

# Osteomyelitis

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CRANIAL OSTEOMYELITIS .....	1
VERTEBRAL OSTEOMYELITIS (S. INFECTIVE SPONDYLITIS).....	1
INFECTIOUS DISKITIS .....	4
GENERAL FEATURES of osteomyelitis → see p. 1192 (2-3) >>	

## CRANIAL OSTEOMYELITIS

### ETIOLOGY

1. Direct extension from paranasal sinuses, ear (e.g. *malignant external otitis* see p. Ear40 >>)
2. Penetrating skull injury
3. Infected craniotomy flap, skeletal traction
4. Hematogenous

GRADENIGO'S syndrome – *apical petrositis* (osteomyelitis) involving CN5 & CN6. see p. CN5 >>

### CLINICAL FEATURES

- **pain, tenderness, swelling, warmth** at infected site.
  - **drainage of purulent material** if open wound is present.
  - if **systemic symptoms** are present, underlying **subdural / epidural empyema** is commonly present.

### DIAGNOSIS

1. **Plain skull film** (positive > 50%)
2. **CT**
3. **Technetium bone scans** (helpful if skull radiographs are negative);
  - **false-positive** in *old trauma* or *previous craniotomy*; H: **gallium scan** (differentiates infection from other causes of positive technetium scan).

### TREATMENT

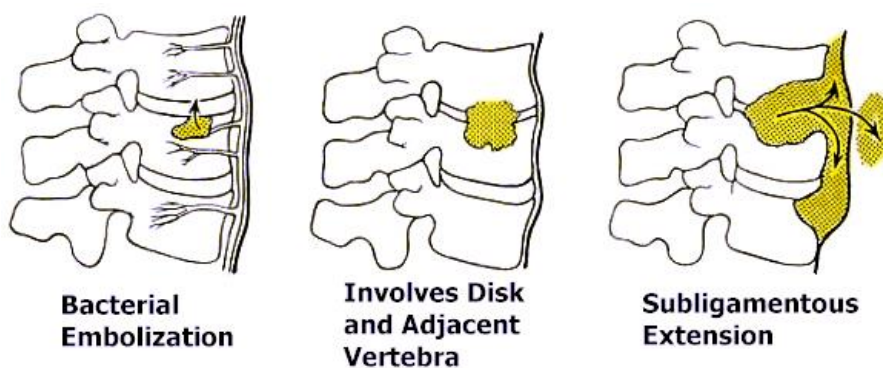
1. **Surgical debridement** (removal of infected bone)
  - adequate margin of normal bone is removed to minimize risk of recurrence.
  - *after at least 1 year* with no evidence of inflammation, **cosmetic / protective cranioplasty** may be performed.
2. **Antibiotics**

## VERTEBRAL OSTEOMYELITIS (S. INFECTIVE SPONDYLITIS)

- **destructive disco-vertebral lesion.**

Infections of vertebrae usually involve disk space (vs. **malignant lesions!**)

- disseminated via small nutrient arteries, bacteria lodge beneath *end-plate of vertebra* (usually anteriorly) → quickly extend into *adjacent disc* and *end-plate of opposite vertebra*.  
In children, because the disk is vascularized, it can be a primary site.
- **complications** - *paraspinal extension* (along spine, beneath paravertebral ligaments, etc) - paraspinal abscess, anterior epidural abscess;
  - paraspinal masses are large in indolent forms of infection (such as tuberculosis).



- occasionally, *NONDISCOGENIC FORMS* (involving only **vertebral bodies** or **neural arches**) are encountered - difficult to distinguish from neoplasia, metastases!

### ETIOLOGY

- **hematogenous spread** (rarely, direct extension\*):
  1. Pyogenic bacteria - *staphylococci* are most common! (≈ 50%).
  2. *M. tuberculosis* (**Pott's disease**) – one of the oldest demonstrated diseases of humankind (in 1779, Percivall Pott presented the classic description of spinal tuberculosis).
    - rare in West; still a significant cause of disease in developing countries.
    - affects young adults.
    - 80% patients have no evidence of pulmonary involvement.
    - most frequent in lower thoracic ÷ upper lumbar vertebrae.
    - tendency to involve *multiple segments* (through subligamentous paraspinal spread).
    - discs frequently are spared until later in course.

\*e.g. complications of discography, lumbar puncture

Most common PRIMARY SOURCES of infection (can be identified only in 40% patients): urinary tract, skin, lungs.

- well-recognized risk factor - **IV drug use**.

### CLINICAL FEATURES

- course tends to be subacute (patients with *pyogenic* spondylitis usually present while infection is still confined to one disc space):

1. **Deep back pain** - exacerbated by motion (**movement restriction** by muscle spasm), may be unrelieved by rest.
2. **Spine tenderness** over involved spine segment.
3. **Fever** (25%).  
N.B. all signs of infection may be absent!

