Journal Scan

Spine

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The efficacy of rhBMP-2 for posterolateral lumbar fusion in smokers. Glassman SD, Dimar JR 3rd, Burkus K, Hardacker JW, Pryor PW, Boden SD, Carreon LY. *Spine (Phila PA 1976)*. 2007;32:1693–1698.

Context: Cigarette smoking is an established risk factor for pseudarthrosis and poor clinical outcomes in lumbar spine fusion. Recombinant human bone morphogenetic protein (rhBMP) was found to be as good as or better than iliac crest bone graft (ICBG) in achieving fusion.

Study Design and Results: This study aimed to determine if the use of rhBMP in lumbar spinal fusion can overcome the negative impact of cigarette smoking. Patients who were part of a randomized, nonblinded trial of an rhBMP-2 matrix (AMPLIFY rhBMP-2 Matrix, Medtronic, Memphis, TN) or ICBG for single-level, instrumented posterolateral lumbar spinal fusion were retrospectively stratified by preoperative smoking status. Of the 148 patients in the study, 42 were smokers and 106 were nonsmokers. Clinical outcome was measured 2 years after surgery using the validated Oswestry Disability Index (ODI) and Medical Outcomes Study Short Form-36 (SF-36). Fusion was defined as bilateral bridging bone on plain radiographs with less than 3° translation and less than 5° angulation on dynamic lateral lumbar radiographs and also was compared between groups. At the 2-year evaluation, fusion was achieved in 100% of nonsmokers using rhBMP-2 and 94.1% of nonsmokers using ICBG; for smokers, 95.2% achieved fusion using rhBMP-2 whereas 76.2% achieved fusion using ICBG. The difference between smokers and nonsmokers was statistically

significant for the overall rate of fusion and the rate of fusion using ICBG. The difference in fusion between smokers who received rhBMP-2 and smokers who received ICBG was not statistically significant. The clinical outcome scores improved significantly for all patients but were better for nonsmokers than smokers.

Conclusions: The study suggests that the use of rhBMP-2 may overcome the detrimental effects of cigarette smoking in patients having single-level, instrumented posterolateral lumbar spinal fusion. The increased rate of fusion does not appear to enhance the clinical outcome as measured by the ODI and SF-36.

Comments: Although it subsequently may be shown that the use of potent osteoinductive factors such as rhBMP-2 may overcome the detrimental effect of cigarette smoking, this study did not have ample power for the conclusion to reach statistical significance. Furthermore, the study shows well that fusion is not the only factor that contributes to a successful clinical outcome as smokers continued to have less favorable response on validated clinical outcome measures. Preoperative smoking cessation remains the optimal choice to avoid the detrimental effects of nicotine.

Pearls: Cigarette smoking reduces the likelihood of achieving successful spinal fusion and additionally adversely affects the scores of validated clinical outcomes.

Anterior screw fixation of odontoid fractures comparing younger and elderly patients. Platzer P, Thalhammer G, Ostermann R, Wieland T, Vécsei V, Gaebler C. *Spine (Phila PA 1976)*. 2007;32:1714–1720.

Context: Anterior screw fixation of odontoid fractures has been shown to produce a high fusion rate while maintaining cervical spine motion. Use of this technique in elderly patients is controversial as a result of often diminished bone quality and patient comorbidity.

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Study Design and Results: This is a retrospective review of 110 patients with odontoid fractures treated with anterior screw fixation and followed for at least 2 years at one trauma center during a 14-year period. Patients were stratified into two groups: younger than 65 years ($n = 69$) and 65 years or older ($n = 41$). Cervical radiographs, CT scans, and functional outcome according to the Smiley-Webster scale (excellent, good, fair, poor) were evaluated. Failures of reduction and fixation were seen in 10% of the younger group and 12% of the older group. Both groups had an average functional outcome of good to excellent, and there was an overall fusion rate of 93%. At the final followup, 86% of patients had returned to their preinjury activity level and were pain-free. The nonunion rate was 4% in the younger group, compared with 12% in the older group, a statistically significant difference. Similarly, there was a statistically significant increase in morbidity and mortality in the elderly group (22% and 9%, respectively) as compared with the younger group (8% and 1%, respectively).

