



American  
Association of  
Neurological  
Surgeons

# SPINAL INFECTIONS

## PATIENT INFORMATION

This resource, developed by neurosurgeons, provides patients and their families trustworthy information on neurosurgical conditions and treatments.

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Spinal infections can be classified by the anatomical location involved: the **vertebral column**, **intervertebral disc** space, the **spinal canal** and adjacent soft tissues. Infection may be caused by bacteria or fungal organisms, and can occur after surgery. Most postoperative infections occur between three days and three months post surgery.

**Vertebral osteomyelitis** is the most common form of vertebral infection. It can develop from direct open spinal trauma, infections in surrounding areas and from bacteria that spreads to a vertebra.

Intervertebral disc space infections involve the space between adjacent vertebrae. Disc space infections can be divided into three subcategories: adult hematogenous (spontaneous), childhood (discitis) and postoperative.

Spinal canal infections include **spinal epidural abscess**, which is an infection that develops in the space around the dura (the tissue that surrounds the spinal cord and nerve root). Subdural abscess is far rarer and affects the potential space between the dura and arachnoid (the thin membrane of the spinal cord, between the dura mater and pia mater). Infections within the spinal cord parenchyma (primary tissue) are called intramedullary abscesses.

Adjacent soft-tissue infections include cervical and thoracic paraspinal lesions and lumbar psoas muscle abscesses. Soft-tissue infections generally affect younger patients and are not seen often in older people.

## Incidence and Prevalence

- Vertebral osteomyelitis affects an estimated 26,170 to 65,400 people annually.
- Epidural abscess is relatively rare, affecting only 0.2 to 2 cases per every 10,000 hospital admissions. However, 5 to 18 percent of patients with vertebral osteomyelitis or disc space infection caused by contiguous spread will develop an epidural abscess.
- Some studies suggest that the incidence of spinal infections is now increasing. This spike may be related to increased use of vascular devices and other forms of instrumentation and to a rise in intravenous drug abuse.
- About 30 to 70 percent of patients with vertebral osteomyelitis have no obvious prior infection.
- Epidural abscess can occur at any age, but is most prevalent in people age 50 and older.
- Although treatment has improved greatly in recent years, the death rate from spinal infection is still an estimated 20 percent.

Risk factors for developing spinal infection include conditions that compromise the immune system, such as:

- Advanced age
- Intravenous drug use
- Human immunodeficiency virus (HIV) infection
- Long-term systemic usage of steroids
- Diabetes mellitus
- Organ transplantation
- Malnutrition
- Cancer

Surgical risk factors include an operation of long duration, high blood loss, use of instrumentation and multiple or revision surgeries at the same site. Infections occur in 1 to 4 percent of surgical cases, despite numerous preventative measures that are followed.

## Causes

Spinal infections can be caused by either a bacterial or a fungal infection in another part of the body that has been carried into the spine through the bloodstream. The most common source of spinal infections is a bacterium called *Staphylococcus aureus*, followed by *Escherichia coli*.

Spinal infections may occur after a urological procedure because the veins in the lower spine come up through the pelvis. The most common area of the spine affected is the lumbar region. Intravenous drug abusers are more prone to infections affecting the cervical region.

Intervertebral disc space infections probably begin in one of the contiguous end plates, and the disc is infected secondarily. In children, there is some controversy as to the origin. Most cultures and biopsies in children are negative, leading experts to believe that childhood discitis may not be an infectious condition, but caused by partial dislocation of the epiphysis (the growth area near the end of a bone), as a result of a flexion injury.

## Symptoms

Symptoms vary depending on the type of spinal infection but, generally, pain is localized initially at the site of the infection. In postoperative patients, these additional symptoms may be present:

- Wound drainage
- Redness, swelling or tenderness near the incision

### Vertebral osteomyelitis

- Severe back pain
- Fever
- Chills
- Weight loss

- Muscle spasms
- Painful or difficult urination
- Neurological deficits

### Intervertebral disc space infections

Patients may initially have very few symptoms, but eventually develop severe back pain. Generally, younger, preverbal children do not have a fever nor seem to be in pain, but they will refuse to flex their spines. Children ages 3 to 9 typically present with back pain as the predominant symptom.

