

Revision Surgery for Spondylolisthesis

A patient guide

In brief: Revision surgery for spondylolisthesis is a distinct undertaking from a first, or primary, operation. Rather than addressing an untreated slip, it sets out to manage the failures and complications that can follow a previous spondylolisthesis fusion. These problems include a fusion that has not solidly united (pseudarthrosis), new degeneration at the level above or below an earlier fusion (adjacent-segment disease), persistent or recurrent narrowing of the nerve passages (recurrent stenosis), difficulties with the metalwork (screw loosening, breakage or malposition, or cage migration), problems at the upper end of a construct (proximal junctional issues), and loss of the spine's natural forward-and-backward balance (flat-back or sagittal imbalance). When persistent pain and disability follow earlier spinal surgery without a single clear explanation, the picture is sometimes grouped clinically under the umbrella term failed back surgery syndrome. This page describes what revision surgery is, the diagnostic puzzle it presents, the evidence on outcomes, and how the considerations differ from primary surgery. It is general information about the condition and the published evidence, not advice about any individual's care.

What makes revision different from a first operation

The defining feature of revision spondylolisthesis surgery is that it operates within a field that has already been altered by previous surgery. The earlier operation leaves scar tissue, changed anatomy, existing implants and, often, a partial or complete fusion. Because of this, the surgeon is not approaching virgin tissue but working around and through the consequences of what came before.

Three features set revision apart. First, the diagnostic task is harder: the surgeon must work out which of several possible failure modes is actually responsible for a patient's symptoms, because the management of each differs. Second, operating in a scarred field carries higher rates of complications, in particular tears of the dura (the membrane around the nerves), as well as greater blood loss and a higher infection risk. Third, the biological potential for a new fusion to take is generally lower second time around, and outcomes are on average more guarded than after primary surgery. The published literature consistently reports that revision lumbar fusions carry higher reoperation rates and worse early outcomes than primary fusions performed for comparable conditions.

The failure modes that prompt revision

Several recognisable patterns lead to consideration of revision. They are described here so that the reader can understand the language used, rather than as a checklist.

****Pseudarthrosis**** describes a previous fusion that has not united into solid bone. The intended bony bridge has not formed, leaving micro-movement that can generate pain and place implants under repeated strain. Whether a fusion unites is strongly dependent on the type of construct used. In a classic trial comparing instrumented with non-instrumented fusion for degenerative spondylolisthesis, solid union was reported in around 82 per cent of instrumented cases against around 45 per cent without instrumentation. Union and non-union have, in turn, been linked to differences in clinical outcome.

****Adjacent-segment degeneration and disease**** refers to new trouble developing at the mobile level immediately above or below a prior fusion. The term degeneration usually means changes seen on imaging, while disease implies that those changes are also causing symptoms. Fusion appears to lower the chance of further trouble at the original level but shifts the burden of failure towards the neighbouring segment. Registry data from the Swedish spine register illustrate this trade-off: index-level reoperation was lower after fusion (around 3 per cent) than without fusion (around 6 per cent), whereas adjacent-level reoperation was higher after fusion (around 9.7 per

cent) than without (around 4.2 per cent). Survivorship analyses have estimated that symptomatic adjacent-segment disease severe enough to prompt further surgery affects roughly 16.5 per cent of patients by five years and around 36.1 per cent by ten years, although such figures vary between series.

****Recurrent or residual stenosis**** describes narrowing of the spinal canal or nerve root passages that either was never fully relieved or has returned over time, sometimes through regrowth of bone or soft tissue at a decompressed level.

****Instrumentation problems**** cover the hardware itself: pedicle screws that loosen, break or sit in a less-than-ideal position, and interbody cages that shift or migrate. Screw loosening is reported more often where bone is weak, and osteoporosis is a recognised contributor.

****Proximal junctional problems**** arise at the top of a longer construct, where the fused, stiffer segment meets the more mobile spine above, and can range from mild change to more significant collapse or deformity.

****Flat-back and sagittal imbalance**** describe loss of the spine's normal forward curve in the lower back, which can leave a person stooped forward and unable to stand fully upright without effort. This is among the more demanding problems to correct.

How common these problems are

Revision is not rare, but its frequency depends heavily on what is being measured and over how long. Population and registry studies report meaningful reoperation rates after lumbar fusion that accumulate over years rather than months, with adjacent-segment disease being a major and time-dependent contributor. Comparative work shows that revision fusions, taken as a group, fare less well at one year and carry higher reoperation rates than primary fusions. Pseudarthrosis rates are strongly construct-dependent, as the instrumented-versus-non-instrumented comparison above illustrates, and are further influenced by the number of levels involved and the quality of the patient's bone.

What raises the risk of a fusion failing

A number of factors are associated, to varying degrees, with a higher chance that a fusion will not succeed or that further surgery will follow. Smoking is repeatedly linked with poorer fusion. Low bone density and osteoporosis reduce the hold of implants and the biological capacity for union, and are associated with screw loosening. A greater number of fused levels, increasing age, and poor sagittal alignment (in particular a mismatch between pelvic incidence and lumbar lordosis, often abbreviated PI-LL mismatch) are each associated with higher rates of adjacent-segment problems and reoperation. Diabetes is a plausible contributor, although its independent effect is less clearly defined. These are statistical associations across populations and do not determine what will happen to any individual.

