Spinescope

Scott D. Boden, MD

One-year outcomes of surgical versus nonsurgical treatments for discogenic back pain: A community-based prospective cohort study

The clinical entity known as discogenic back pain remains controversial. Four randomized trials have attempted to compare efficacy of surgical and nonsurgical treatment with one trial showing improved results with surgery and the others showing comparable results. Mirza et al. performed a prospective observational cohort study to compare the outcomes of community-based surgical and nonsurgical treatments for patients with chronic back pain attributed to degeneration at one or two lumbar discs.

Patients presenting with axial back pain to academic and private practice orthopaedic surgeons and neurosurgeons in a large metropolitan area were included. Patients receiving spine surgery within 6 months of enrollment were designated at the surgical treatment group and the remainder as nonsurgical treatment. Outcomes were assessed at intervals up to 1 year after enrollment. Overall, 495 patients with discogenic back pain presented to 16 surgeon offices.

A total of 86 patients (17%) had surgery within 6 months of enrollment. Surgery typically consisted of instrumented fusion (79%), disc replacement (12%), and laminectomy or discectomy (9%). Surgical patients who reported more severe pain and physical disability at baseline were more likely to have had prior surgery. Adjusting for baseline differences in groups, surgery showed a limited benefit over nonsurgical treatment of 5.4 points on the modified 23-point Roland disability questionnaire.

On the basis of these data, the authors conclude that the surgical group showed greater improvement at 1 year compared with the nonsurgical group, although the composite success rate for both treatment groups was only fair. The results should be interpreted cautiously because outcomes were only short term, and the treatment groups were not randomly assigned. Some studies have showed early advantages of surgery, which tend to be less pronounced with longer follow-up.


Risk factors for poor outcome of cervical laminoplasty for cervical spondylotic myelopathy in patients with diabetes

Diabetes is one of the most frequent comorbidities in patients with cervical spondylotic myelopathy. Cervical laminoplasty is the most established treatment for cervical spondylotic myelopathy in Japan. Machino et al. performed this study to characterize the risk factors for poor treatment outcome, following cervical laminoplasty for cervical spondylotic myelopathy in patients with diabetes.

A total of 105 consecutive patients with diabetes and cervical spondylotic myelopathy who underwent double-door laminoplasty were included in this study. There were 65 males and 40 female patients with a mean age of 68.2 years. All patients were followed for a minimum of 12 months after surgery, with a mean follow-up of 25.7 months. All patients had palliative controlled blood glucose levels in the immediate perioperative period.

Univariate logistic regression analysis showed that a patient age of 65 years or older (odds ratio = 3.1) and a duration of cervical spondylotic myelopathy symptoms for 12 months or more (odds ratio = 3.9) were associated with an increased risk of poor surgical outcome. High glycated hemoglobin levels of ≥6.5% (odds ratio = 2.6) and a duration of diabetes of 10 years or more (odds ratio = 2.2) were significant risk factors for poor surgical outcome. Multivariate logistic regression analysis determined that glycated hemoglobin levels of ≥6.5% and diabetes duration of greater than 10 years were significant risk factors for poor treatment outcome.

On the basis of these data, the authors conclude that diabetes with advanced age and long-term cervical spondylotic myelopathy adversely affected cervical laminoplasty outcomes. High preoperative glycated hemoglobin levels and long-term diabetes are the risk factors for poor cervical laminoplasty outcomes in patients with diabetes and cervical spondylotic myelopathy. Although the follow-up period was relatively short, early recovery is an important predictor of outcome after laminoplasty.

Operative compared with nonoperative treatment of a thoracolumbar burst fracture without neurological deficit

Studies comparing operative and nonoperative treatment of a stable burst fracture of the thoracolumbar junction in neurologically intact patients have not shown a meaningful difference in early follow-up. Operative management has been proposed to offer immediate stability, correction of deformity, early ambulation, and less reliance on orthotic containment. However, nonoperative care offers the avoidance of surgical intervention with its attendant risks and morbidity. Wood et al. performed this prospective randomized study with long-term follow-up to relook at this important question.