Conclusion: Anterior screw fixation is an acceptable means of management of odontoid fractures in patients of all ages, but the risks of nonunion, morbidity, and mortality are significantly greater in patients older than 65 years.

Comments: This study reports successful treatment of a large number of odontoid fractures in patients of all ages. The retrospective nature of this study, however, introduces potential selection bias to the comparison of treatment groups. The authors state that all patients with Anderson and D'Alonzo Type II odontoid fractures are treated with anterior screw fixation with the exception of those with unacceptably high surgical risk. Although it is possible that some elderly patients may have been excluded from anterior screw fixation, those who underwent the procedure appear to have been treated with good success. The establishment of strict surgical exclusion guidelines may help to identify the patients at highest risk for complication or death and also show that anterior odontoid screw fixation can be used in patients of any age.

Pearls: Only odontoid fractures amenable to interfragmentary compression are appropriately treated by anterior screw fixation. These typically are noncomminuted or minimally comminuted Anderson and D'Alonzo Type II fractures with fracture obliquity from anterosuperior to posteroinferior. One or two screws can be used and have been shown to be biomechanically equivalent.

Hip-spine syndrome: the effect of total hip replacement surgery on low back pain in severe osteoarthritis of the hip. Ben-Galim P, Ben-Galim T, Rand N, Haim A, Hipp J, Dekel S, Floman Y. *Spine (Phila PA 1976)*. 2007;32:2099–2102.

Context: Severe osteoarthritis of the hip often is associated with low back pain. The “hip-spine syndrome”

originally was described to explain the reduction in back pain in a group of patients who underwent total hip replacement (THR). The authors hypothesized that improvement in back pain symptoms may result from changes in spinal alignment and posture after THR.

Study Design and Results: This study is the first to prospectively investigate the validity of the hip-spine syndrome in a cohort of 25 adult patients scheduled for elective THR. Patients with prior spine surgery, spondylolisthesis or spinal stenosis, radicular pain, inflammatory or seronegative spondyloarthropathy, or patients currently undergoing medical treatment for low back pain were excluded from the study. Patients' medical history and physical examination were assessed before surgery and patients were followed for 2 years after THR. Back pain and disability were measured using the Visual Analog Scale (VAS) pain score and Oswestry Disability Index (ODI). Lumbar spine radiographs were reviewed to evaluate the sacral inclination and lumbar total lordosis angles. All patients reported low back pain and spinal disability before THR. The VAS for back pain improved from 5.0 to 3.7 and the mean ODI improved by 12.7 points after THR. Both were statistically significant and sustained for 2 years of followup. There was no change in sacral inclination or lumbar lordosis after THR.

Conclusion: This study confirms an association between back and hip pain in patients with debilitating hip arthropathy who are candidates for THR. There does not appear to be any effect of THR on the lumbosacral sagittal alignment.

Comments: Lumbar degenerative disease commonly results in pain referred to the pelvis and hip and often is difficult to differentiate from the pain of hip arthropathy. Patients often suffer both conditions comorbidly. In this study, the mean VAS for hip pain was greater than that of back pain and suggests the presence of one predominant pain generator can exacerbate the impact of another. The spinal motion segments and hips comprise links in the kinetic chain; the authors did not comment on the possible impact of alteration of hip motion on lumbar spinal pain.

Pearls: Validated outcome measures such as the ODI have become the standard tools for evaluating the clinical results of treatment. The minimal clinically important difference (MCID) has been defined as the smallest change in an outcome measure score that results in alteration of a patient's quality of life. The actual value of the MCID for many outcome tools has not been fully defined but, nevertheless, must be considered when reviewing the results of a study such as this. A statistically significant difference may not always correlate with a clinically important difference.