Postoperative disc space infection may be present after surgery, occurring, on average, one month after surgery. The pain is usually alleviated by bed rest and immobilization but increases with movement. If left untreated, the pain gets progressively worse and intractable, unresponsive even to prescription painkillers.

### Spinal canal infections

Adult patients often progress through the following clinical stages:

1. Severe back pain with fever and local tenderness in the spinal column
2. Nerve root pain radiating from the infected area
3. Weakness of voluntary muscles and bowel/bladder dysfunction
4. Paralysis

In children, the most overt symptoms are prolonged crying, obvious pain when the area is palpated and hip tenderness.

### Adjacent soft-tissue infections

In general, symptoms are usually nonspecific. If a paraspinal abscess is present, the patient may experience flank pain, abdominal pain or a limp. If a psoas muscle abscess is present, the patient may feel pain radiating to the hip or thigh area.

## Diagnosis

The biggest challenge is making an early diagnosis before serious morbidity occurs. Diagnosis typically takes an average of one month, but can take as long as six months, impeding effective and timely treatment. Many patients do not seek medical attention until their symptoms become severe or debilitating.

### Laboratory Tests

Specific laboratory tests can be useful in helping to diagnose a spinal infection. It may be beneficial to get blood tests for acute-phase proteins, erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) levels. Both ESR and CRP tests are often good indicators as to whether any inflammation is present in the body (the higher the level, the more likely it is that inflammation is present). These tests alone however, are limited, and other diagnostic tools are usually required.

Identification of the organism is essential, and this can be accomplished through computed tomography-guided biopsy sampling of the vertebra or disc space. Blood cultures, preferably taken during a fever spike, can also help identify the pathogen involved in the spinal infection.

### Imaging Tools

Imaging studies are necessary to pinpoint the location and extent of a lesion. The choice of specific imaging techniques varies slightly depending on the location of the infection.

Vertebral osteomyelitis: The degree of bone destruction is best imaged by computed tomography scan (CT or CAT scan), whereas soft tissue involvement is best defined by magnetic resonance imaging (MRI).

Intervertebral disc space infections: If childhood discitis is suspected, plain X-rays are ordered first, followed by MRI if the X-rays are negative. For postoperative disc space infection, MRI is the imaging tool of choice. Inflamed areas generally show up clearly when a contrast agent is employed.

Spinal canal infections: MRI with Gd enhancement has become the gold standard, largely replacing myelography to provide high resolution images of neural structures. If the MRI comes back negative and infection is still suspected, imaging should be repeated.

Adjacent soft-tissue infections: Both MRI and CT scan can accurately identify soft-tissue abscesses.

## Nonsurgical Treatment

Spinal infections often require long-term intravenous antibiotic or antifungal therapy and can equate to extended hospitalization time for the patient. Immobilization may be recommended when there is significant pain or the potential for spine instability. If the patient is neurologically and structurally stable, antibiotic treatment should be administered after the organism causing the infection is properly identified. Patients generally undergo antimicrobial therapy for a minimum of six to eight weeks. The type of medication is determined on a case-by-case basis depending on the patient's specific circumstances, including his or her age.

## Surgical Treatment

Nonsurgical treatment should be considered first when patients have minimal or no neurological deficits and the morbidity and mortality rate of surgical intervention is high. However, surgery may be indicated when any of the following situations are present:

- Significant bone involvement
- Neurological deficits
- Sepsis with clinical toxicity caused by an abscess unresponsive to antibiotics
- Failure of needle biopsy to obtain needed cultures
- Failure of intravenous antibiotics alone to eradicate the infection

The following questions, which are considerations in most spine surgeries, may present additional challenges in the presence of a spinal infection:

- Will the approach be anterior or posterior?
- Should fusion be performed?
- Is instrumentation beneficial?

The primary goals of surgery are to:

- Debride (clean and remove) the infected tissue
- Enable the infected tissue to receive adequate blood flow to help promote healing
- Maintain or restore spinal stability
- Limit the degree of neurological impairment

Once it is determined that the patient requires surgery, imaging tools such as plain X-rays, CT scans or MRI can help further pinpoint the level at which to perform surgery.

Current treatment protocols for spinal infections require treatment by a multidisciplinary team of physicians, including infectious disease experts, neuroradiologists, and spine surgeons. The team will be able to assess the best treatment approach on an individualized basis, whether it is surgical or nonsurgical.

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