

Williams Syndrome (Williams-Beuren Syndrome) and the Spine

A patient guide

In brief: Williams syndrome, also called Williams-Beuren syndrome, is a rare genetic condition caused by the loss of a small piece of one copy of chromosome 7, at a location written as 7q11.23. The deleted segment contains around twenty-five to twenty-eight genes, and among them is the gene for elastin, the protein that gives connective tissue throughout the body its stretch and recoil. The condition is recognised by a distinctive combination of features: a characteristic facial appearance, narrowing of arteries (most often the large vessel leaving the heart), a particular learning profile with an unusually sociable manner, and a range of connective tissue and musculoskeletal differences. From the point of view of the spine, the relevant story is one of posture and curvature. In early childhood the body is typically floppy, with loose joints, and as the years pass the muscles and tendons tend to tighten, the heel cords and hamstrings shorten, and the spine commonly develops exaggerated curves: an increased forward curve of the lower back (lordosis), an increased rounding of the upper back (kyphosis), and, less often, a sideways curve (scoliosis). This page concentrates on the spinal aspects of Williams syndrome, set against the wider picture of the elastin deletion and the cardiovascular features that make any anaesthetic, including one for spinal surgery, a matter requiring particular care.

What Williams syndrome is

Williams syndrome arises when one copy of a stretch of chromosome 7 is missing. This is described as a contiguous gene deletion, meaning that a block of neighbouring genes is lost together, and it usually happens as a new event rather than being inherited. The deletion typically measures between roughly 1.5 and 1.8 million base pairs of DNA and removes in the order of twenty-five to twenty-eight genes. The condition occurs in approximately one in every seven and a half thousand to one in twenty thousand live births, and affects all populations and both sexes.

Because so many genes are lost at once, the effects are felt across several body systems. The features that bring the condition to attention are commonly a distinctive facial appearance, narrowing of blood vessels, a feeding history of early difficulty, sometimes a raised blood calcium level in infancy, a particular cognitive profile, and a famously warm and talkative personality. The diagnosis is confirmed in the laboratory by demonstrating the missing piece of chromosome 7, traditionally using a technique called fluorescence in situ hybridisation, abbreviated FISH, and increasingly by newer methods such as chromosomal microarray or a test called multiplex ligation-dependent probe amplification.

Among the lost genes, one in particular underpins much of what matters for the spine and the circulation: the elastin gene.

The elastin deletion and why it matters to connective tissue and the spine

Elastin is the protein that allows tissues to stretch and then spring back. It is woven through the walls of arteries, the skin, the lungs, the joints and the supporting tissues of the body, forming part of the elastic fibres that give these structures their resilience. In Williams syndrome only one working copy of the elastin gene remains, a state described as haploinsufficiency, meaning a single copy is not quite enough to produce the normal amount of the protein. Laboratory work on cells taken from affected individuals has shown that they lay down only a fraction of the elastin made by unaffected cells.

The clearest consequence of this elastin shortfall is in the arteries, where reduced and abnormally organised elastic fibres lead to thickened, stiffer vessel walls and a tendency to narrowing, a pattern referred to as elastin arteriopathy. The most characteristic example is narrowing just above the aortic valve, known as supraaortic stenosis. This vascular picture is the part of Williams syndrome most firmly attributed to the elastin deletion.

The connection between the elastin deletion and the musculoskeletal features is less direct. The loss of elastin is widely regarded as contributing to the connective tissue laxity, the loose joints and the soft, lax tissues seen in young children, and it is often cited as one of the reasons orthopaedic and postural difficulties are common. At the same time, the published literature is careful to note that several of the connective tissue problems of Williams syndrome, including the joint contractures that develop later, have not been pinned firmly to elastin alone and may reflect the loss of other genes within the deleted region. The spine therefore sits at the meeting point of a connective tissue framework that is initially too lax and later too tight, and the curves that develop are best understood as the product of this changing balance of muscle tone, tendon length and joint behaviour over time.

How the spine and posture evolve over the lifespan

A striking feature of Williams syndrome is that the musculoskeletal picture changes markedly with age, and the spine reflects this evolution.

In infancy and early childhood the dominant theme is low muscle tone, described as hypotonia, together with loose, hyperextensible joints. The young child is often floppy and the joints move through an unusually wide range. This combination tends to delay the motor milestones such as sitting and walking, and it leads children to adopt unusual compensating postures in order to find stability. At this stage the spine is generally mobile.