Are lumbar spine reoperation rates falling with greater use of fusion surgery and new surgical technology?

Martin BI, Mirza SK, Comstock BA, Gray DT, Kreuter W, Deyo RA. *Spine (Phila PA 1976)*. 2007;32:2119–2126.

Context: The rate of lumbar fusion surgery has increased dramatically in the United States during the past decade. This has coincided with the development and implementation of technologies such as intervertebral fusion cage implants, pedicle screws, and biologic bone-graft substitutes.

Study Design and Results: The purpose of this study was to evaluate the impact of the increased rate of fusion surgery and improved technology on the rate of revision spinal surgery. The authors hypothesized that the advanced technology should reduce the occurrence of revision surgery. The Washington State registry of hospital discharges was used to identify a cohort of patients who underwent a first lumbar spine surgery from 1990 to 1993 and a second cohort who underwent surgery from 1997 to 2000. For patients undergoing surgery for lumbar degenerative disease, the initial procedure was fusion in 9% of the 1990–1993 cohort patients, compared with 19% of the 1997–2000 cohort, confirming other reports of increased use of fusion procedures during the 1990s. The 4-year incidence of reoperation was 14% in the 1997–2000 cohort compared with 12.4% in the 1990–1993 cohort. When comparing only patients who underwent fusion surgery, the 1997–2000 cohort was 40% more likely to undergo a reoperation within the first year than the 1990–1993 cohort. There was no significant difference in the reoperation rate beyond 1 year. Patients undergoing decompression alone in the 1997–2000 cohort were 18% more likely to undergo reoperation than those in the 1990–1993 cohort. In both groups, approximately 65% of reoperations were performed for a complication of the initial surgery. Among these, device complications were more prevalent in the 1990–1993 cohort, whereas pseudarthrosis was more prevalent in the 1997–2000 cohort.

Conclusion: The development and use of new technology for spinal fusion surgery does not appear to reduce the rate of reoperation.

Comments: The introduction of new technologies for spine surgery appears to be associated with an increase in the use of the technology. This may be a result of broadening of indications for lumbar spinal fusion, or the use of such technology in patients who would have benefited from it had it been introduced earlier. The rate of spinal implant development observed in the 1990s has been eclipsed by that of the current decade. Additionally, performance of spine fusion and use of advanced implants varies geographically in the United States. To truly conclude that new spinal implant technology does not reduce the rate of revision surgery, a broader nationwide study evaluating even newer technology would be needed.

Pearls: The availability of new technology does not eliminate the need for proper patient selection and surgical technique. The nature of each patient's disease must be considered individually to determine who may benefit from the use of new spinal fusion techniques and implants.

Relationship between early opioid prescribing for acute occupational low back pain and disability duration, medical costs, subsequent surgery and late opioid use.

Webster BS, Verma SK, Gatchel RJ. *Spine (Phila PA 1976)*. 2007;32:2127–2132.

Context: During the past two decades, there has been a substantial increase in the use of opioid analgesics for acute and chronic musculoskeletal pain.

Study Design and Results: The purpose of this study was to evaluate the relationship between opioid prescription for acute low back pain and clinical outcome. The authors retrospectively examined 8443 workers' compensation claims nationwide for patients with acute low back pain. Participants were grouped stratified by morphine equivalent amount (MEA) of opioid analgesics received during the first 15 days after onset of their claim. 21.2% of patients received at least one opioid prescription. Low back injury severity strongly correlated with outcome. After controlling for injury severity and other covariate factors, the authors found that duration of disability, average medical cost, risk of subsequent surgery, and late opioid use all increased with increasing MEA. Patients in the highest MEA group were on average disabled 69 days longer and had three times the risk of undergoing surgery than patients receiving no opioid analgesics.

Conclusion: Use of opioid analgesics for acute low back pain may be detrimental to recovery.