Neurological involvement - late and inconstant feature ( $\approx$  1% cases; but in 40% of cases caused by **tuberculosis!**) by:

- intraspinal extension of infection (epidural abscess)
- spine instability and fractures

### DIAGNOSIS

- ESR $\uparrow$  (!!!), WBC $\uparrow$  (30%)
- X-ray** (changes may take weeks  $\div$  months to appear!):
  - progressive **narrowing of disk space**
  - erosion and **destruction of adjacent vertebral end-plates**  $\rightarrow$  **body collapse**  $\rightarrow$  wedging, subluxations, sharp kyphosis (GIBBUS).
  - paravertebral soft-tissue masses**:
    - cervical spine* - focal swellings of retropharyngeal soft-tissue stripe;
    - thoracic spine* - displacement of paraspinal lines;
    - lumbar spine* - lost psoas muscle shadow.

Radiographic changes of spinal TUBERCULOSIS on plain films:

- Lytic destruction of anterior portion of vertebral body
- Reactive sclerosis on a progressive lytic process
- Enlarged psoas shadow with or without calcification; fusiform paravertebral shadows suggest abscess formation  
In contrast to pyogenic disease, **calcification is common** in tuberculous lesions!
- Vertebral end plates are osteoporotic.
- Intervertebral disks may be shrunk or destroyed.
- Vertebral bodies show variable degrees of destruction  $\rightarrow$  collapse with anterior wedging
- Bone lesions may occur at more than one level.

- MRI** (**diagnostic method of choice** – **highly sensitive and specific!** – changes are seen 2–3 weeks earlier than on plain X-rays):
  - low T1 signal (high signal on T2) throughout disc and in adjacent vertebral bodies.
  - thinning, fragmentation (and eventual loss) of dark line of vertebral end-plates.
  - IV Gd-DTPA  $\rightarrow$  diffuse enhancement in areas showing signal change.

N.B. in *degenerative disk disease*, changes are less uniform, disk is desiccated and bone destruction is absent, no paravertebral soft-tissue masses.

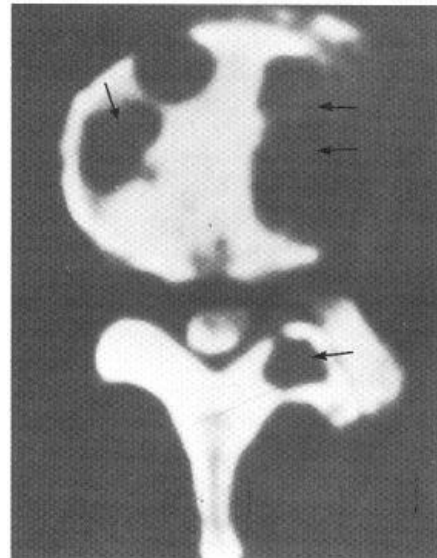
Specific MRI findings of TUBERCULOUS spondylitis:

- thin and smooth enhancement of the abscess wall (vs. pyogenic spondylitis - thick and irregular enhancement of abscess wall)
  - well-defined paraspinal abnormal signal (vs. pyogenic spondylitis - ill-defined paraspinal abnormal signal).
- CT** (less sensitive and specific; better tolerated by some patients with severe back pain): punched-out erosions of bone adjacent to involved disc (“moth-eaten” appearance), small dense sequestra, prominent sclerosis.
  - Bone scan** with technetium, gallium.
  - CT-directed needle biopsy** of affected vertebrae; **open biopsy** may be necessary to obtain adequate tissue for culture.

Discovertebral osteomyelitis, L4-5 (sagittal T1-MRI): diffuse low intensity throughout L4/5 vertebral bodies, and even lower signal from intervening disc space (which is barely visible because of loss of dark line of vertebral end-plates); little epidural soft-tissue thickening suggesting extraosseous extension.



Staphylococcal discovertebral spondylitis (axial CT): vertebral end-plate shows typical **moth-eaten appearance** (upper arrows) and another focus of infection is visible in inferior articular process (lower arrow):

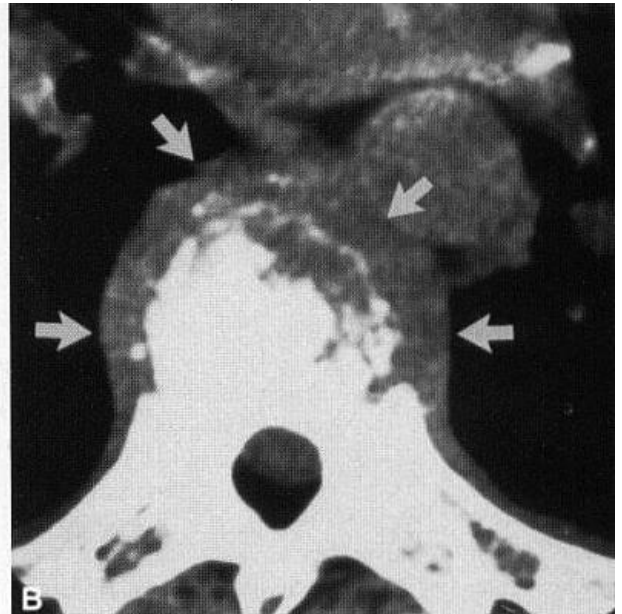
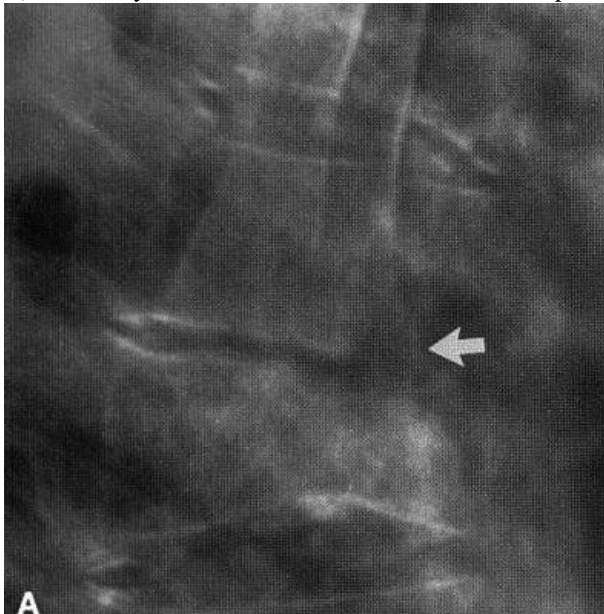