As childhood progresses into adolescence the balance shifts, sometimes considerably. Muscle tone tends to increase rather than decrease, and many older children and adults show raised tone and brisk reflexes. Alongside this, a gradual tightening of the soft tissues takes hold: the heel cords at the back of the ankles and the hamstrings behind the thighs shorten, joint contractures develop, and the overall effect is a stiff, somewhat awkward way of walking. It is against this background of tightening muscles and tendons that the characteristic spinal curves emerge. The lower back tends towards an exaggerated forward curve, the lordosis, partly as a postural response to tight hamstrings and hips; the upper back may round into an increased kyphosis; and a sideways curvature, scoliosis, may appear, more often later in childhood.

This lifespan pattern, of a body that starts loose and becomes tight, is one of the defining orthopaedic narratives of Williams syndrome and explains why posture and the spine are a recurring focus of attention across the years.

Lordosis and kyphosis: the commonest spinal findings

Within the spine, exaggerated curvature in the front-to-back plane is described in the literature as more common than the sideways curve of scoliosis. An increased lumbar lordosis, the forward sway of the lower back, and an increased thoracic kyphosis, the rounding of the upper back, are both recognised features that tend to become apparent during adolescence and adulthood.

These curves are closely tied to the muscle and tendon tightening described above. When the hamstrings and hip flexors shorten, the pelvis is pulled into a position that the lower spine accommodates by deepening its forward curve. Tightening through the trunk and the tendency of some individuals to combine relatively high tone in the legs and hips with lower tone in the trunk can together favour a rounded upper back. Much of the literature regards these postural curves as the kind of problem where movement, stretching and physiotherapy aimed at maintaining the length of the heel cords and hamstrings and the range of the joints have a recognised preventive role, which is why ongoing attention to posture and flexibility features so prominently in descriptions of care.

Scoliosis in Williams syndrome

Scoliosis, the sideways curvature of the spine often accompanied by a degree of rotation, is described as the least frequent of the three principal spinal curves in Williams syndrome, yet it is the one that can carry the greatest surgical significance.

Studies that have looked specifically at groups of people with Williams-Beuren syndrome have reported scoliosis in roughly a fifth of those examined, with figures around eighteen to twenty per cent in published series spanning childhood into adulthood. The curves are frequently mild, and many do not progress to a degree that prompts intervention. The importance of scoliosis in this condition lies less in how common it is than in how it can sometimes behave.

The spine literature contains a clear note of caution drawn from reported cases in which scoliosis in Williams syndrome progressed rapidly. One often-cited account describes a child whose curve advanced quickly despite attempts to control it with a brace, ultimately reaching a severe magnitude and requiring surgical stabilisation. The lesson drawn from such reports is that scoliosis in Williams syndrome cannot be assumed to follow the gentle course of mild idiopathic curves, and that the possibility of rapid progression is part of why the spine is kept under review. Where a curve does progress, it may take on a combined sideways and rounded form, a kyphoscoliosis, which is the pattern described in the surgical reports.

Why the cardiovascular picture matters to spinal surgery

No account of the spine in Williams syndrome is complete without the heart and blood vessels, because the cardiovascular features bear directly on the safety of any operation, including spinal surgery, performed under general anaesthetic.

The elastin arteriopathy that narrows arteries can affect not only the aorta above its valve but also the arteries supplying the heart muscle itself, the coronary arteries, and the pulmonary arteries to the lungs. Where the outflow from the heart is obstructed and the coronary supply is compromised, the heart muscle thickens and its demand for oxygen rises while the ability to deliver that oxygen is constrained. This combination creates a recognised vulnerability during sedation and anaesthesia. The literature documents that the risk of sudden death in Williams syndrome is many times that of the general population, with a substantial number of reported cardiac arrests and deaths occurring around sedation or anaesthesia, particularly in those with significant narrowing of the heart's outflow and coronary vessels.

This has direct implications for spinal surgery. A scoliosis or kyphoscoliosis correction is a major procedure conducted under prolonged general anaesthesia, often with deliberate changes in blood pressure and significant blood loss, and with periods when the patient lies face down. Each of these elements interacts with a circulation that may already be operating with limited reserve. The published case of spinal surgery in Williams syndrome, an operation to correct an acquired kyphoscoliosis in a young person, is framed almost entirely around the careful cardiac assessment and the anaesthetic precautions that such an undertaking demands. The general theme across the anaesthetic literature is thorough preoperative cardiac evaluation, including blood pressure measured in all four limbs, an electrocardiogram and an ultrasound scan of the heart, together with meticulous attention during the procedure to maintaining the pressures that keep the heart muscle and the spinal cord adequately supplied. This is described as a setting in which the involvement of cardiology and experienced anaesthetic teams is routinely emphasised.

