

Cervical Rib

A patient guide

In brief: A cervical rib is an extra, or supernumerary, rib that arises from the seventh cervical vertebra, the lowest bone of the neck, sitting just above the normal first rib. It is an anatomical variant that is present from birth, formed during the earliest development of the skeleton, and in the great majority of people it is entirely silent, causing no symptoms and discovered, if at all, only by chance on an X-ray or scan performed for some other reason. A cervical rib may be a fully formed bony rib, a short bony stub, or no more than a fibrous band of tissue too thin to be seen on a plain film. It is more common in women than in men and is frequently present on both sides. The single most important idea is that a cervical rib is, for most people who have one, a harmless quirk of anatomy rather than a disease. In a minority, however, the extra rib or its associated band can crowd the narrow space at the base of the neck through which the nerves to the arm and the main artery and vein to the limb must pass, and this crowding can contribute to a condition called thoracic outlet syndrome. This page explains, in general and educational terms, what a cervical rib is, why it forms, how often it causes trouble, and what the medical literature describes about how it is assessed and managed.

What a cervical rib is

The neck is built from seven cervical vertebrae, and below them the twelve thoracic vertebrae of the chest each carry a pair of ribs. A cervical rib is an extra rib that grows out from one of the cervical vertebrae, almost always the seventh and lowest, although it can occasionally arise from the sixth. Because it sits above the level of the normal first rib, it is sometimes described as a rib in the wrong place, a small structure occupying a region of the body that does not usually have ribs at all.

The form a cervical rib takes varies enormously from one person to the next. At one end of the spectrum it may be a fully developed, complete bony rib, with a head, a neck and a tubercle like an ordinary rib, sometimes reaching forward to join or fuse with the first rib or the breastbone. At the other end it may be a tiny bony nubbin projecting from the vertebra, or simply a tough fibrous band of soft tissue, an incomplete rib, that runs from the tip of the seventh cervical vertebra forwards towards the first rib. These fibrous bands are radiologically invisible on an ordinary X-ray, because they contain no bone, yet they occupy space and may have effects out of proportion to their slender appearance.

A cervical rib should be distinguished from an elongated transverse process, which is simply a longer-than-usual bony wing on the side of the seventh cervical vertebra without forming a separate rib. The two are related variants of the same developmental theme and are sometimes grouped together, but a true cervical rib is a distinct, articulated extra rib.

Why it forms: a variant present from birth

A cervical rib is a congenital anatomical variant, meaning it is present from birth and forms during the earliest weeks of development in the womb. It is not something that grows later in life, is not caused by injury, posture or activity, and is not a sign of any underlying illness.

During the development of the embryo, the skeleton arises from blocks of tissue called somites, which lie in pairs alongside the developing spinal cord. Part of each somite, the sclerotome, gives rise to the vertebrae and, at the levels of the chest, to the ribs. The pattern of which segments develop ribs and which do not is controlled by a family of master regulatory genes known as the Hox genes, together with related signalling molecules such as growth differentiation factor 11. These genes set the boundaries of the body's regions, telling the segments of the

future neck not to form ribs and the segments of the future chest to do so.

A cervical rib is understood as a small variation in this segmental patterning, in which a costal element that would normally remain rudimentary at the seventh cervical level instead persists and grows into a rib. In this sense it is a boundary phenomenon, a slight shift in where the rib-bearing region begins. Because the underlying genetic instructions are laid down so early, the result is fixed from birth, and the rib then simply grows in proportion with the rest of the skeleton. The same developmental logic explains why an extra rib can sometimes appear at the other end of the rib cage, as a lumbar rib below the twelfth thoracic vertebra.

How common it is, and who is affected

A cervical rib is an uncommon but far from rare variant. Across the medical literature the reported prevalence varies considerably according to the population studied and the method used to detect it, but a figure of around 0.5 to 1 per cent of the general population is the most widely cited estimate from radiographic studies, meaning that somewhere between one in two hundred and one in a hundred people carry one. Some series report figures higher than this, particularly in certain populations and in postmortem studies, where rates of several per cent have been described; the range quoted across all studies runs from well below 1 per cent up to a few per cent.

