

Spondyloptosis (Meyerding grade V)

A patient guide

In brief: Spondyloptosis is the most severe form of spondylolisthesis, in which one vertebra has slipped so far forward on the one below that the slip exceeds one hundred per cent. In practice this almost always describes the fifth lumbar vertebra (L5) having translated completely off the front of the sacrum and descended into the pelvis. It is classified as Meyerding grade V, the highest grade in a system that runs from I to V. The word derives from the Greek for "a falling", reflecting the way the upper vertebra appears to have fallen off the segment beneath it. Spondyloptosis sits at the extreme end of a spectrum of slip, and although it shares mechanisms with lower grades it differs from them in important ways: the deformity is dominated by a severe and often fixed lumbosacral kyphosis, the sacro-pelvic imbalance is the most marked seen in any spondylolisthesis, the trunk appears foreshortened, and the risk to the nerves is the highest of any slip. It is also the only grade at which removing the L5 vertebral body altogether (the Gaines procedure) enters the discussion. This page describes the condition and the published evidence in general terms and is not a substitute for individual assessment.

What distinguishes spondyloptosis from high-grade spondylolisthesis

Spondylolisthesis is graded by how far the upper vertebra has slipped forward relative to the one below, using the Meyerding system. Grades I and II describe slips of up to half the width of the vertebra below. Grades III and IV, often grouped together as high-grade spondylolisthesis, describe slips of between half and the full width. Grade V, spondyloptosis, is reserved for slips that exceed the full width, where translation is greater than one hundred per cent.

The distinction is more than a matter of degree. In high-grade spondylolisthesis the upper vertebra remains, broadly, on top of the one below, even if substantially displaced. In spondyloptosis the L5 body has come off the front of the sacrum entirely and dropped down in front of it, so that the relationship between the two segments is lost. As a consequence, several features that are present to a lesser extent in grade III to IV disease become dominant in grade V: the lumbosacral junction is no longer simply slipped but is severely angulated forward into a kyphosis; the pelvis rotates backwards to compensate; the spine above must work harder to keep the head balanced over the pelvis; and the visible shape of the body changes, with the trunk appearing short and the lower ribs drawn down towards the pelvis. These differences shape both how spondyloptosis presents and what is discussed when management is considered.

Pathoanatomy and spinopelvic imbalance

The hallmark of spondyloptosis is the loss of the normal load-bearing relationship at the lumbosacral junction. The top of the sacrum, which is normally a flat platform, frequently becomes rounded, or domed, as a result of the abnormal forces and the developmental nature of the deformity. As L5 slides forward and tips into kyphosis, it carries the exiting L5 nerve roots with it, dragging them forward and stretching them over the prominence at the front of the upper sacrum (the sacral promontory). This stretching is central to why neurological symptoms are common and why the L5 nerve is particularly vulnerable.

The deformity is closely linked to the shape and orientation of the pelvis. Many people with high-grade slips and spondyloptosis have a high pelvic incidence, a fixed anatomical measure that describes a more vertically inclined sacrum and a tendency towards forward slip. In response to the forward translation and kyphosis, the pelvis tends to rotate backwards, a posture described as pelvic retroversion, and the hips and knees may flex to keep the body upright. The overall pattern is one of severe sacro-pelvic imbalance, the most marked encountered across the range of spondylolisthesis. Researchers have proposed dividing high-grade slips into balanced and unbalanced patterns according to these pelvic measurements, because the pattern of imbalance appears relevant to how the deformity behaves and how alignment is considered.

How rare it is

Spondyloptosis is rare, and there is no robust population-based figure for how often it occurs. Its rarity is reflected indirectly in the published literature: the best-known surgical series of the grade-V-specific operation gathered only thirty cases over roughly twenty-five years at experienced centres, which itself indicates how infrequently the condition is encountered even where complex deformity is treated.

Most cases are developmental, arising from a dysplastic, or congenitally weak, lumbosacral junction rather than from a simple stress fracture of the bony bridge (the pars interarticularis). This developmental, high-dysplastic form tends to declare itself in late childhood or adolescence, often as the spine grows, and is reported more often in girls than boys. Because the underlying anatomy is abnormal from early in life, the condition can progress during periods of rapid growth.

