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Complications Associated with Posterior Lumbar Surgery

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Complications associated with posterior lumbar surgeries include pseudarthrosis, loss of fixation, instrumentation malposition, and cerebrospinal fluid leakage. An understanding of the associated risk factors and their incidences can help to reduce the likelihood of complications. Adhering to meticulous operative technique is also essential. Once complications occur, establishing the diagnosis and tailoring treatment to each individual patient can help to reduce the risk for progression of symptoms and can limit additional complications.
Semin Spine Surg 23:101-113 © 2011 Elsevier Inc. All rights reserved.

KEYWORDS cerebrospinal fluid leakage, complications, instrumentation malposition, loss of fixation, posterior lumbar surgery, pseudarthrosis

This article addresses complications related to posterior lumbar spine surgery. Posterior lumbar surgeries include posterior decompression (eg, laminotomy, laminectomy, discectomy, foraminotomy, and laminoplasty) and posterior fusions (posterior facet fusion, posterolateral intertransverse fusion, transforaminal lumbar interbody fusion, and posterior lumbar interbody fusion).

Pseudarthrosis After Posterior or Posterolateral Fusion

Pseudarthrosis is not a direct surgical complication but rather an unfavorable outcome of fusion surgery. Although not all pseudarthroses are necessarily symptomatic, in some cases a persistent nonunion can lead to instrumentation failure, such as breakage of rods or screws, screw loosening, or screw pullout. This section reviews the incidence, risk factors, and clinical manifestations of patients presenting with lumbar pseudarthrosis and the available treatment and prevention options.

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Incidence

The reported incidence for postoperative pseudarthrosis after posterior lumbar spine fusions varies widely, depending on the detection method used (eg, radiographs, computed tomography [CT], clinical improvement, and surgical exploration).[1] Nevertheless, it appears that the use of instrumentation may lower the incidence of postoperative pseudarthrosis after posterolateral spinal fusions.[1-4] Zdeblick[4] reported the incidence of pseudarthrosis after posterolateral fusion to be 5% in instrumented cases and 35% in noninstrumented cases. Similar results were reported by Fischgrund et al[3] for degenerative spondylolisthesis treated with posterolateral fusion (18% of instrumented cases and 55% of noninstrumented cases), whereas Brodsky et al[2] reported a 13% pseudarthrosis rate with instrumentation and 31.5% without instrumentation during surgical exploration. Park and Cho[5] reviewed radiographs and clinical outcomes with minimum 5-year follow-up and reported the pseudarthrosis rate after posterolateral lumbar fusion to be as low as 1.6%.

Causes and Risk Factors

Many factors can increase the risk of pseudarthrosis, including the method of graft bed preparation, the quality or quantity of graft material used, patient factors (smoking, use of nonsteroidal anti-inflammatory medications [NSAIDs], steroid use, etc), and instrument-related factors (eg, inappropriate position, inadequate fixation points above and below intended fusion).[6] In a rabbit model biomechanical study, Silcox et al[7] compared the posterolateral fusion rates in a nicotine group with those in a control group: at 35 days,

1040-7383/$-see front matter
doi:10.1053/j.semss.2010.12.013

there was a solid fusion mass in 0% and 56%, respectively. Dimar et al[8] performed a similar study in rats, comparing posterior fusion rates between a group injected with NSAIDs and a control group. After 12 weeks, the fusion rates were 10% and 45%, respectively.[8] Other risk factors include postoperative anemia[9] and postoperative infection, particularly deep infections that require removal of instrumentation and/or grafted material.[10]

Diagnosis

When a pseudarthrosis is suspected, the most accurate method for detection is surgical exploration. However, this approach is neither practical nor necessary in all cases because not all pseudarthroses need to be repaired. Unfortunately, to the authors' knowledge, there are no highly accurate noninvasive diagnostic methods for detecting pseudarthrosis.

Conventional radiographs are widely used to detect pseudarthroses. Anteroposterior (AP), lateral, oblique, and flexion-extension views should be analyzed carefully. Lenke et al[11] created a fusion grading scale consisting of grades A to D on the basis of standing AP views for the lumbar region and Ferguson AP views for the lumbosacral region: A, definite solid fusion with large trabeculae bilaterally; B, possible solid fusion with unilateral trabeculae; C, probably no solid fusion with apparent crack in fusion mass bilaterally; and D, definite pseudarthrosis with graft resorption bilaterally.