Two patterns emerge consistently. The first is that cervical ribs are more common in women than in men. Many studies place the prevalence in women at roughly twice that in men, although the exact ratio varies. The second is that cervical ribs are frequently bilateral, present on both sides of the neck rather than one alone. In several series, a substantial proportion of those with a cervical rib, in some studies around forty per cent or more, were found to have one on each side. The fact that a rib is present on both sides does not in itself make symptoms more likely; it simply reflects the symmetry of the developmental process that produces the variant.

It is worth restating that the overwhelming majority of these ribs are never noticed. They are found incidentally, turning up on a chest or neck X-ray, or on a CT scan, requested for an entirely unrelated reason, and the person carrying them has no symptoms attributable to the rib at all.

The anatomy of the thoracic outlet

To understand why a cervical rib occasionally matters, it helps to picture the crowded region at the base of the neck through which the nerves and blood vessels of the arm must travel. This region is called the thoracic outlet.

The nerves that supply the arm and hand begin as roots emerging from the lower part of the neck and the top of the chest, the levels from the fifth cervical to the first thoracic vertebra. These roots join and divide to form a network called the brachial plexus, which then carries signals down the arm. The lowest part of this network, derived from the eighth cervical and first thoracic roots, supplies the small muscles of the hand and the sensation along the inner forearm and little finger. Alongside the nerves run the subclavian artery, carrying blood out to the arm, and the subclavian vein, returning it.

These structures pass through a narrow triangular gap known as the interscalene triangle, bordered by two strap-like muscles of the neck, the anterior and middle scalene muscles, with the first rib forming its floor. From there they continue beneath the collarbone and through the space behind the chest muscle into the arm. A cervical rib, sitting at the apex of this region, can narrow and distort the triangle, raising the floor over which the artery and the lower nerves must arch and reducing the room available. A fibrous band running from the tip of the rib forward to the first rib can act in the same way, forming a tight cord across the path of the nerves even when little or no bone is visible.

Thoracic outlet syndrome: when a cervical rib contributes to symptoms

In the minority of people whose cervical rib does cause trouble, the resulting condition is called thoracic outlet syndrome, an umbrella term for the symptoms that arise when the nerves or blood vessels passing through the thoracic outlet are compressed. The literature commonly reports that only around one in ten people with a cervical

rib ever develop symptoms from it, so the great majority remain unaffected throughout life. Thoracic outlet syndrome is conventionally divided into three forms, depending on which structure is compressed.

Neurogenic thoracic outlet syndrome is by far the commonest form and involves compression of the brachial plexus, most often its lowest part, the eighth cervical and first thoracic nerve fibres. Because these fibres serve the hand, the features described include aching pain in the neck, shoulder and arm, pins and needles or numbness running down the inner forearm into the ring and little fingers, and, in more advanced cases, weakness and wasting of the small muscles of the hand. A particular pattern of muscle wasting affecting the base of the thumb has historically been associated with longstanding compression of this kind. True neurogenic thoracic outlet syndrome of this severe, objectively demonstrable type is, however, very uncommon.

Venous thoracic outlet syndrome involves compression of the subclavian vein and may produce swelling, heaviness and a bluish discoloration of the arm, sometimes with the formation of a clot in the vein.

Arterial thoracic outlet syndrome is the rarest form but the one in which a bony cervical rib is most strongly implicated; cervical ribs are present in a high proportion of arterial cases in published series. Here the subclavian artery is compressed or irritated as it arches over the rib, which over time can damage the lining of the vessel, cause a localised widening or aneurysm just beyond the narrowing, and allow small clots to form. These clots can travel down the arm, reducing the blood supply to the hand and fingers. Features described in the literature include coldness, paleness, pain and reduced pulses in the affected limb. This form, though uncommon, is the one that draws the most clinical attention because of its potential vascular consequences.

How a cervical rib is assessed

Because most cervical ribs are silent, the majority are identified incidentally on imaging performed for another purpose. Where a cervical rib is being assessed in the context of possible thoracic outlet symptoms, several imaging tests are described in the literature, each contributing different information.