From 1992 to 1998, 47 consecutive patients with a stable thoracolumbar burst fracture and without neurological deficit, we evaluated and randomized to one of the two treatment groups: operative treatment (posterior or anterior arthrodesis) or nonoperative treatment (a body cast or orthosis). The authors previously reported the results of follow-up at an average of 44 months. The current study presents the results of long-term follow-up, at an average of 18 years (range: 16–22 years). As in the earlier study, patients at long-term follow-up indicated the degree of pain on a visual analog scale and completed the Roland and Morris disability questionnaire, the Oswestry Disability Index, and the Short-Form-36 health survey.

Of the original operatively treated group of 24 patients, follow-up data were obtained for 19 (one patient had died and four could not be located). Of the original nonoperatively treated group of 23 patients, data were obtained for 18 (2 patients had died and 3 could not be located). The average kyphosis was not significantly different between the two groups (13° for operative treatment and 19° for nonoperative). Median scores for pain, Oswestry Disability Index, and Roland and Morris scores were all significantly better in the group treated nonoperatively. Seven of eight SF-36 scores also favored nonoperative treatment.

On the basis of these data, the authors conclude that while early analysis at 4 years revealed few significant differences between the operative and nonoperative group, the long-term follow-up showed that those with a stable burst fracture who were treated nonoperatively reported less pain and better function compared with those who were treated surgically. A limitation is that just under 80% of the patients were available for follow-up in a relatively small-size study group to be able to detect meaningful clinical differences in areas such as pain and disability.


Smoking as an independent predictor of reoperation after lumbar laminectomy: A study of 500 cases

Reoperation rates after posterior decompression of the lumbar spine approach 15% over 5 years after the index surgery. Bydon et al. performed this retrospective study to identify the factors predicting an increased risk for reoperations in patients who had undergone lumbar laminectomy.

The authors retrospectively reviewed the electronic medical records of all patients who had undergone first-time bilateral laminectomy at 1, 2, or 3 levels for lumbar spondylolisthesis at a single institution. The patients who underwent fusion laminotomy, discectomy or complete facetectomy were excluded. The patients’ preoperative symptoms and comorbidities were also obtained from their medical records.

Over an average follow-up period of 47 months, 81 of 500 patients who had undergone laminectomy (16.2%) developed subsequent spinal disorders that required a reoperation. A multiple logistic regression analysis identified smoking as an independent predictor of reoperation (OR = 2.15, p = 0.01). Smoking was also an independent predictor of reoperation after single-level laminectomy (OR = 11.3, p = 0.02) and after a multilevel laminectomy (OR = 2.0, p = 0.05). For 72 patients undergoing reoperation only for spinal degeneration, smoking remained an independent, statistically significant predictor of reoperation. Nine patients underwent reoperation for nondegenerative conditions such as hematoma, wound infection or dehiscence, and in these patients, chronic obstructive pulmonary disease was the only statistically significant predictor of reoperation.

On the basis of these data, the authors conclude that smoking was the strongest predictor of reoperation in patients who had undergone single-level laminectomy, multilevel laminectomy, or reoperation for progression of spinal degeneration. These findings suggest that smokers have worse outcomes from lumbar decompression than nonsmokers.


Does intraoperative cell salvage system effectively decrease the need for allogeneic transfusions in scoliotic patients undergoing posterior spinal fusion? A prospective randomized study

Scoliosis patients undergoing posterior spinal fusion can experience significant intraoperative blood loss and often require perioperative blood transfusions. Various options for blood replacement are available, including intraoperative autologous cell salvage and transfusion. Liang et al. performed this prospective study to determine the safety and efficacy of intraoperative cell salvage and decrease in the need for allogeneic transfusions in a cohort of scoliosis patients undergoing primary posterior spinal fusion with segmental spinal instrumentation.