In patients with internal fixation, pseudarthrosis should be strongly suspected in the presence of implant loosening, pullout, or breakage. Flexion-extension views can be a simple and cost-effective technique for identifying pseudarthrosis with gross motion,[12] but they can be insensitive in patients with micromotion or limited effort secondary to muscle spasm or contracture because of pain.[13]

CT can also be used, but the reported accuracy varies. Lang et al[14] advocated the high reliability of 3-dimensional CT for detecting pseudarthrosis. Bohnsack et al[15] studied Tc-99 scintigraphy and reported a 93% specificity; however, they also reported only a 50% sensitivity and a 40% positive predictive value.

Some studies have reported on the inaccuracy of these methods, whether used in alone or in combination. For example, Brodsky et al[2] reported noncorrelations in 36% of conventional radiographs, 38% of bending flexion-extension radiographs, and 43% of CT scans. In another study, Larsen et al[13] reported that a combination of conventional radiographs, CT, and bone scans did not necessarily increase the detection rate of pseudarthrosis.

Because of this dilemma, some surgeons have recommended the use of a brace before making a diagnosis of pseudarthrosis; if the brace eliminates the back pain, pseudarthrosis can be strongly suspected. Others have advocated the use of diagnostic injections with local anesthetic into the suspected pseudarthrosis site to confirm the source of the pain.[16]

Clinical Manifestation and Outcomes

Because of difficulty in detection, the diagnosis of pseudarthrosis should not be made solely on the basis of radiographic analysis but also on clinical manifestation. Unfortunately, the correlation between fusion and clinical outcomes is controversial. DePalma and Rothman[17] found a 9% rate of pseudarthrosis after posterolateral fusion, reporting that patients with pseudarthrosis also had as much improved back pain and sciatica as did patients with a solid fusion, thus supporting the existence of a stable, fibrous nonunion in a percentage of pseudarthroses cases. Conversely, Turner et al[18] reported in their analysis of the literature that despite the presence of a solid fusion, patients can still have an unfavorable outcome. However, these results may be confounded by the fact that many of the reported "solid fusions" were based on the use of conventional radiographs alone and may have actually been undiagnosed pseudarthroses. In contrast, Deguchi et al[19] reported a strong positive correlation when they compared clinical success and evidence of radiologic fusion. In addition, 1 study of patients with compensation and litigation issues reported less favorable outcomes, even in the presence of solid fusions.[20]

Treatment

Only patients with clinical symptoms and evidence of radiographic abnormalities require treatment of a pseudarthrosis. Asymptomatic patients, even those with clear radiographic evidence of pseudarthrosis, may be followed clinically. Furthermore, even in presence of radiographic and clinical evidence of a pseudarthrosis, a thorough evaluation for other causes as the source of pain, such as initial misdiagnosis, adjacent-segment disorders, postoperative infection, prominent instrumentation, worker's compensation, and litigation, should be investigated before surgery. In the uncommon case where a pseudarthrosis is suspected without radiographic evidence, a surgical exploration may be considered.

Larsen and Capen[21] illustrated an algorithm for diagnosing and treating pseudarthrosis and advocated that for patients with idiopathic back pain, but no other identified causes for the pain, nonoperative treatment (such as exercise and physical therapy) should be attempted first. They advocated anterior lumbar interbody fusion as a salvage procedure for pseudarthrosis after posterolateral fusion or as an augmentation method for pseudarthrosis with solid fixation. However, pseudarthrosis without solid fixation can be treated with regraft and reimplantation alone. Savini et al[22] reported late paraparesis secondary to pseudarthrosis and suggested that revision should not be performed before 1 year after initial surgery unless there is a progressing neurologic deficit so that solid consolidation of the fusion mass can be achieved.

Several studies have shown that the results of pseudarthrosis repair are poor compared with those of primary fusion surgery. Lauerman et al[23] reported 7% excellent, 35% good, 9% fair, and 49% failed clinical outcomes after repair of lumbar pseudarthrosis. Carpenter et al[24] reported similar clinical outcomes after lumbar pseudarthrosis repair: 10% excellent, 17% good, 19% fair, and 54% poor. They pointed out that