

Vertebral Osteomyelitis

A patient guide

In brief: Vertebral osteomyelitis is an infection of the bone of the spine, the vertebral body. When the same infection also involves the cushioning disc between two vertebrae, the combined condition is called spondylodiscitis, or discitis-osteomyelitis. In the great majority of cases the infection is pyogenic, meaning it is caused by pus-forming bacteria, most often a germ called *Staphylococcus aureus*, which reaches the spine through the bloodstream from a source elsewhere in the body. It is an uncommon but serious spinal infection. It tends to declare itself slowly, with back pain that does not settle, and it is notorious for being recognised late because its early features are so easily mistaken for the ordinary wear-and-tear back pain that is far more common. Once suspected, it is investigated with a magnetic resonance imaging scan and with cultures of the blood and, where needed, a sample taken directly from the affected bone. The cornerstone of treatment is a prolonged course of targeted antibiotics, usually for at least six weeks, directed by a multidisciplinary team. Surgery is reserved for particular situations rather than being the default. This is a condition that calls for specialist, team-based care, and the single most important idea is that it is a treatable infection whose outcome is shaped above all by how promptly it is recognised and how precisely the responsible organism is identified.

What vertebral osteomyelitis is, and how it relates to spondylodiscitis

Osteomyelitis is the medical term for infection of bone. When that bone is a vertebra, one of the building blocks of the spinal column, the condition is called vertebral osteomyelitis. The infection takes hold in the body of the vertebra, the thick, weight-bearing block of bone at the front of each spinal segment, and it can then spread outwards to neighbouring structures.

The intervertebral disc, the tough, cushioning pad that sits between two vertebrae, is very often drawn into the process. When the infection involves both the bone and the disc, which is the usual pattern in adults, the condition is described as spondylodiscitis, or discitis-osteomyelitis. In practice the terms vertebral osteomyelitis, spondylodiscitis and spinal infection are frequently used to describe overlapping aspects of the same disease, and the distinction is largely one of which structures are most heavily involved.

The word pyogenic, which often accompanies these terms, simply means pus-forming, and indicates that the infection is caused by ordinary bacteria rather than by tuberculosis, brucellosis or a fungus, which behave somewhat differently. Pyogenic vertebral osteomyelitis is the form discussed throughout this guide, and it is by some margin the commonest type in most parts of the world.

The reason this group of conditions is taken so seriously is the company the spine keeps. The vertebrae sit immediately in front of the spinal cord and the nerve roots, and they enclose a potential space, the epidural space, into which infection can track. An infection that begins quietly in the bone can therefore, if left unchecked, threaten the nervous system itself. That proximity is what turns an infection of bone into a condition that a spinal surgeon, alongside infection specialists, is closely involved in managing.

How the infection reaches the spine: the bloodstream and Batson's plexus

In most adults, vertebral osteomyelitis arises by haematogenous spread, which means the bacteria travel to the spine through the bloodstream from a source somewhere else in the body. That source might be a skin or soft-tissue infection, a urinary tract infection, a chest infection, an infected heart valve, a dental focus, an intravenous line, or an injection site, and sometimes no source is ever identified. Bacteria circulating in the blood, a state called bacteraemia, are seeded into the spine and establish an infection there.

The particular vulnerability of the vertebral body owes a great deal to its blood supply. The bone next to the endplates, the vascular region just beneath the disc, is richly supplied by small arteries, and it is here that circulating bacteria tend to lodge first. From this beachhead the infection spreads, breaching the endplate and invading the disc, which is why the bone and the disc are so commonly affected together. The disc itself has little blood supply of its own and is damaged largely by the enzymes the bacteria release, in a process that has been likened to the cartilage destruction seen in an infected joint.

A second route deserves mention because it helps to explain certain patterns of infection. The spine is drained by a network of valveless veins known as Batson's plexus, which runs the length of the vertebral column in the epidural space and connects with the venous systems of the pelvis, abdomen and chest. Because these veins have no valves, blood, and anything carried in it, can flow backwards into the spine when pressure rises in the abdomen or pelvis. This anatomical quirk provides a plausible pathway by which infection from the pelvis or urinary tract can reach the spine, and it is one of the classical explanations for the link between pelvic infections and spinal infection.

Less commonly, infection reaches the spine by other means: by direct spread from an infection in adjacent tissue, or by direct introduction during a spinal procedure, injection or operation. The haematogenous, bloodstream route, however, remains the dominant story in the spontaneous, or native, form of the disease that develops without prior surgery.

Which organisms are responsible

The microbiology of vertebral osteomyelitis is led, by a wide margin, by a single organism. *Staphylococcus aureus*, a common skin and bloodstream bacterium, is the most frequently identified cause, responsible for roughly half of pyogenic cases in most series. This includes both the ordinary, antibiotic-sensitive form, usually abbreviated MSSA, and the more resistant strain known as MRSA, which is harder to treat and is seen more often in those with healthcare contact or a history of injecting drugs.

