

Sacralisation of L5

A patient guide

In brief: Sacralisation of L5 is an anatomical variation in which the fifth lumbar vertebra, the lowest of the mobile vertebrae of the lower back, is partly or fully joined to the sacrum, the solid block of bone at the base of the spine. It is the commoner form of a broader group of variants known as the lumbosacral transitional vertebra, where the boundary between the lowest lumbar level and the sacrum is blurred. In sacralisation, the transverse process of L5, the wing of bone that projects to the side, becomes enlarged and either forms a false joint with the sacrum or fuses solidly to it, on one or both sides. This is overwhelmingly a variant of normal anatomy that a person is born with rather than a disease; it is very common, is usually discovered by chance on a scan performed for another reason, and in most people causes no symptoms at all. Its main practical consequences are subtle ones: it can make the lower spine appear to have only four lumbar vertebrae rather than five, it can lead to levels being miscounted on imaging, and it alters the way load is shared between the lowest segments, tending to protect the disc immediately below while placing a little more demand on the level above. In an uncommon minority, a false joint formed by an enlarged transverse process can itself become a source of pain, a situation known as Bertolotti syndrome.

What sacralisation of L5 is

The spine is built as a column of separate bones, the vertebrae, stacked one on another and cushioned by discs. In the conventional pattern there are five lumbar vertebrae in the lower back, labelled L1 to L5, sitting above the sacrum, which is itself five originally separate segments fused into a single curved triangular bone. The lowest mobile level of the spine is therefore the joint between L5 and the first sacral segment, S1.

The lumbosacral junction is, in developmental terms, a borderland, and the precise point at which the mobile lumbar spine ends and the fixed sacrum begins is not fixed in every person. A lumbosacral transitional vertebra is the general name for a vertebra at this junction that takes on features of both regions, sitting ambiguously between lumbar and sacral. There are two mirror-image forms. In sacralisation, the lowest lumbar vertebra, L5, takes on the character of the sacrum and becomes partly or wholly incorporated into it. In the opposite variant, lumbarisation, the uppermost sacral segment separates from the rest of the sacrum and behaves like an extra lumbar vertebra. Of the two, sacralisation is the more frequently encountered.

The defining change in sacralisation lies in the transverse process of L5. Normally this is a modest projection of bone to either side. In a sacralised L5 it becomes broad and enlarged, and reaches across towards the upper part of the sacrum, the sacral ala. Depending on how far this goes, the enlarged process may simply form a false joint, a pseudoarticulation, against the sacrum, or it may fuse with it into continuous bone. This may happen on one side only, making the variant asymmetrical, or on both sides.

A variation of normal anatomy, not a disease

It is worth stating plainly, because the word can sound alarming, that sacralisation of L5 is a variant of normal anatomy rather than an illness or an injury. It is present from early development and is carried, silently, by a substantial proportion of the population. The great majority of people who have it never know, because it produces no symptoms and is found, if at all, only incidentally when the lower back or abdomen is imaged for some unrelated reason.

This framing matters because incidental anatomical findings are easily misread as something wrong. A report that mentions a transitional vertebra, a sacralised L5 or a Castellvi type describes the shape of the bones, not a diagnosis of disease. For most people the finding has no bearing on their health and requires nothing to be done about it. Its significance, where it has any, lies chiefly in the practical points addressed below: the counting of spinal levels and the subtle redistribution of mechanical load.

How common it is

Sacralisation, as part of the wider family of lumbosacral transitional vertebrae, is among the more frequent anatomical variants of the spine. Reported prevalence varies considerably between studies, reflecting differences in the populations examined, the imaging used and, importantly, the threshold applied to decide what counts as a transitional vertebra. Figures across the literature range broadly, from a few per cent to around a third, with many large studies clustering in the region of roughly four to a third of people; one large series of consecutive patients with low back pain found a transitional vertebra in about eight per cent. Within this group, sacralisation is generally reported as the commoner of the two forms.

The wide spread of figures is itself instructive. It is a reminder that the boundary between a clearly transitional vertebra and a merely large or slightly asymmetrical transverse process is a matter of degree and of definition, not a sharp line. The headline point for a person reading their own scan report is simply that this is a common variant, not a rarity, and that finding it does not place them in an unusual or worrying category.

Partial versus complete sacralisation

Sacralisation exists on a spectrum, and where a given person sits on that spectrum is what most of the formal descriptions try to capture.

