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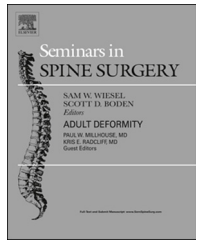

Does fusion increase the incidence of adjacent segment disease in patients with symptomatic lumbar degenerative disk disease?

Kris E. Radcliff, MD[a,*], *Scott Vizzi, MD*[b], *Paul W. Millhouse, MD*[b], *Christopher K. Kepler, MD, MBA*[a], *and Alexander R. Vaccaro, MD, PhD*[a]

[a]*Department of Orthopedic Surgery, Thomas Jefferson University Hospital, 925 Chestnut Street, Philadelphia, PA 19107*

[b]*Rothman Institute, Philadelphia, PA*

ABSTRACT

This is a retrospective cohort study. It was conducted to compare the incidence of adjacent segment disease (ASD) in patients who have undergone fusion for treatment of lumbar degenerative disk disease and patients who were treated conservatively to determine if fusion increases the risk of adjacent segment disease. Previous case series have indicated that fusion increases the risk of ASD. The eligible population included patients without previous spinal surgery who were evaluated for symptomatic lumbar degenerative disk disease. The study population underwent lumbar fusion with instrumentation. The control population consisted of patients with the same diagnosis who were managed conservatively. ASD was defined as new symptoms of radiculopathy, referable to a different anatomical level of the spine. There were 83 patients with a mean follow-up of 4.3 years including 42 males and 41 females. There were 24 patients who underwent fusion ("fusion") and 59 patients who were managed nonoperatively ("nonsurgery"). A total of 22 patients reported new symptoms of radiculopathy after a mean 6.5 years. There was no statistically significant difference in the incidence of new radiculopathy between the groups (fusion 17% vs. nonsurgery 30%, $P = 0.27$). Six patients underwent surgery for symptoms different than their initial complaint after a mean disease-free interval of 7.5 years. There was no statistically significant difference in the incidence of additional surgery between the groups (fusion 4% vs. nonsurgery 8%, $P = 0.67$). There was no statistically significant difference in mean period before reoperation in patients who underwent fusion (7.8 years) vs. nonsurgery (7.5 years). In conclusion, among a population of patients with symptomatic lumbar degenerative disk disease, there was no difference in incidence of new spinal symptoms (according to a newly-created questionnaire to define ASD) or rates of operation in patients who underwent fusion compared to nonoperative treatment. These findings challenge the commonly held observation that adjacent segment disease is directly attributable to fusion. Further study is warranted to determine whether fusion increases the incidence of degeneration at adjacent spinal segments.

1. Introduction

Adjacent segment disease (ASD) is development of symptomatic disease at spinal segments near a spinal fusion. Adjacent segment disease may occur due to increased mechanical load, loss of shock absorption, abnormal kinematics from muscle and tissue dissection, or increased segmental motion at unfused segments to compensate to maintain global motion. ASD has been estimated to occur at a mean annual incidence of 2.5% per year after lumbar fusion.[1]

There is continual controversy in the spine literature about the precise cause of ASD. ASD has long been attributed to the mechanical demands of spinal fusion. Potential causes of ASD include the mechanical demands of the fusion, the

* *Corresponding author.*
E-mail address: radcliffk@gmail.com (K.E. Radcliff).

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dissection and detachment of the paraspinous muscles, or disruption of the posterior spine ligamentous complex. Other explanations for ASD include the possibility that biological[2,3] or environmental factors predispose some patients to deteriorate at adjacent segments regardless of whether the index segment undergoes fusion.

The purpose of this study was to test the hypothesis that fusion leads to an increased incidence of adjacent segment reoperation. In this study, we compared the incidence of adjacent segment reoperation in patients who underwent fusion compared to patients who underwent nonsurgical treatment for single level degenerative disk disease.

2. Materials and methods

Following IRB approval, a consecutive list of patients who underwent lumbar discography for identification of lumbar degeneration disease from 2002 to 2005 was identified from a prospectively collected administrative database who were able to be reached for long-term follow-up. From this set of eligible patients, records were reviewed. The study population included patients who underwent lumbar fusion ("fusion") with instrumentation within 180 days after discography. The control population included patients with positive discograms who were managed nonsurgically ("nonsurgery") due to either patient or surgeon preference.