After staphylococci, several other groups of bacteria account for most of the remainder. Streptococci and enterococci are well-recognised causes. Aerobic gram-negative bacteria, such as *Escherichia coli*, are an important group, particularly when the source of infection lies in the urinary tract, and they feature more prominently in older people and those with urinary problems. A slow-growing skin organism, now called *Cutibacterium acnes*, is occasionally implicated, especially in infections involving previous spinal hardware.

Beyond the everyday bacteria, certain organisms behave distinctively and are actively considered when the circumstances fit. *Brucella*, a bacterium acquired from unpasteurised dairy products or from livestock, causes vertebral infection in parts of the world where it is endemic and requires a particular and prolonged antibiotic regimen. Tuberculosis can affect the spine in a chronic form, historically called Pott's disease, which tends to behave differently from pyogenic infection. Fungi, such as *Candida* or *Aspergillus*, are rare causes seen chiefly in people whose immune defences are weakened, in those who inject drugs, or after prolonged intravenous treatment. Identifying the responsible organism precisely is the single most influential step in management, because the entire antibiotic strategy is built upon it.

Who is at greater risk

Vertebral osteomyelitis can affect anyone, but it occurs more often against certain backgrounds, and these tend to share a common thread: either an increased likelihood of bacteria entering the bloodstream, or a reduced ability of the body to clear them.

Advancing age is consistently associated with the condition, and most cases occur in middle-aged and older adults. Diabetes is one of the most frequently reported risk factors, both because it predisposes to infection and because it impairs the body's response to it. A weakened immune system, whether from medication such as long-term steroids or other immune-suppressing drugs, from cancer and its treatment, from chronic kidney disease and dialysis, from liver disease, or from conditions such as HIV, raises susceptibility.

The injection of drugs is a particularly important risk factor, because it repeatedly introduces bacteria directly into the bloodstream and is associated with infections at unusual sites and with more resistant organisms. Anything that provides a portal of entry for bacteraemia carries risk, including intravenous lines and catheters, recent procedures, and infections elsewhere in the body that spill into the blood.

The link with the heart deserves particular emphasis. Infective endocarditis, an infection of the heart valves, and vertebral osteomyelitis are closely connected. They share risk factors, they are caused by overlapping organisms, and each can be the source of the other: an infected heart valve can seed the spine, and a spinal infection can be accompanied by, or point towards, an unsuspected valve infection. For this reason, the discovery of one prompts careful consideration of the other, and the combination is recognised as carrying a worse outlook than either alone.

Why the diagnosis is so often delayed

One of the defining and most frustrating features of vertebral osteomyelitis is how readily it is missed in its early stages, with delays from the first symptoms to the correct diagnosis frequently running into weeks or months. Understanding why this happens explains a great deal about the condition.

The central problem is that the dominant symptom, back or neck pain, is one of the commonest complaints in all of medicine, and is overwhelmingly due to benign, mechanical causes. A spinal infection at first produces pain that is indistinguishable from ordinary back pain, and there is nothing about it in the earliest days that announces an infection. Fever, the symptom that might raise the alarm, is present in only a minority to a little over half of cases, so its absence does nothing to reassure and its presence is easily attributed to something else. Blood tests of inflammation, such as the ESR and CRP, are usually raised but are entirely non-specific, pointing to inflammation somewhere without saying where.

The result is that the diagnosis depends heavily on a clinician thinking of it in the first place. Certain features tend to prompt that thought: back pain that is constant, that is present at night and at rest rather than only on movement, that is not relieved by the usual measures and does not settle over the expected timescale, and that occurs in someone with risk factors such as diabetes, recent bacteraemia or injecting drug use. Pain combined with fever, or with any sign of nerve involvement such as weakness, numbness or disturbance of the bladder or bowel, raises the level of concern considerably. The practical message woven through the literature is that the price of the delay can be high, and that a low threshold for imaging in the right circumstances is what shortens it.

How it is diagnosed: MRI, blood cultures and biopsy

The diagnosis rests on bringing together a compatible clinical picture, characteristic imaging and the identification of the responsible organism, and each of these has a defined role.

****Magnetic resonance imaging, the MRI scan,**** is the central investigation and is regarded as the gold standard. It is highly sensitive and highly specific, and it can detect the changes of infection earlier than any other imaging method, often within days of the infection taking hold. It shows the affected bone and disc, reveals fluid collections, and, crucially, demonstrates whether infection has tracked into the epidural space to form an abscess pressing on the spinal cord or nerves. Because it shows the soft tissues and the neural structures so clearly, MRI both confirms the diagnosis and defines its extent. Where the earliest scan is equivocal, a repeat scan after a short interval can reveal changes that were not yet apparent.

****Blood cultures**** are taken early and are simple, but valuable: they grow the responsible organism in roughly half to two-thirds of cases. When blood cultures are positive, particularly with *Staphylococcus aureus*, and the MRI changes are compatible, they may be sufficient to direct treatment without any further sampling.

****Inflammatory markers,**** the ESR and CRP, support the diagnosis and, importantly, provide a baseline against which the response to treatment is later judged.