At one end is partial, or incomplete, sacralisation. Here the enlarged transverse process of L5 reaches the sacrum but does not fuse with it. Instead it forms a false joint, a pseudoarticulation, a contact surface that behaves loosely like a joint without being a true one. The L5 vertebra retains some independence and some movement, but its relationship with the sacrum is altered.

At the other end is complete sacralisation, in which the transverse process fuses solidly with the sacrum so that L5 becomes, in effect, part of the sacral block. The level is then immobile, and on a scan the lowest lumbar vertebra can appear to have been absorbed into the sacrum.

Because the change can affect one side or both, and can be a false joint or a fusion, several combinations are possible: a false joint on both sides, a fusion on both sides, or a mixed pattern with a false joint on one side and a fusion on the other. This variety is precisely what the standard classification, described next, sets out to organise.

The Castellvi classification and the broader LSTV framework

The most widely used scheme for describing lumbosacral transitional vertebrae was set out by Castellvi and colleagues in 1984, based on their appearance on imaging. It sorts the variants into four types according to how enlarged the transverse process is and whether it forms a false joint or a fusion, with each type further divided into a one-sided form, labelled A, and a two-sided form, labelled B.

Type I describes a transverse process that is simply enlarged and dysplastic, broadened to a width of at least nineteen millimetres, without forming a joint or a fusion with the sacrum. Type IA is one-sided and type IB

two-sided. Type II describes incomplete sacralisation, where the enlarged transverse process forms a false joint, a pseudoarticulation, against the sacral ala; type IIA is one-sided and IIB two-sided. Type III describes complete sacralisation, where the transverse process fuses solidly to the sacrum; again IIIA is one-sided and IIIB two-sided. Type IV is a mixed pattern, with a false joint on one side and a solid fusion on the other.

Across studies, the false-joint and fusion patterns, types II and III, are the ones most often seen. The classification is a descriptive tool for radiologists and surgeons; it labels the anatomy and provides a shared language, but a Castellvi type is not in itself a measure of pain or of how a person feels.

Bertolotti syndrome: when a false joint becomes a pain source

In a small minority of people, the false joint of a partly sacralised L5 is itself implicated as a source of low back pain. This situation, where a transitional vertebra is associated with symptoms attributed to the anomalous articulation, is known as Bertolotti syndrome, named after the Italian physician who described the association in the early twentieth century.

The proposed mechanism is mechanical and degenerative. The false joint between the enlarged transverse process and the sacrum is not a true, well-formed joint, and over time it may develop wear-and-tear changes much as other joints do. Studies that have examined the tissue from these pseudoarticulations have described changes consistent with degeneration of the joint surface; interestingly, examinations of the removed tissue have not consistently found nerve fibres within it, so the precise way in which the joint generates pain is not fully settled. Altered mechanics around the transitional level may also place extra demand on neighbouring discs and joints.

The crucial point of proportion is that Bertolotti syndrome is uncommon, and far less common than the transitional vertebra itself. The presence of a transitional vertebra on a scan is the rule among those who have the variant; symptoms genuinely arising from it are the exception. Establishing whether a false joint is actually responsible for a person's pain, rather than coincidentally present alongside it, is a careful clinical matter, since low back pain is common and has many possible causes. Where the question is pursued, a targeted local anaesthetic injection into the false joint is one of the approaches described in the literature for exploring whether that joint is the pain generator, with various conservative and, occasionally, surgical options described thereafter. These are descriptions of what the literature reports, not recommendations for any individual.

The apparent "four lumbar vertebrae" and the counting of levels

One of the most practically important features of sacralisation is the way it changes the apparent count of vertebrae. When L5 is fully sacralised and absorbed into the sacrum, the lower back can appear, on a scan of the lumbar region alone, to contain only four mobile lumbar vertebrae instead of the usual five. The opposite variant, lumbarisation, can make it appear that there are six.

This is not merely a curiosity. The conventional labelling of spinal levels assumes the standard count, and a transitional vertebra breaks that assumption. If the lowest mobile level is mislabelled, every level above it may be numbered one place out, so that what one observer calls L4–L5 another calls L5–S1. Such discrepancies are a recognised source of confusion between scans and between clinicians, and the literature identifies transitional anatomy as one of the leading reasons that spinal levels are miscounted.