Natural history

The risk of progression is greatest in those who are skeletally immature, who have a high-dysplastic anatomy, and who already have a high slip and a high slip angle (a measure of the forward tipping at the lumbosacral junction). In other words, the more severe and the more biologically active the deformity, the greater the tendency to worsen. Once a slip has reached the spondyloptotic stage and the segment has settled, however, the deformity is generally fixed, meaning it no longer moves freely and is held in its abnormal position by stiff soft tissues and adapted bone. The published natural history is drawn from relatively small numbers, and individual courses vary, so general statements should be read with that uncertainty in mind.

How it presents

Spondyloptosis often produces a recognisable outward appearance. The trunk looks short and foreshortened, sometimes to the point that the lower ribs approach the top of the pelvis, and a horizontal crease may appear across the abdomen where the trunk has telescoped down. The buttocks can look flat or heart-shaped because of the underlying bony shape. Many people walk with a crouched, waddling gait, sometimes described as a pelvic waddle, with the hips and knees slightly bent, partly because of tightness in the hamstring muscles at the back of the thighs, which is a characteristic finding.

Back pain and pain radiating into the legs are common. Because the L5 nerve roots are stretched over the sacrum, an L5 radiculopathy, with pain, altered sensation or weakness in the distribution of that nerve, may be present. At the severe end, pressure on the bundle of nerves at the base of the spine can produce features of cauda equina compromise, affecting bladder, bowel or saddle sensation. The combination of marked visible deformity, gait change and nerve symptoms is part of what sets spondyloptosis apart from milder slips.

Imaging

Imaging is used to confirm the diagnosis, to measure the deformity and to plan around the nerves and bone. A standing lateral radiograph of the lumbosacral spine confirms a translation of more than one hundred per cent, demonstrates the slip angle, and shows whether the top of the sacrum has become domed. Because spondyloptosis is fundamentally a problem of whole-body balance, full-length standing images of the spine and pelvis, including low-dose biplanar (EOS) imaging where available, are used to measure spinopelvic parameters such as pelvic incidence, pelvic tilt and sacral slope, and to assess where the plumbline dropped from the seventh cervical vertebra (C7) falls relative to the pelvis.

It is worth noting that lumbosacral kyphosis, a key measurement in this condition, can be quantified in several different ways, and the agreement between observers and between methods is variable; published work has examined this reliability directly. Magnetic resonance imaging (MRI) is used to show the nerves and any compression, while computed tomography (CT) gives the clearest picture of the bony detail, including the domed sacrum and the bony defect. Together these provide a description of the deformity rather than a single number that captures it.

What the evidence says about management

There is no class I evidence in spondyloptosis. The condition is too rare for randomised trials, and the published experience consists of case series and reviews, so all statements about management are descriptions of reported outcomes rather than high-certainty conclusions. The figures quoted below are drawn from primary surgical series and from secondary reviews, and these two kinds of source are not equivalent: a primary series reports a single team's first-hand results, whereas a review summarises across studies of differing quality.

Broadly, the published approaches fall into two philosophies. The first accepts the deformity and aims to fuse the segment where it lies (in-situ fusion), which avoids the substantial risk to the nerves that comes from physically moving the slipped vertebra back. The second aims to restore alignment by reducing the slip and correcting the lumbosacral kyphosis, which addresses the deformity and balance but carries a higher risk to the L5 nerve. Comparative work between reduction and in-situ fusion in high-grade disease has been published, and the trade-off between correction and neurological risk is a recurring theme.

The operation that is specific to grade V is the Gaines procedure. In its classic form it is a two-stage operation in which the L5 vertebral body is removed entirely (a vertebrectomy) and the fourth lumbar vertebra (L4) is then brought down and fused directly onto the sacrum (S1). This does not arise in lower grades, because only in spondyloptosis is the L5 body so displaced that removing it becomes a logical way to restore a column from L4 to the sacrum. In the primary series of thirty cases, a neurological deficit affecting the L5 nerve was frequently described after the procedure, but this deficit was predominantly transient, recovering over time, with permanent

functional loss of L5 function reported in only a low single-digit number of cases. This distinction between transient and permanent deficit should be attributed specifically to that primary thirty-case series, and the exact figures warrant confirmation against the institutional full text rather than reliance on secondary summaries.

