

Paediatric Spondylolisthesis and Spondylolysis (Younger Children)

A patient guide

In brief: Spondylolysis and spondylolisthesis in younger children describe a defect or forward slip at the lower lumbar spine arising in a still-growing skeleton. What sets the youngest age group apart from the adolescent and adult presentations is skeletal immaturity. Because the spine has substantial growth remaining, the central concern described in the literature is growth-related progression of any slip, with progression tending to concentrate around the pubertal growth spurt. A higher proportion of dysplastic and high-grade slips is reported in this youngest group than in older patients, and neurological involvement, although uncommon overall, becomes more relevant where a high-grade dysplastic slip is present. This page describes the condition and the published evidence impersonally. It is not medical advice, and it does not tell any reader what to do.

How the paediatric picture differs from the adolescent and adult forms

The three age-related presentations are best understood as distinct chapters of the same anatomical story. In the adolescent athlete, attention in the literature centres on an acute or sub-acute pars stress fracture and on the question of whether that fracture can be encouraged to heal. In the adult, the lesion is typically long past, and symptoms, where present, are described as arising from degenerative or foraminal change layered over an old defect, or from degenerative disease entirely without any pars defect at all.

The younger child sits at the other end of this spectrum. Here the skeleton is immature, the posterior elements may be dysplastic from the outset, and the published worry is forward slip that may advance as the child grows. Reports consistently note that the youngest age group contains a greater share of developmental, dysplastic and high-grade slips, and it is in these high-grade dysplastic slips that the literature describes the clearest, if still uncommon, neurological risk. The remainder of this page sets out the anatomy, classification, frequency, natural history, presentation, imaging and management evidence relevant to this group, with areas of genuine uncertainty flagged as such.

Pathoanatomy

Spondylolysis denotes a defect in the pars interarticularis, the narrow bony bridge connecting the upper and lower facet joints of a vertebra, most often at the fifth lumbar level. Where both sides are affected, the vertebral body above the defect may translate forwards relative to the one below, producing a spondylolisthesis.

In the developmental, dysplastic form that is more prominent in younger children, the literature describes a constellation of structural features. The posterior elements may be congenitally deficient or attenuated, the top of the sacrum may take on a rounded or domed contour, the fifth lumbar vertebral body may become trapezoidal in profile, and spina bifida occulta of the lower lumbar or sacral arch is frequently observed alongside the slip. These dysplastic features are described as offering less mechanical restraint to forward translation, which is the reasoning given in the literature for the association between dysplastic morphology and higher-grade slips.

Classification orientation

Several classification frameworks appear in the literature, and they describe overlapping but different aspects of the condition.

The Wiltse, Newman and Macnab system separates the condition by aetiology into dysplastic, isthmic, degenerative, traumatic and pathological types, with the isthmic group further subdivided according to the nature

of the pars lesion. The Marchetti and Bartolozzi framework draws a broad line between developmental forms, themselves split into high-dysplastic and low-dysplastic subgroups, and acquired forms such as those following trauma or surgery. This developmental versus acquired distinction is the one most often invoked when the younger child is discussed, because the developmental, dysplastic end carries the morphology associated with progression.

The Meyerding grade describes severity rather than cause. It quantifies the degree of forward slip by dividing the upper surface of the lower vertebra into quarters, with grades one to four corresponding to translation of up to a quarter, half, three-quarters and the full width respectively, and complete dislocation termed spondyloptosis. Low-grade conventionally refers to grades one and two and high-grade to grades three and above. Paediatric surgical classifications, such as that described by Mac-Thiong and Labelle, additionally incorporate the sagittal balance of the pelvis and spine, reflecting a view in the literature that overall spinopelvic alignment, not slip percentage alone, characterises the more severe developmental cases.

Epidemiology

The frequency figures most often cited derive from longitudinal and imaging studies. A pars defect is reported in roughly 4.4 per cent of children by the age of six, rising to approximately 6 per cent by adulthood, indicating that a proportion of defects appear after early childhood. In computed tomography series of very young children, spondylolysis is described as present but uncommon, with one such series reporting a prevalence of around 4.7 per cent in children under eight.

Ethnic variation is documented, with markedly higher rates reported in some populations. A sex difference is consistently described, with pars defects roughly twice as common in boys, yet girls reported as more prone to high-grade slip and to progression. This apparent paradox, more defects in boys but more severe slips in girls, recurs through the literature and is relevant to how the younger child is described.

Natural history

The natural history is informed by several classic longitudinal studies, and their findings are descriptive rather than prescriptive.

The long-term work associated with Fredrickson and later Beutler followed a cohort from childhood into adulthood. Among the observations reported were that unilateral pars defects did not go on to slip, that any progression of slip was greatest during childhood and adolescence and slowed with each subsequent decade, and that the magnitude of slip correlated poorly with the presence or severity of pain. The Seitsalo studies, including work focused on patients under twelve, reported that most of the eventual slip was already present at first presentation, and that in-situ fusion did not clearly alter the subsequent course of progression in the cases examined.

Drawing these threads together, the literature lists risk factors associated with progression as a higher Meyerding grade, a high slip angle or lumbosacral kyphosis exceeding roughly fifty degrees, dysplastic morphology, the timing of the growth spurt and female sex. An important caveat repeated across these studies is that predicting which individual low-grade lesion will progress remains imprecise. The named factors describe groups at higher reported risk; they do not reliably forecast the path of any single child.