Comments: Current practice guidelines of the American Academy of Orthopaedic Surgeons suggest that opioid analgesics may be used for a short period in the treatment of acute low back pain, but for a short time only. Greater than 90% of patients with an episode of acute low back pain will recover within a few weeks with no sequelae. This study suggests that opioid analgesics are detrimental to the process of recovery. Other methods of analgesia should be implemented and may include steroids, nonsteroidal antiinflammatory drugs, and physical therapy modalities. Other studies have indicated that job-related back injuries lead to inferior outcomes than nonjob-related injuries. This study appears to control for that by including only workers' compensation (job-related injury) claim data.

Pearls: Opioid analgesics are used routinely for fracture and postoperative care in orthopaedic surgery. This study highlights the importance of prescribing these medications

for short durations and communicating with patients the possible risks inherent in taking them.

Neurologic complications of lumbar pedicle subtraction osteotomy: a 10-year assessment. Buchowski JM, Bridwell KH, Lenke LG, Kuhns CA, Lehman RA Jr, Kim YJ, Stewart D, Baldus C. *Spine (Phila PA 1976)*. 2007;32:2245–2252.

Context: Pedicle subtraction osteotomy is performed infrequently but is a powerful technique for correcting fixed sagittal plane spinal imbalance. The rates of complication for this technically demanding procedure have not been well defined.

Study Design and Results: The purpose of this study was to evaluate the rate of neurologic complications in 108 consecutive patients who underwent pedicle subtraction osteotomy. Neurologic deficit was defined as motor loss of ≥ 2 grades, loss of bowel/bladder control, or loss of sensation in a dermatomal pattern and occurred in 11.1% of patients. The deficits always were unilateral and typically did not correspond to the osteotomy level. Permanent deficits occurred in three patients, all of whom were diagnosed with degenerative sagittal imbalance. Importantly, intraoperative neurologic monitoring did not detect the impending loss of neurologic function. Further surgical intervention was performed in nine patients for additional neural decompression.

Conclusion: Neurologic injury commonly occurs after pedicle subtraction osteotomy. The deficits typically are unilateral and generally are reversible.

To decrease the risk of neurologic injury, the authors recommend: central canal enlargement, careful osteotomy closure, performing an intraoperative wake-up test, and performing a full motor examination immediately after surgery.

Comments: Pedicle subtraction osteotomy can be used to achieve as much as 40° sagittal plane spinal correction at one spinal level. The procedure is technically demanding but carries the advantages of limiting the number of surgical levels and avoiding anterior column and vascular lengthening. Intraoperative neuromonitoring (including somatosensory evoked potentials, motor evoked potentials, and electromyography) are used frequently with the hope that developing neurologic deficits will be observed at a time when reversal of the spinal correction and instrumentation can be performed conveniently so that permanent injury can be avoided. In this study, intraoperative monitoring was used but did not detect any of the neurologic deficits. Other methods of neurologic evaluation include an intraoperative wake-up test, careful central spinal canal enlargement and ligamentum flavum resection, and immediate postoperative motor function testing.

Pearls: As much as 40° sagittal plane correction can be achieved with one-level pedicle subtraction osteotomy. The Smith-Petersen osteotomy is an alternative and involves a chevron resection of the posterior elements with posterior compression instrumentation. The anterior column of the spine is lengthened and left in distraction and can stretch or injure the great vessels. Approximately 10° correction can be achieved with each level of the Smith-Petersen osteotomy.

Circumferential fusion is dominant over posterolateral fusion in a long-term perspective: cost-utility evaluation of a randomized controlled trial in severe, chronic low back pain. Soegaard R, Bünger CE, Christiansen T, Høj K, Eiskjaer SP, Christensen FB. *Spine (Phila PA 1976)*. 2007;32:2405–2414.

Context: Various authors have reported improved functional outcome after circumferential lumbar spine fusion compared with posterolateral lumbar spine fusion. Societal outcome measures such as ability to return to work and quality of life have not been investigated as thoroughly.