A total of 110 consecutive scoliosis patients undergoing posterior instrumented spinal fusion were randomized into two groups according to whether a cell saver machine for intraoperative blood salvage was used or not. Chi square test and t-test were performed for intraoperative and perioperative allogeneic transfusion between groups. The regression analysis was performed between selected covariates to investigate the predictive factors of perioperative transfusion.

Perioperative allogeneic blood transfusion rate was lower in the cell saver group (14.5% vs. 32.7%, p = 0.025). Mean intraoperative red blood cell transfusion requirement was also lower (0.21 µpt vs. 0.58 µpt). A multivariate analysis
demonstrated that the number of fused segments, preoperative hemoglobin level, and the use of cell saver had a trend toward significance in predicting likelihood of transfusion.

On the basis of these data, the authors conclude that cell saver use significantly reduces the need for allogeneic blood transfusion in spine deformity surgery. This benefit is particularly in patients with low preoperative hemoglobin or longer operation time. The study confirms the utility of routine cell saver use during posterior spinal fusion with segmental spinal instrumentation for scoliosis patients.


**Intermittent administration of teriparatide enhances graft bone healing and accelerates spinal fusion in rats with glucocorticoid-induced osteoporosis**

It is well known that certain osteoporosis treatments can have an impact on bone graft remodeling and healing during spinal fusion. There has not been a study regarding the effect of intermittent administration of teriparatide (recombinant human parathyroid hormone, 1–34) on spinal fusion in patients with glucocorticoid-induced osteoporosis. Sugiuira et al. performed this animal study to elucidate the effect of intermittent administration of teriparatide on spinal fusion in rats with glucocorticoid-induced osteoporosis.

Eight-week-old rats were given 5 mg/kg of methylprednisolone (MP) for 12 weeks. After 6 weeks of MP administration, the rats underwent posterolateral spine fusion with iliac crest autograft. Then, five times a week, they were given either saline or 40 μg/kg of teriparatide for 6 weeks.

In the teriparatide group, values for bone volume and other bone microstructural parameters at the fusion mass increased and peaked 4 weeks after surgery, and these values were significantly greater than those for the control group at 4 and 6 weeks after surgery. Fusion assessment showed that the fusion rate was higher in the teriparatide group than in the control group (89% vs. 56%, respectively). Bone histomorphometry revealed that the values for bone formation parameters were significantly higher in the teriparatide group than in the control group.

On the basis of these data, the authors conclude that under continuous glucocorticoid exposure in a rat-model spinal fusion, intermittent teriparatide administration accelerated bone modeling and remodeling predominantly by stimulating bone formation at the fusion mass and increasing the fusion rate. Intermittent teriparatide administration also improved bone microarchitecture of adjacent vertebrae. Clearly, there are differences between responses in small rodents and in humans, and whether these results will translate clinically remains to be determined.


**Outcomes and their predictors in lumbar spinal stenosis: A 12-year follow-up**

Lumbar spinal stenosis is a common disorder, which increases in prevalence with increased age. Trials documenting long-term natural course of the disease and predictors have not been common. Adamova et al. performed this prospective observational cohort to evaluate long-term outcomes in patients with mild-to-moderate lumbar spinal stenosis and to analyze the predictors of clinical outcomes.

A group of 53 patients were re-examined after a median period of 139 months. Evaluations were made of subjective clinical outcome, objective clinical outcome and its predictors, any correlation between subjective and objective outcome, and the development of changes in radiological and electrophysiological parameters after 12 years. Satisfactory objective and subjective clinical outcomes were recorded in 54.7% and 43.4% of patients, respectively. No statistically significant correlation between objective and subjective clinical outcome was found. Patients with isolated unsatisfactory subjective outcome exhibited the highest Functional Morbidity Index of all subgroups. Electrophysiological and radiographic findings did not demonstrate statistically significant changes after 12-year follow-up. Multivariate logistic regression confirmed only the lowest transverse diameter of spinal canal ≤13.6 mm as an independent predictor of unsatisfactory clinical outcome.