Plain X-rays of the neck and chest are the standard means of demonstrating a bony cervical rib and of showing its size and shape, including whether it is complete or a shorter stub. An ordinary radiograph cannot, however, show a purely fibrous band, which contains no bone.

Computed tomography, the CT scan, gives a far more detailed picture of the bony anatomy and the way the rib relates to the first rib and the surrounding structures. When combined with an injection of contrast dye to highlight the blood vessels, CT angiography is used to assess the subclavian artery, looking for narrowing, widening or clot, particularly where arterial thoracic outlet syndrome is suspected.

Magnetic resonance imaging, the MRI scan, and its vascular variants are valued for showing the soft tissues, including the scalene muscles, the brachial plexus and fibrous bands that no X-ray can reveal, and for demonstrating compression of the nerves or vessels.

Imaging of the blood vessels is sometimes performed in two positions, with the arm at rest and then raised, because raising the arm can reproduce the compression that occurs during everyday movements. Alongside imaging, the assessment described in the literature includes clinical examination, with positional tests of the pulse such as the manoeuvres in which the arm is moved and the neck turned, and, where nerve involvement is suspected, nerve conduction studies and electromyography to measure the function of the nerves to the hand. These investigations together build a picture of whether, and how, a cervical rib is affecting the structures around it.

What the evidence shows about management

It is important to state at the outset that the management of a cervical rib depends almost entirely on whether it is causing symptoms, and that for the great majority it causes none. The descriptions that follow report what the literature observes about the spectrum of management; they are general and educational and are not advice for any

individual, whose circumstances are a matter for assessment by a qualified clinician.

****No treatment, simple observation****, is the course described for the overwhelming majority of cervical ribs, which are incidental, asymptomatic findings. The literature is consistent that an extra rib found by chance, in a person with no symptoms, does not in itself require removal or any intervention, and is best understood as a normal anatomical variant to be left alone. Around nine in ten cervical ribs fall into this category.

****Conservative, non-surgical management**** is described as the first approach where a cervical rib is associated with mild or moderate thoracic outlet symptoms, particularly of the neurogenic type. This centres on physiotherapy, with programmes aimed at improving posture, stretching tight muscles at the front of the chest and neck, strengthening the muscles that support the shoulder girdle, and so opening up the thoracic outlet and reducing the crowding of its contents. Activity modification and pain management are described alongside.

****Surgical decompression**** is reserved in the literature for the minority of cases in which symptoms are significant and persistent despite conservative measures, or in which there is established compression of the artery or vein with vascular complications such as clot or aneurysm, or progressive nerve damage with weakness and wasting. The procedures described aim to relieve the compression by removing the cervical rib and any fibrous band, often together with division of the scalene muscle and sometimes resection of the first rib, through one of several surgical approaches to the region. The vascular form may additionally require repair of the affected artery or treatment of any clot. Published series describe these decompression operations as generally safe and effective for appropriately selected patients, with good relief of symptoms, while recognising that any operation in this anatomically crowded area carries its own risks. The decision to operate, and the choice of approach, are individualised matters weighed by the treating team.

Outlook

For almost everyone who has one, a cervical rib is a benign incidental finding with no bearing on health or daily life. It is present from birth, grows quietly with the rest of the skeleton, and is frequently discovered only by accident, if it is ever discovered at all. The reassuring message running through the literature is that the mere presence of a cervical rib is not a problem to be fixed and that the large majority of people who carry one will never have any symptoms from it.

Where a cervical rib does contribute to thoracic outlet syndrome, the outlook depends on which structures are involved and on how early the situation is recognised. Mild neurogenic symptoms often respond to conservative measures such as physiotherapy. The less common vascular forms, in which the artery or vein is compressed, are the ones that draw the most attention, because they carry the potential for clots and reduced blood supply, and these are the situations in which decompression surgery is most clearly described as beneficial. Across the whole picture, the consistent themes are that a cervical rib is a common anatomical variant rather than a disease, that symptoms arise only in a small minority, that the relationship between the appearance of the rib on a scan and the presence of symptoms is far from automatic, and that any individual assessment is a matter for a qualified clinician rather than something to be read from an image alone.