Study Design and Results: The purpose of this study was to evaluate the cost effectiveness of circumferential spinal fusion compared with posterolateral spine fusion for isthmic spondylolisthesis or degenerative disc disease. The authors determined the cost per Quality-Adjusted-Life-Year (QALY) at 5 to 9 years followup for 125 patients randomized to undergo circumferential or posterolateral spinal fusion. They used a well-documented definition of cost effectiveness as a cost per QALY less than \$50,000 (US dollars). All costs to the patient and society related to the treatment were analyzed, including that of the index surgery, any reoperations, hospitalizations, service utilization, medications, and productivity of the patient. Quality of life was measured using EuroQoL, a validated outcome instrument. The circumferential fusion group had a significantly greater rate of fusion and significantly less functional disability and pain. Although the index operation was slightly more expensive versus for circumferential fusion (\$12,070 [US dollars]) compared with posterolateral fusion (\$11,472 [US dollars]), these patients had lower rates of reoperation and resource utilization and a higher rate of return to work. Overall, the circumferential fusion group had a \$12,943 (US dollars) lower cost per patient compared with the posterolateral group. The EuroQoL instrument showed a significantly better quality of life in patients treated with circumferential versus posterolateral fusion.

Conclusion: Circumferential spinal fusion is clinically superior and overall more cost effective than posterolateral fusion.

Comments: Circumferential fusion is considered by many to be more resource-intensive than posterolateral fusion. This study shows circumferential fusion to be more cost effective with time, most likely owing to a lower reoperation rate and lower use of other medical resources such as outpatient visits. Although this study does confirm the benefit of circumferential fusion, a surgeon may need to consider cost effectiveness along with a patient's diagnosis, age, and comorbidities to determine the optimal surgical plan.

Pearls: Circumferential spine fusion involves posterolateral fusion combined with intervertebral fusion and can be achieved by various methods. Anterior lumbar interbody fusion (ALIF) requires a separate anterior spinal exposure for fusion whereas posterior lumbar interbody fusion (PLIF) and transforaminal lumbar interbody fusion (TLIF) can be performed from one posterior spinal exposure through which posterolateral fusion also can be performed.

Major vascular injury during anterior lumbar spinal surgery: incidence, risk factors, and management. Fantini GA, Pappou IP, Girardi FP, Sandhu HS, Cammisa FP Jr. *Spine (Phila PA 1976)*. 2007;32:2751–2758.

Context: The anterior approach to the lumbar spine provides excellent exposure of the intervertebral disc for discectomy or disc replacement. The great vessels, however, lie directly within the surgical field and are at risk for injury during surgery.

Study Design and Results: The purposes of this study were to evaluate the incidence of vascular injury in anterior lumbar spine surgery and determine factors that predispose vascular injury. The authors retrospectively reviewed the records of 338 patients who underwent anterior spine surgery. The surgical diagnoses were deformity in 39% and infection in 5%. Total disc arthroplasty was performed in 18%. Vascular injury occurred in 10 patients (2.9%). A common iliac vein was injured in all but one case in which the terminal aorta was injured. Risk factors for injury included osteomyelitis or discitis (current or prior), prior anterior spinal surgery, spondylolisthesis, a large anterior osteophyte, and anterior migration of an interbody device. Direct vascular repair was performed by the exposure surgeon and augmented with topical hemostatic agents. Venous thrombosis occurred in one patient who required venorrhaphy.

Conclusions: Osteomyelitis or discitis, prior anterior spinal surgery, spondylolisthesis, a large anterior osteophyte, and anterior migration of an interbody device predispose a patient to vascular injury in anterior lumbar spine surgery.