Presentation

The reported presentation in younger children most commonly centres on lower back pain, although the literature emphasises that pain correlates poorly with slip severity and that some defects are noted incidentally. Hamstring tightness is a frequently described finding and is understood in the literature as a reflection of altered lumbosacral mechanics and posture rather than of the muscle itself. Where a slip is more advanced, changes in posture and gait are described, including a flattening of the lower back contour, a forward tilt of the pelvis and, in severe cases, a characteristic stance.

Neurological symptoms are described as uncommon and as concentrated in the high-grade dysplastic group, where the deformity and the position of the fifth lumbar nerve may give rise to leg symptoms. In low-grade lesions, neurological involvement is reported as unusual.

Imaging staging (descriptive)

The imaging approaches described in the literature each address a different question, and what follows is description of those methods rather than any recommendation.

The standing lateral radiograph is described as the projection from which the Meyerding grade and the slip angle are measured, with the standing position allowing the slip to be seen under physiological load. Oblique radiographs may demonstrate the pars defect as a break in the neck of the so-called Scottie dog outline, although this sign is described as less reliable in young children.

Computed tomography is described as defining the bony defect and, importantly, its maturity. The Morita staging characterises a pars stress lesion as early, progressive or terminal according to the appearance of the fracture margins, a distinction that the management literature links to healing potential. Magnetic resonance imaging is described as demonstrating active marrow oedema, indicating a metabolically active or recent lesion, and as displaying the neural structures, while avoiding ionising radiation. Single-photon emission computed tomography has historically been described as a means of identifying metabolically active lesions. All of these modalities are presented here descriptively, as tools the literature characterises, and no inference about what any individual should undergo is intended.

Management evidence (descriptive)

The published evidence on management is set out here as description of reported outcomes, not as guidance.

For pars stress injuries, the prospect of bony healing is described as stage-dependent. In the Morita series, healing was reported in approximately 73 per cent of early-stage lesions, 38.5 per cent of progressive lesions and none of the terminal lesions. Subsequent work associated with Sairyo reported a similar gradient and added that around 77 per cent of lesions positive for marrow oedema on magnetic resonance imaging healed, against none of those without oedema, framing oedema as a radiological marker of healing potential. Within this conservative literature, activity modification and bracing are described as the measures employed while a lesion is given the opportunity to consolidate.

Where a defect is established and a young patient is considered for surgical management of the pars itself, direct pars repair is described, with reported healing of around 92 per cent in patients under the age of twenty in some series. For high-grade slips, the literature describes a long-standing debate between in-situ fusion and reduction. In-situ fusion stabilises the segment in its slipped position, whereas reduction attempts to restore alignment. Reduction is reported to carry a risk of injury to the fifth lumbar nerve root, cited in the region of 9 to 11 per cent and described as most often transient. The balance between these approaches is presented in the literature as a matter of ongoing discussion rather than settled consensus, and it is described here, not advised.

Prognosis

The overall outlook described in the literature is favourable for low-grade lesions, which are characterised as benign over the course of a lifetime, with unilateral defects reported not to slip. The adverse group, by contrast, is consistently identified as the high-grade and high-dysplastic slips, in which progression and, occasionally, neurological involvement are described. The realistic window for bony healing is reported to lie with early or metabolically active lesions, with terminal defects described as not healing. As with natural history, these statements describe reported group tendencies and not the certain course of any individual child.

Common questions

What is spondylolysis, and what is spondylolisthesis?

Spondylolysis describes a defect or break in the pars interarticularis, a small bony bridge at the back of a lumbar vertebra. Spondylolisthesis describes a forward slip of one vertebra on the one below. The two are related, because a defect on both sides can allow the slip to occur. This is a description of the terms only.

How is the condition in a younger child different from the type seen in teenage athletes?

The literature describes the adolescent athletic presentation as centring on a recent pars stress fracture and on whether that fracture might heal. In the younger child, by contrast, the skeleton is immature and the published emphasis is on whether a forward slip might progress as the child grows. They are different chapters of the same underlying condition.

How does it differ from the adult form?

In adults, the literature describes the lesion as typically long past, with any symptoms arising from degenerative or foraminal change layered over an old defect, or from degenerative disease alone. The younger child sits at the opposite end, where growth and dysplastic anatomy dominate the picture.

Does it run in families?

The literature reports a familial tendency and notable variation between ethnic groups, which together suggest an inherited contribution to the development of pars defects. This is described as an observed association rather than a precise prediction for any individual family.

Will the slip get worse over time?

The published natural history reports that progression, where it occurs, is greatest during childhood and adolescence and slows with each later decade. It also reports that unilateral defects do not slip. Whether any particular low-grade lesion will progress is described in the literature as difficult to predict.

What does the growth spurt have to do with it?

Progression of a slip is reported to concentrate around the pubertal growth spurt, the period of most rapid skeletal growth. This timing is one reason the literature treats skeletal immaturity as the defining feature of the younger child's presentation.

What does high-grade mean?

The Meyerding grade measures how far one vertebra has slipped forward on the next, in quarters of the vertebral width. Grades one and two are termed low-grade, and grades three and above high-grade, with complete slip termed spondyloptosis. High-grade slips are the group the literature associates with progression and, occasionally, nerve involvement.

What is a dysplastic slip?

Dysplastic refers to a slip occurring against a background of congenitally deficient or poorly formed posterior bony elements, often with a rounded sacral top, a trapezoidal fifth lumbar vertebra and spina bifida occulta. The literature associates this morphology with a greater tendency towards higher-grade slips.

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