On the basis of these data, the authors conclude that satisfactory objective and subjective clinical outcomes were disclosed in about half of the patients with mild-to-moderate lumbar spinal stenosis in a 12-year follow-up study. The number of comorbid diseases had an unfavorable effect on subjective evaluation of clinical outcome. The lowest transverse diameter of spinal canal proved to be the only independent predictor of deterioration of clinical status in lumbar spinal stenosis patients. The study highlights the fact that radiographic progression does not necessarily correlate with subjective symptoms.


**Long-term outcomes of lumbar spinal stenosis**

Surgery for spinal stenosis has been shown to be more effective than nonoperative treatment during 4-year follow-up, but longer-term data have been less clear. Lurie et al. report on a randomized trial with a concurrent observational cohort to compare 8-year outcomes of surgery with nonoperative care for symptomatic lumbar spinal stenosis.

Surgical candidates from 13 centers in 11 U.S. states with at least 12 weeks of symptoms and confirmatory imaging were enrolled in a randomized cohort or observation cohort. Treatment was standard, decompressive laminectomy vs. standard nonoperative care.

Data were obtained for 55% of the participants in the randomized group and 52% of the participants in the observational group at the 8-year follow-up. Intent-to-treat analyses showed no differences between randomized cohorts; however, 70% of those randomized to surgery and 52% of those randomized to nonoperative care had undergone surgery by 8 years. As-treated analyses in the randomized group showed the early benefit for surgery after 4 years converged over time with no significant treatment effect of surgery seen in years 6–8 for any of the primary outcomes. In contrast, the
observational group showed a stable advantage for surgery in all outcomes between years 5 and 8. Patients who were lost to follow-up were older, less well educated, sicker, and had worse outcomes during the first 2 years in both surgical and nonoperative arms.

On the basis of these data, the authors conclude that patients with symptomatic spinal stenosis showed diminishing benefits of surgery and as-treated analyses of the randomized group between 4 and 8 years. In contrast, outcomes in the observational group remained stable. These results are not surprising given the high cross-over rate in the randomized group. I think the long-term results in the observational cohort are likely more consistent with what one would expect in an actual surgical or nonoperatively treated population.


**Effectiveness of surgery for lumbar stenosis and degenerative spondylolisthesis in the octogenarian population**

The elderly population in the United States is growing at an exponential rate due to the aging of the baby boomer generation. The operative treatment of lumbar spinal stenosis and degenerative spondylolisthesis provides substantial lasting benefit compared with nonoperative care. Previous reports from the Spine Patients Outcomes Research Trial (SPORT) did not specifically address the effect that patient age has on outcomes. The purpose of this study was to determine whether surgery is an effective option for the treatment of lumbar spinal stenosis and degenerative spondylolisthesis in the octogenarian population.

An as-treated analysis of patients with lumbar stenosis and degenerative spondylolisthesis enrolled in the Spine Patient Outcomes Research Trial (SPORT) was performed. The patients who were at least 80 years of age (n = 105) were compared with those younger than 80 years (n = 1130). Baseline patient and clinical characteristics were noted, and the difference in improvement from baseline between operative and nonoperative treatment was determined for each group at each follow-up time period up to 4 years.

There were no significant baseline differences in the primary or secondary patient-reported clinical outcome measures between the two patient age groups. Patients at least 80 years of age had higher prevalences of multilevel stenosis, severe stenosis, and asymmetric motor weakness. Patients at least 80 years of age also had higher prevalences of hypertension, heart disease, osteoporosis, and joint problems at baseline but had a lower body mass index and lower prevalences of depression and smoking. Overall, 58 of the 105 patients at least 80 years of age and 749 of the 1130 younger patients underwent operative management. There were no differences in the rates of intraoperative or postoperative complications, reoperation, or postoperative mortality between the older and the younger groups. Averaged over a 4-year follow-up period, operatively treated patients at least 80 years of age had significantly greater improvement in all primary and secondary outcome measures compared with nonoperatively treated patients. The treatment effects in patients at least 80 years of age were similar to those in younger patients for all primary and secondary measures except the Short-Form-36 bodily pain domain and the percentage who self-rated their progress as a major improvement, in both of which the treatment effect was significantly smaller.