Comments: Anterior exposure of the lumbar spine provides excellent access to the intervertebral discs and bodies of the lumbar spine. Extreme care must be taken to avoid

potentially life-threatening damage to the great vessels. The authors identify various factors that predispose vascular injury that very likely share inflammation and vascular scarring as common pathophysiologic features. The presence of these factors should be sought in the preoperative plan so that proper exposure techniques can be used to minimize the risk of vascular injury.

Pearls: The anterior aspect of the L5-S1 disc typically is exposed between the common iliac vessels distal to the great vessel bifurcation. The median sacral vessels must be identified and ligated for this exposure. The anterior aspect of L4-L5 is exposed from the left side of the great vessels and common iliac vessels. An iliolumbar vein often is encountered and must be ligated. If it is injured, the origin on the iliac vein can retract and make hemostasis and venorrhaphy much more difficult.

Heterotopic bone formation with the use of rhBMP2 in posterior minimal access interbody fusion: a CT analysis. Joseph V, Rampersaud YR. *Spine (Phila PA 1976)*. 2007;32:2885–2890.

Context: Recombinant human bone morphogenetic proteins (rhBMP) have been used with increasing frequency in lumbar spine fusion surgery because of the excellent rates of fusion associated with their use. One safety concern, however, is the possibility of heterotopic bone formation in the spinal canal and neuroforamina.

Study Design and Results: The purpose of this study was to document the incidence and significance of epidural heterotopic bone formation with minimally invasive posterior access lumbar interbody fusion. The authors reviewed CT scans 6 months after surgery in 33 consecutive patients who underwent either posterior or transforaminal interbody fusion with ($n = 23$) or without ($n = 10$) rhBMP. Heterotopic bone formed in 20.8% of the spinal levels fused with rhBMP and 8.3% of the levels without rhBMP. The heterotopic bone was noted in the neuroforamen in all but one level. There was no ectopic bone formed. No signs of nerve root or cauda equine compression were noted in any of the patients in whom heterotopic bone had formed. None of the differences between the groups reached statistical significance.

Conclusions: The authors concluded that rhBMP may lead to a greater incidence of heterotopic bone formation in posterior access lumbar interbody fusion, although this bone does not appear to lead to clinically important sequelae.

Comments: Although the authors' data do support their conclusions, the small sample size of both groups makes the generalizability of the results unknown. A study with a larger sample size may indeed reveal a significant difference in the formation of heterotopic bone with rhBMP. Other authors have shown that use of rhBMP leads to a

higher postoperative incidence of radiculitis after posterior access lumbar interbody fusion. A larger sample size may show a different effect of foraminal heterotopic bone than that concluded in this study.

Pearls: Internal validity of a study refers to the accuracy of the conclusions of a study based on the hypothesis and results. External validity refers to the generalizability of the conclusions to a population larger than the study sample.

Spinal cord injury in patients with ankylosing spondylitis: a 10-year review. Thumbikat P, Hariharan RP, Ravichandran G, McClelland MR, Mathew KM. *Spine (Phila PA 1976)*. 2007;32:2989–2995.

Context: Ankylosing spondylitis is a common seronegative spondyloarthropathy that often leads to spontaneous spinal fusion, rendering the spine susceptible to fracture with low-energy trauma. Seemingly innocuous fractures often are unstable and can result in severe neurologic injury.

Study Design and Results: The purpose of this study was to evaluate the long-term clinical and neurologic outcomes of patients with ankylosing spondylitis who sustained spinal cord injuries as a result of low-energy fracture-dislocations. The authors identified 18 patients treated and followed for a minimum of 10 years. The mechanism of injury was a low-energy fall in 14, traffic accident in one, and following surgical or medical treatment in three. Twelve of the patients were ambulatory immediately after the injury and deteriorated later. The most common reason for decompensation was overcorrection of kyphosis at the fracture site. Four of the 18 patients died during the initial hospitalization. Four regained some ambulatory ability. The remainder were dependent on a wheelchair for mobility.