****Image-guided biopsy**** comes into its own when the blood cultures are negative, which is common. Under the guidance of a CT scanner, a needle is passed into the affected bone or disc to obtain a sample for culture, so that

the precise organism and its antibiotic sensitivities can be established. Where indicated by the clinical setting, the sample is also tested for tuberculosis, brucella and fungi. Because pinning down the organism is so central to successful treatment, guidelines generally advise that, unless someone is severely unwell or has nerve compromise, antibiotics are held back until samples have been obtained, so that they are not rendered uninformative by premature treatment.

What the evidence shows about treatment — impersonal

The management of vertebral osteomyelitis is grounded in a body of evidence that includes formal guidelines, notably those of the Infectious Diseases Society of America, and at least one substantial randomised trial of treatment duration, alongside many observational series. The descriptions that follow report what that literature observes and recommends in general terms; they are not guidance for any individual, and decisions in practice are made by the treating team on a case-by-case basis.

****Targeted antibiotics are the foundation.**** The central principle is that treatment should, wherever possible, be directed at the specific organism identified from blood cultures or biopsy, rather than given blindly. For most people with pyogenic native vertebral osteomyelitis, the guidelines describe a total course of around six weeks of antibiotics, beginning intravenously and, in suitable cases, switching to highly absorbed oral agents. A landmark randomised trial found that six weeks of treatment was no less effective than twelve weeks, with cure rates around ninety per cent in both groups, which is why six weeks has become the usual benchmark for uncomplicated disease. Particular situations call for longer courses; brucellar infection, for example, is treated for around three months, and complicated or relapsing cases may need extended treatment. The response is monitored through symptoms and through the falling inflammatory markers rather than by a fixed scan schedule.

****Surgery is reserved for defined indications.**** The literature is consistent that the majority of cases are managed with antibiotics alone, and that surgery is not the default. The recognised indications for operating are a progressive neurological deficit, such as developing weakness or bladder disturbance; significant destruction of bone producing instability or deformity of the spine; a substantial epidural or paravertebral abscess, particularly one causing nerve compression; intractable pain; and failure of the infection to respond to appropriate medical treatment. Where surgery is undertaken, its goals are to remove infected tissue, to drain abscesses and decompress the neural structures, and to restore the stability of the spine, sometimes with instrumentation.

****Supportive care and the multidisciplinary approach**** run through the whole of management. Bracing may be used for comfort and stability, the source of the original infection is sought and addressed, and any associated condition such as endocarditis is treated in its own right. Throughout, the literature emphasises that this is a condition best handled by a team, with spinal surgeons, infection specialists, radiologists and microbiologists each contributing, precisely because the decisions, about which antibiotic, for how long, and whether and when to operate, depend on information from all of them.

Complications, including spinal epidural abscess

The seriousness of vertebral osteomyelitis lies less in the bone infection itself than in what it can lead to if it advances. The most important complication is the spinal epidural abscess, a collection of pus in the space surrounding the spinal cord and nerve roots. Infection from the vertebra can track directly into this space, and as the abscess enlarges it can compress the spinal cord or nerves, producing weakness, numbness, and loss of control of the bladder and bowel. A spinal epidural abscess with developing neurological signs is regarded as an emergency, because the recovery of nerve function can depend on relieving the pressure promptly. This is one of the principal reasons that any sign of nerve involvement in a spinal infection is treated with urgency.

Other complications follow from the local destruction the infection causes. Collapse of the infected bone can lead to deformity of the spine and to instability, sometimes requiring surgical reconstruction. Pus can collect alongside the spine, in the paravertebral or psoas regions, forming abscesses that may themselves need drainage. The infection can persist or return, with relapse reported in a meaningful minority of cases, particularly where there

was extensive bone destruction, large abscesses or recurrent bloodstream infection. And because the condition arises against a background of bloodstream infection, it can be accompanied by infection elsewhere, the heart valves above all.

These possibilities explain why the condition is monitored closely during and after treatment, and why a return or worsening of symptoms is taken seriously. They also underline the value of early diagnosis, since most of the gravest complications develop in infections that have been allowed to advance.

Outlook

The outlook in vertebral osteomyelitis is, for many people, good, but it is an outlook that has to be earned through prompt recognition, precise identification of the organism and a properly completed course of treatment, and it varies considerably with the circumstances. With appropriate antibiotic therapy, a large proportion of people are cured, and the prospect of cure is best when the infection is caught before it has caused neurological damage or extensive bony destruction.

At the same time, the literature is honest about the fact that this is a serious illness. Long-term studies report that a minority of patients die, often from associated illness or from the bloodstream infection rather than from the spinal disease in isolation, that some are left with residual back pain or disability, and that a proportion relapse. The features repeatedly linked to a worse outcome are familiar from the rest of this account: delay in diagnosis, neurological compromise at presentation, older age, significant other illnesses, and the presence of associated infection such as endocarditis.

The threads that run through the whole subject are therefore consistent. Vertebral osteomyelitis is a treatable infection whose outcome turns on how early it is recognised and how accurately the organism is pinned down; antibiotics, given for long enough and aimed at the right target, are the foundation of treatment; surgery is reserved for specific problems; and the best results come from coordinated, specialist, team-based care. Any individual outlook is a matter for assessment by the treating team rather than something that can be read from a category alone.