Other techniques are described. Single-stage posterior approaches, including posterior vertebral column resection (VCR), aim to achieve a similar correction through one operation from the back. Transsacral techniques, including the modified Bohlman approach in which a graft or implant is passed from the back of the sacrum up into the L5 body, aim to achieve fusion across the lumbosacral junction along the line of load. Across all of these correction strategies, injury to the L5 nerve is the signature complication, and failure of the bone to fuse (pseudarthrosis), gradual loss of the correction achieved, and problems at the segments next to the fusion (adjacent-segment issues) are all reported.

Prognosis and where care takes place

Spondyloptosis is high-complexity, high-risk and low-volume surgery. The published experience consistently comes from specialist deformity units, and the rarity of the condition means that expertise is concentrated in a small number of experienced centres. Outcomes in the literature vary with the severity and rigidity of the deformity, the skeletal maturity of the individual, and the degree of sacro-pelvic imbalance. There is no single strategy that applies to everyone; the published evidence describes management as being individualised according to maturity, balance and how fixed the deformity has become, and weighed against the risk to the nerves that any correction entails.

Common questions

What does spondyloptosis mean?

Spondyloptosis is the most severe grade of spondylolisthesis, in which one vertebra has slipped more than one hundred per cent forward on the vertebra below. The name comes from the Greek for "a falling", describing how the upper vertebra appears to have fallen off the one beneath it. It is classified as Meyerding grade V.

How is it different from high-grade spondylolisthesis?

High-grade spondylolisthesis (Meyerding grades III and IV) describes a slip of between half and the full width of the vertebra below, where the upper vertebra still sits broadly on top of the lower one. In spondyloptosis the slip exceeds the full width, so the upper vertebra has come off the front of the segment below and dropped down in front of it, and the deformity is dominated by forward angulation and imbalance rather than translation alone.

What does a slip of "more than one hundred per cent" actually mean?

Slip percentage describes how far the upper vertebra has moved forward relative to the width of the vertebra below it. A slip of one hundred per cent means it has moved by the full width. A slip of more than one hundred per cent means it has moved beyond the front edge of the lower vertebra altogether, which in the lumbosacral spine means the L5 body has translated off the front of the sacrum.

Which vertebra is usually involved?

In almost all cases it is the fifth lumbar vertebra (L5) slipping forward off the first sacral vertebra (S1), at the junction between the lowest part of the lumbar spine and the sacrum. This is the level that bears the greatest forward-tilting load and is most often affected by developmental forms of spondylolisthesis.

Why is the neurological risk described as the highest of any spondylolisthesis?

As L5 slips forward and tips into kyphosis, it carries the L5 nerve roots with it and stretches them over the bony prominence at the front of the upper sacrum. This stretching, combined with the severity of the deformity, places the nerves under more strain than in any lesser grade, which is why nerve symptoms are common and why correction carries a notable risk to the L5 nerve.

What is lumbosacral kyphosis and why does it matter here?

Lumbosacral kyphosis is forward angulation at the junction between the lumbar spine and the sacrum, where the spine would normally curve gently the other way. In spondyloptosis this forward angulation is severe and often fixed, and it is

a major part of why the trunk looks short and why whole-body balance is disturbed. It can be measured in several different ways, and these measurements do not always agree closely.

What is meant by trunk foreshortening?

Because the upper vertebra has dropped down in front of the sacrum, the spine effectively telescopes, so the trunk appears shorter than expected. The lower ribs may come to lie close to the top of the pelvis, and a horizontal crease can appear across the abdomen where the trunk has shortened.

What is the crouched, waddling gait that is sometimes described?

Some people with spondyloptosis walk with the hips and knees slightly bent and a rolling, waddling movement of the pelvis. This pattern relates partly to tightness in the hamstring muscles at the back of the thighs and partly to the body's attempt to keep itself balanced over a severely deformed lumbosacral junction.

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