Conclusions: The subtle presentation and relative low energy of the injury in patients with ankylosing spondylitis require a high index of suspicion to detect and prevent catastrophic neurologic compromise. Medical alert cards or bracelets should be carried by patients who know of their disease so that emergency medical personnel can be prepared to adjust their methods of prehospital and early treatment.

Comment: The authors describe long-term followup of a relatively large cohort of patients with ankylosing spondylitis and spinal cord injury. They identify the importance of vigilance in protecting these patients from catastrophic neurologic compromise. The potential for such injury must be made clear to patients with severe disease so that methods of secondary prevention of spinal injury can be instituted.

Pearls: Ankylosing spondylitis is a seronegative spondyloarthropathy. Patients, by definition, will not make the antibody detectable as rheumatoid factor. The major

histocompatibility complex molecule HLA B-27 is detectable in 96% of patients with ankylosing spondylitis; it is present in only 8% of the population at large. The danger of spinal fracture in ankylosing spondylitis lies in the development of a biomechanical construct that behaves more like an unsegmented long bone than the segmented spine. Even a seemingly innocuous fracture is rendered unstable by the long lever arm above and below the fracture, much like the femur or tibia.

Clinical outcomes of 90 isolated unilateral facet fractures, subluxations, and dislocations treated surgically and nonoperatively. Dvorak MF, Fisher CG, Aarabi B, Harris MB, Hurbert RJ, Rampersaud YR, Vaccaro A, Harrop JS, Nockels RP, Madrazo IN, Schwartz D, Kwon BK, Zhao Y, Fehlings MG. *Spine (Phila PA 1976)*. 2007;32:3007–3013.

Context: Fracture and dislocation of the cervical facet joint comprise a spectrum of injury for which little consensus exists regarding terminology, diagnosis, or treatment. Most reports involve too few patients or a population too heterogeneous for valid conclusions to be made with respect to the variables most likely to affect outcome.

Study Design and Results: This is a retrospective, multicenter study of the Spine Trauma Study Group evaluating patients with isolated, unilateral injury to a cervical facet joint with 25% or less vertebral subluxation at the injured level. Mechanism of injury, patient demographics, and method of treatment characteristics were examined to determine the variables that most strongly influence outcome. Quality of life outcome was measured to a mean followup of 29.7 months using the North American Spine Society Cervical Pain and Disability Subscale and the Short Form 36 Physical Component Score and Bodily Pain subscale. Motor vehicle accidents accounted for 49% of all injuries followed by sports injuries (31%). A majority of injuries occurred at the C6-C7 level (60%) followed by C5-C6 (17%). A nondisplaced superior facet fracture was the most common pattern of injury (35% of all injuries) and was more likely to be treated nonoperatively than any other pattern. A majority of injuries were treated surgically (80%). Although the results did not reach statistical significance, the patients treated surgically reported better improvements in outcome measures than did patients who were treated nonoperatively. The scores, however, indicated a lower quality of life for injured patients than age-matched normative values and reached statistical and clinical significance. Comorbidities and advanced age also contributed to a worse outcome.

Conclusions: Cervical facet injuries lead to pain and disability that result in worse scores on quality of life measures than those of the healthy population.

Nonoperative treatment may lead to worse outcomes than surgical treatment.

Comments: This is the largest series of cervical facet injuries reported to date. The main weakness of the study is the small number of patients treated nonoperatively. These patients, however, comprise a group with injuries believed to be benign and therefore amenable to conservative treatment. The finding of worse outcome scores with nonoperative treatment that persist during a 29-month followup does suggest that any injury to the cervical facet may diminish

quality of life and may be improved with surgical treatment. Additional study and longer followup are needed to strengthen the authors' conclusions and recommendations.

Pearls: Cervical facet joint injuries most commonly involve the C6-C7 level and most often are caused by motor vehicle accidents. The most common pattern of injury is a nondisplaced superior facet fracture followed by displaced superior facet fractures. Unilateral facet injuries typically do not allow more than 25% anteroposterior translation of the injured level.