On the basis of these data, the authors conclude that operative treatment of lumbar spinal stenosis and degenerative spondylolisthesis offered a significant benefit over nonoperative treatment in patients at least 80 years of age. There were no significant increases in the complication and mortality rates following surgery in this population compared with younger patients. Further studies will be required to specifically analyze the cost-effectiveness data and improvement of quality of life for this elderly and retired population.


**In brief**

**The effects of hospital and surgeon volume on postoperative complications after lumbar spine surgery**

Studies have shown improved outcomes in patients treated by high-volume surgeons and hospitals in cardiac and other types of surgery. It is unclear whether this relationship is true for lumbar spine surgery. A retrospective review was conducted from the National Inpatient Sample for the years 1992–2005 for patients undergoing lumbar spine surgery. Over 232,000 hospitalization records were listed as posterolateral lumbar decompression with fusion and/or exploration/decompression of the spinal canal. When controlled for other variables, mortality was significantly lower in the highest volume hospitals and among the highest volume surgeons. The complication rate was slightly lower in the highest volume hospitals and significantly lower in the highest volume surgeons than in the lowest volume counterparts. On the basis of these data, the authors conclude that mortality and complication rates associated with lumbar spine surgery are lower when patients are treated by high-volume surgeons and hospitals. The key issues here are whether or not there is some minimum volume and whether that volume is the same for all surgeons, and similarly, whether there some effect of low-volume surgeons that can be compensated for by high-volume hospitals.


**Comparison of effects of nonoperative treatment and decompression surgery on risk of patients with lumbar spinal stenosis falling**

Falls are a major factor contributing to fragility fractures. Patients with lumbar spinal stenosis have an increased risk of falling. From June to November 2001, 76 patients were enrolled into the surgery group and 50 patients into the nonoperative group. The mean age was 62.4 years in the surgery group and 64.6 years in the nonoperative group.
Comparison between the two groups showed more significant improvement in the surgery group, especially for the Six Meter Walk Test at 1 year, postoperatively, and for the timed “up and go” test at 3 months and 1 year following surgery. The Oswestry Disability Index and visual analog scores improved in both groups. On the basis of these data, the authors conclude that the surgery-treated group for lumbar spinal stenosis showed a greater decrease in the risk of falling than those in the nonoperative group. Improved physical function including walking and balancing after decompressive lumbar surgery reduced the risk of future falls.


Annular repair after lumbar discectomy did not reduce the need for reherniation surgery

A question remains whether patients undergoing lumbar discectomy for herniated disc would have a lower reoperation rate for recurrent disc herniation if the annulus fibrosus was repaired. Araghi et al. performed a randomized controlled trial with 2-year follow-up in 34 centers in the United States. A total of 750 patients who required discectomy for symptomatic herniated nucleus pulposus after 6 weeks of nonoperative treatment were included. All patients had to have sufficient tissue for reapproximation of the annular defect. If deemed sufficient, patients were allocated in a 2:1 ratio to annular repair or to a no repair control group. Annular repair was performed with the Xclose Tissue Repair System (Anulex technologies, Minnetonka, MN), which makes use of tension bands held in place with tissue T anchors. The primary outcome measure was reoperation for recurrent herniation. A reduction in the rates of reoperation for recurrent herniation at 3 and 6 months and at 2 years was observed between the Xclose and control groups; however, these differences were not significant. For the Xclose and control groups, the Oswestry Disability Index scores improved by 37.9 and 38.1 points, respectively, and the SF-12 physical component summary scores improved by 17.3 points in both groups. On the basis of these data, the authors conclude that in patients undergoing lumbar discectomy for herniated disc, the addition of annulus fibrosus repair did not induce a significant reduction in reoperation for recurrent disc herniation.


