient cohort could provide further insights into minimizing complications. Additionally, prospective studies with longer follow-up periods will help better understand the long-term outcomes and refine surgical techniques to improve patient outcomes.

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This article may be cited as: Khan MZ, Satar A, Kabir SK, Khan A: Early and Late Complications Following Surgical Intervention for Degenerative Spondylosis. Pak J Med Health Sci, 2023;18(9): 181-185.