Avoiding this confusion is a matter of careful, consistent counting rather than guesswork. Established approaches include numbering the vertebrae from the top of the spine downwards on a whole-spine image rather than from the bottom of a lumbar-only study, and using reliable anatomical landmarks. The iliolumbar ligament, a band that characteristically arises from the transverse process of the true L5, is widely used as a marker to identify that level, although it is acknowledged to be less reliable in some transitional and segmentation variants. The consistent theme in the imaging literature is that, in the presence of a transitional vertebra, the level must be established deliberately and documented clearly, so that any later procedure is directed at the intended segment.

How sacralisation affects spinal mechanics: protecting below, loading above

Beyond the question of counting, sacralisation alters the way mechanical load is distributed through the lowest part of the spine, and the pattern that emerges from the literature is reasonably consistent.

Because a sacralised L5 is partly or wholly anchored to the sacrum, the lowest disc, the one between the transitional vertebra and the sacrum, is shielded from much of the movement and stress it would otherwise bear. Several studies have observed that this transitional disc, particularly in the more complete forms of sacralisation, tends to show fewer degenerative changes than the corresponding disc in people without the variant. In this limited sense the variant is often described as protective of the disc immediately below.

The trade-off is that the movement and load not taken by the stiffened lowest segment have to go somewhere, and they are transferred upwards. The level immediately above the transitional vertebra, in effect the new lowest mobile segment, tends to take up the extra demand. The literature reports that the discs and joints above the transitional level show, on average, more degenerative change, more disc narrowing and a higher rate of disc herniation than in people without the variant, with the effect generally more pronounced in the fused than in the false-joint forms. This is the same adjacent-segment principle seen throughout spinal mechanics: when one level is stiffened, whether by nature or by surgery, the neighbouring levels compensate by moving and loading more.

Two cautions belong with this account. First, these are statistical tendencies observed across groups of people, not predictions for any one individual; many people with a sacralised L5 never develop any problem at the level above. Second, the presence of degenerative change on a scan is itself extremely common with age and does not, on its own, equate to pain or to any need for treatment.

How it is identified on imaging

Sacralisation is identified on the imaging of the lower spine, and the different methods each contribute something.

Plain X-rays, particularly a frontal view that shows the lumbosacral junction clearly, are a traditional and effective means of demonstrating an enlarged transverse process and its relationship to the sacrum, and of distinguishing a false joint from a solid fusion. A whole-spine or long film is especially valuable because it allows the vertebrae to be counted from the top down and the true level to be established.

Computed tomography, the CT scan, shows the bony anatomy in fine detail and is well suited to characterising the transverse process, the false joint and any fusion, and to defining the Castellvi type precisely.

Magnetic resonance imaging, the MRI scan, is the usual means of assessing the discs, nerves and soft tissues, and it is on MRI that the counting pitfall is most often encountered, because a study limited to the lumbar region may not include enough of the spine above to count reliably. Whole-spine localiser images, and landmarks such as the iliolumbar ligament, are used to anchor the numbering. In some circumstances, additional functional imaging has been described to explore whether a false joint is metabolically active, which can be relevant when the question of Bertolotti syndrome is being weighed. Across all of these, the recurring message is that the anatomy is described accurately and the levels are numbered with care.

Putting it in proportion

The sensible way to hold sacralisation of L5 in mind is as a common, generally harmless variation in the architecture of the lowest spine, present from birth, found mostly by chance, and of no consequence to health in the great majority of people who carry it. Its practical importance lies in two areas. The first is administrative and technical rather than medical: it can make levels difficult to count, so the anatomy needs to be described and numbered carefully whenever the lower spine is imaged or treated, to ensure that any procedure is aimed at the right segment. The second is mechanical: it tends to protect the lowest disc while placing a little more demand on the level above, an example of the adjacent-segment principle that runs throughout spinal science, though one that plays out as a group tendency rather than an individual certainty.

Set against this, the situation in which the variant itself causes pain, Bertolotti syndrome, is genuinely uncommon, and attributing back pain to a transitional vertebra is a careful judgement rather than an automatic conclusion, given how often the two simply coexist. The overall picture is therefore a reassuring one: an ordinary anatomical variant, usually silent, occasionally relevant to how the spine is numbered and how it ages, and only rarely a problem in its own right. Any individual significance is a matter for assessment by a person's own clinicians rather than something that can be read from a category or a scan report alone.