Nationwide practice patterns in the use of recombinant human bone morphogenetic protein-2 in pediatric spine surgery as a function of patient-, hospital-, and procedure-related factors

Current national patterns as a function of patient-, hospital-, and procedure-related factors and complication rates exist in the use of recombinant human bone morphogenetic protein-2 as an adjunct to the practice of pediatric spine surgery. The authors conducted a cross-sectional study using data from the Healthcare Cost and Utilization Project Kids Inpatient Database. Univariate and multivariate logistic regression were used to calculate unadjusted and adjusted odds ratios. The authors identified 9538 hospitalizations in pediatric patients 20 years old or younger who had undergone spinal fusion in 2009. Overall, 1541 of these admissions were associated with rhBMP-2 use. By multivariate logistic regression, the following factors were associated with rhBMP-2 use: patient age 15–20 years, length of hospital stay, insurance status, hospital type, spinal fusion, multilevel fusion, and preoperative diagnosis of Scheuermann kyphosis or spondylolisthesis. Use of BMP in pediatric spine procedures now comprises more than 10% of pediatric spinal fusion. Patient-related and procedure-related factors seem to be associated with a variation in the BMP use. Recent warnings about the unknown cancer risks in the pediatric patient may temper use until additional data becomes available.


The effect of work-focused rehabilitation among patients with neck and back pain

A growing number of studies have focused on the return-to-work processes associated with patients with back pain. Many studies have combined a workplace focus with multidisciplinary treatments; however, this focus has not been evaluated in Norway among patients with neck and back pain to date. The authors performed a multicenter randomized controlled trial with patients listed as sick for 1–12 months due to neck or back pain and referred to secondary care. A total of 405 patients who were referred to spine clinics at two university hospitals were randomly assigned into work-focused and control intervention groups. The existing treatments at each hospital were used as a control intervention, which entailed either a comprehensive multidisciplinary intervention or a brief multidisciplinary intervention. The return-to-work rates and proportions were compared at 12 months. During the first 12 months after inclusion, 70% of the participants in the work-focused rehabilitation group and 75% in the control group returned to work. The median return-to-work time was 161 days in the work-focused group and 158 days in the control group. On the basis of these data, the authors conclude that a focus on the workplace in specialist care does not substantially improve the return-to-work rate or timing compared with standard multidisciplinary treatments.


Do CT scans overestimate the fusion rate after anterior cervical discectomy and fusion?

Although fusion status may be obvious when evaluating anterior cervical discectomy and fusion operations performed in the remote past, determining the presence of a solid fusion in earlier time points is often ambiguous. The authors performed this radiographic analysis to compare the fusion rates after anterior cervical discectomy and fusion using plain x-rays vs. computerized tomography. Overall, 22 patients after ACDL with cortical allograft and anterior plate at 34 levels underwent CT scans and dynamic flexion extension lateral x-rays at 3, 6, and 12 months, postoperatively. On the basis of the x-ray criteria, the fusion rates were 26%, 41%, and 65% at 3, 6, and 12
months, respectively. On the basis of CT criteria, the fusion rates were 79%, 79%, and 91% at 3, 6, and 12 months, respectively. There was a significant difference in the predicted fusion rate at each time point, comparing x-ray vs. CT criteria. In addition, at 3 months, 41% of the levels thought to be fused by CT criteria demonstrated >1 mm motion on dynamic x-rays. At 12 months, 23% of the levels considered fused by CT still had persistent motion. On the basis of this data, the authors conclude that CT scans may overestimate the fusion rate during the early stages of anterior cervical discectomy fusion, healing with cortical allograft. Unfortunately, without direct exploration there is no way to determine the accuracy of the flexion/extension views, and indeed, whether or not there was solid fusion achieved, the authors clearly point out that some definitions of fusion allow for up to 2 mm in motion, and they intentionally decided to use a 1 mm and more stringent cutoff, which may have also affected their conclusions.