Patients were contacted and queried via telephone for report of new symptoms of radiculopathy and/or severe axial back pain, requiring treatment, including new surgeries, spinal stimulation, or a morphine pump (Fig.). Charts were reviewed for baseline demographic characteristics, number of discogram levels studied, and number of concordant levels. Patients were specifically asked about the location, anatomical level, and laterality of the new complaints. This report was compared to the description in the original notes by the treating physician. Furthermore, seven patients who underwent late surgery at the index level (>180 days after discogram) were excluded from the nonsurgical cohort. It was felt that these patients may represent failures of attempted nonsurgical treatment of the index level surgery. Patients who underwent reoperation at the index level were excluded. New symptoms of radiculopathy or back pain were recorded. The number and date of new surgeries for degenerative conditions was also recorded.

In this study, adjacent segment disease was the main outcome measure. We used two definitions of ASD. The first included the incidence of new leg pain symptoms which were severe enough to require treatment, although they did not have to be treated. The second definition included patients who underwent new surgical procedures performed to treat leg complaints in a different location. Since adjacent segment disease can be defined according to the presentation of new symptoms or additional surgeries, we calculated the mean disease-free survival in either scenario.

Categorical variables such as smoking, number of males, and adjacent segment reoperation were compared between groups using chi-square analysis. A secondary outcome measure, disease-free survival, was calculated as the time between the index treatment and development of new symptoms, reoperation, or present time. Non-overlap of the confidence intervals of disease-free survival was considered to be statistically significant. Stepwise backward multiple linear regression analysis was also performed to determine whether baseline demographic characteristics were predictive of ASD.

What is your current overall Pain Score (0-10)?
What is your Current Back Pain Score (0-10)?
What is your Current Leg Pain Score (0-10)?
How satisfied are you with the results of your treatment? (completely, very, neutral, unhappy)
Did you experience any new symptoms?
If you did experience new symptoms was it Back pain, Leg pain, or Both?
If leg pain, in which leg did you experience new pain?
Did you have new Surgery?
What was the date?
Did you have new injections?
Did you have a Spinal Stimulator?
Did you have a Morphine Pump?
Are you working (full, part-time, or none)
Have you had a new MRI? Does it show new disk herniations?
If so, where?
What are your current pain medications?

Fig – Follow-up telephonic survey for all patients.

3. Results

There were 83 patients who were followed up at a mean 4.3 years after diagnosis of degenerative disk disease (Table 1). There were 24 patients who underwent fusion and 59 patients who were managed nonsurgically. Average patient characteristics were BMI = 29.6, age = 47.7 years, number of levels tested = 3.2, number of concordant levels = 1.7; there were 23 smokers and 42 males and 41 females. The most common clinical presentation was back pain (n = 49). The mean initial pain score was 7.6. At final follow-up, the mean pain score was 4.4, and 69% of patients were satisfied with their result. There were statistically significant differences between the operative and nonoperative groups (Table 2) in mean age (fusion 42.9 vs. nonsurgery 50, P = 0.01) and percentage satisfied at final follow-up (fusion 87% vs. nonsurgery 61%). There were no other statistically significant differences between the fusion and nonoperative groups in body mass index, gender, smoking status, and other parameters (Table 2).

We calculated the incidence of ASD using the definition of ASD as development of new symptoms of radiculopathy. A total of 22 patients reported new symptoms of radiculopathy or stenosis meeting the criteria of adjacent segment disease (severe enough to require treatment). The mean symptom free period was 6.5 years (95% CI: 5.9–7.1 years). There was no statistically significant difference in the incidence of new symptoms between the fusion (17%) vs. nonsurgery groups (30%, P = 0.27). Stepwise backward linear regression analysis revealed no association between baseline variables (fusion, age, gender, smoking, BMI, origin of pain, initial pain score, and number of concordant levels) and development of new symptoms, other than the number of levels to undergo discography (Table 3). There was no statistically significant