The diagnostic task: telling the failure modes apart

Much of the skill in revision practice lies in identifying which problem is actually present, because pseudarthrosis, adjacent-segment disease, recurrent stenosis and ordinary post-surgical scar tissue can produce overlapping symptoms yet call for very different responses. The evidence on imaging is therefore worth describing.

Fine-cut computed tomography (CT) is generally regarded as the most accurate single test for assessing whether a previous fusion has united, since it shows bony bridging in detail. Distinguishing scar tissue from recurrent disc material is a separate question, and here magnetic resonance imaging (MRI) with gadolinium contrast has a long-established role: scar tissue tends to take up contrast and enhance soon after injection, whereas a recurrent disc fragment generally does not enhance in the same early way. For suspected adjacent-segment disease and instability, MRI is used to show the soft tissues and nerves, and flexion-extension X-rays (films taken bending forward and back) can demonstrate abnormal movement. The reference to a CT and a gadolinium-enhanced MRI in discussions of revision reflects these complementary strengths rather than any single rule about what is done.

How revision is approached: the evidence

The published evidence describes a range of revision techniques, matched to the problem identified.

Where a fusion has failed to unite, revision often aims to improve the biological and mechanical environment for union. Adding interbody support, in which a spacer is placed within the disc space, and circumferential (front-and-back) approaches are described as ways to raise fusion rates compared with bone graft laid only along the back of the spine. Studies report that revision can achieve high union rates when interbody support is added, though it does so from a less favourable starting point than primary surgery.

Where adjacent-segment disease is responsible, extending the existing construct to include the affected neighbouring level is a commonly described strategy. Series examining revision for adjacent-segment disease have reported clinical improvement in a substantial proportion of patients, with figures around 71 per cent quoted in some reports.

Where fixed sagittal imbalance or flat-back deformity is present, larger deformity-correcting procedures may be described, including a pedicle subtraction osteotomy, in which a wedge of bone is removed to restore the spine's forward curve. Such procedures can achieve powerful correction but carry the highest complication burden of any revision technique, and the literature documents significant rates of complications associated with them.

Across all these approaches, the recurring theme in the evidence is that operating on a previously fused, scarred spine is associated with higher rates of dural tear, infection and blood loss than primary surgery.

Outlook

On average, revision surgery for spondylolisthesis reliably improves symptoms, but the degree of improvement reported is generally less than that seen after primary surgery, and the chance of needing further surgery is higher. Among revision scenarios, correction of fixed deformity and flat-back is described as the highest-risk and most demanding. It is also worth noting that much of the spondylolisthesis-specific revision evidence is retrospective, drawn from reviews of past cases rather than randomised trials, so the figures quoted should be read as broad indications rather than precise predictions. The balance of benefit and risk in any individual situation depends on the specific failure mode, the patient's overall health and bone quality, and the alignment of the spine.

Common questions

What is revision surgery for spondylolisthesis?

It is surgery carried out to address problems arising from a previous spondylolisthesis operation, rather than to treat a slip for the first time. It deals with complications such as a fusion that has not united, new trouble at a neighbouring level, returning nerve compression, or difficulties with the metalwork.

How does it differ from a first operation?

The main difference is that revision works within a spine already altered by surgery, with scar tissue, existing implants and changed anatomy. This makes the diagnosis harder, raises the rate of complications such as dural tears, and tends to make a new fusion less likely to take than in a first operation.

What does pseudarthrosis mean?

Pseudarthrosis describes a fusion that has not solidified into continuous bone. The intended bony bridge has not formed, so small movements persist where the spine was meant to become rigid, and this can cause pain and strain the implants.

What is adjacent-segment disease?

It refers to new degeneration that develops at the level just above or below a previous fusion, and which is causing symptoms. Fusion reduces problems at the original level but tends to shift the burden of wear towards the neighbouring mobile segment.

What is the difference between adjacent-segment degeneration and disease?

Degeneration usually means changes that are visible on a scan, whereas disease means those changes are also producing symptoms. A person can have degeneration on imaging without it troubling them.

What does recurrent stenosis mean?

Stenosis is narrowing of the spinal canal or the passages the nerves travel through. Recurrent or residual stenosis means this narrowing has returned or was never fully relieved, sometimes through regrowth of bone or soft tissue at a previously decompressed level.

What are instrumentation problems?

These are difficulties with the metalwork used in a previous fusion: screws that loosen, break or sit in a less than ideal position, or cages that shift or migrate from where they were placed. Loosening is reported more often where the bone is weak.

What is scar tissue, and how does it differ from a recurrence?

Scar tissue, sometimes called epidural fibrosis, is the body's natural healing response after surgery. It can press on nerves and mimic the symptoms of a returning disc problem, but it is not a fresh disc herniation. Telling the two apart matters because they are managed differently.

The full set of questions and answers, with references, is available on the condition page.