Surgical considerations for the spine

When spinal deformity in Williams syndrome reaches the point where surgery is considered, the literature describes a procedure that is technically similar to scoliosis or kyphoscoliosis correction in other syndromic conditions but framed by the particular features of Williams syndrome.

The deformity in question is most often a progressive kyphoscoliosis. The aims of corrective surgery in such cases mirror those in deformity surgery generally: to halt progression, to improve the alignment and balance of the

spine, and to stabilise the affected segments. The connective tissue characteristics of the condition, with tissues that have passed from laxity in childhood to tightness in adolescence, form part of the surgical background.

What distinguishes the Williams syndrome setting most sharply is the perioperative environment rather than the bony work itself. The cardiovascular vulnerability described above places a premium on the anaesthetic conduct and on maintaining stable, adequate blood pressure, both for the heart and for the spinal cord during the period when its blood supply may be most sensitive. In deformity surgery generally, the function of the spinal cord is watched throughout using neurophysiological monitoring, and the literature on neuromuscular and syndromic scoliosis notes that some monitoring changes are related to blood flow and recover when the blood pressure is raised, underlining how closely circulation and cord safety are linked. In a circulation already constrained by elastin arteriopathy, this relationship between perfusion and safety carries particular weight. The learning profile and the sociable but anxious temperament common in Williams syndrome also feature in descriptions of perioperative care, shaping how assessment, preparation and recovery are approached.

Assessment of the spine

The assessment of the spine in Williams syndrome rests on the same tools used for spinal curvature generally, applied within an awareness of the condition's natural history.

Clinical examination of posture and curvature, of the length of the heel cords and hamstrings, of joint range and of gait builds the picture over time, and because the musculoskeletal situation evolves with age, repeated review is a theme of the literature. Plain X-rays are the standard means of measuring the magnitude of a scoliosis or kyphosis and of following whether a curve is stable or progressing. Where surgery is contemplated, more detailed imaging of the spine and, importantly, a full cardiovascular work-up are described, the latter reflecting the central place of the heart and great vessels in any decision involving anaesthesia. The literature presents this combined orthopaedic and cardiac assessment as inseparable in the context of Williams syndrome.

What the evidence shows about management

It is important to state that the evidence concerning the spine in Williams syndrome is built on case reports, small series and descriptive reviews rather than on large trials, and the descriptions that follow report what the literature observes rather than constituting guidance for any individual. Decisions in practice are made by the treating teams on a case-by-case basis.

For the common postural curves, the increased lordosis and kyphosis, the literature emphasises movement, stretching and physiotherapy directed at preserving the length of the heel cords and hamstrings and the range of the joints, with these measures described as having a preventive role against the later tightening that drives the curves. For mild scoliosis that is not progressing, observation over time is the course described. Where a curve progresses, bracing has been attempted, though the reported experience includes instances in which progression continued despite a brace, and surgical correction has been undertaken for severe, progressive deformity. Throughout, the cardiovascular features shape the threshold and the conduct of any intervention requiring anaesthesia, and the consistent message is one of coordinated care between orthopaedic, cardiac and anaesthetic teams, with physiotherapy a recurring thread across the lifespan.

Outlook

The outlook for the spine in Williams syndrome is varied and depends heavily on which spinal feature is in question and on the wider health of the individual, particularly the heart and blood vessels.

For the majority, the spinal story is one of postural curves, an exaggerated lordosis and kyphosis, that emerge alongside the general tightening of muscles and tendons through adolescence, and that are the focus of ongoing attention to posture and flexibility. Scoliosis is less common and frequently mild, though the documented potential for rapid progression in some individuals is the reason the spine is kept under review. Where significant deformity develops and surgery is considered, the outlook is bound up as much with the cardiovascular picture and the safety

of anaesthesia as with the spinal correction itself.

The themes that run through the whole subject are the evolution from a loose-jointed child to a tighter-tendoned adolescent, the central role of the elastin deletion in the connective tissue and especially the vascular features, the relative frequency of front-to-back curves over sideways ones, and the overriding importance of the heart and circulation whenever an operation under anaesthesia is in prospect. Any individual outlook is a matter for assessment by the treating team rather than something that can be read from the diagnosis alone.