Source of picture: Ronald G. Grainger, David J. Allison “Grainger & Allison’s Diagnostic Radiology: A Textbook of Medical Imaging”, 4<sup>th</sup> ed. (2001); Churchill Livingstone, Inc.; ISBN-13: 978-0443064326 >>

Infectious spondylitis at T6-7:

A) lateral radiograph - disc space narrowing, erosion of adjacent vertebral end-plates (arrow), reactive sclerosis in inferior vertebra.

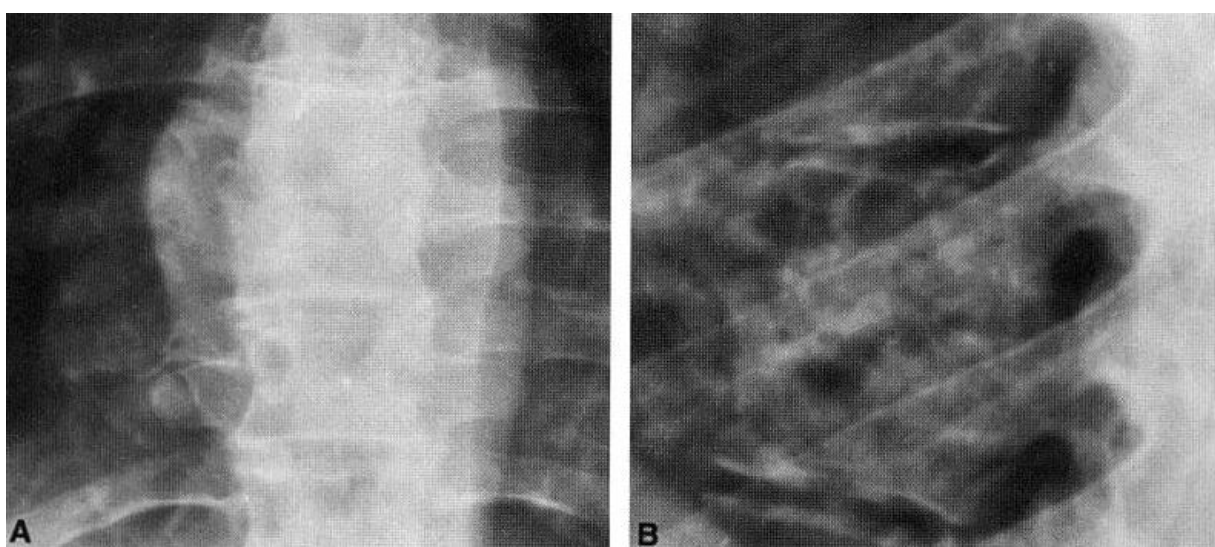
B) CT - bony destruction; note extent of associated paraspinal soft-tissue mass (arrows).



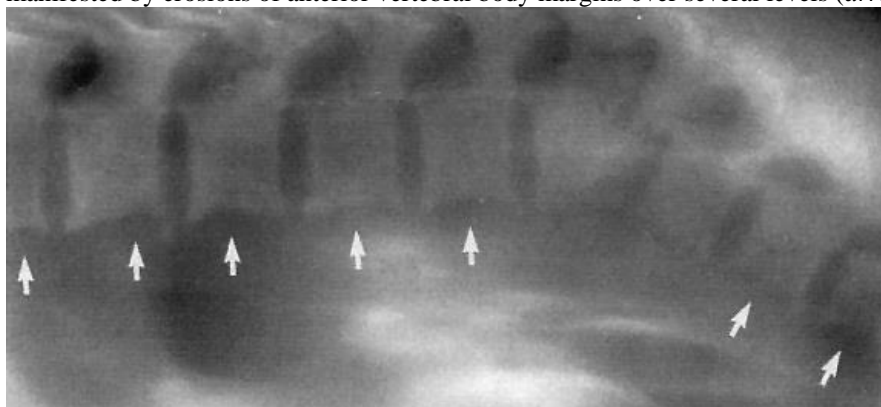
Thoracic tuberculous spondylitis:

A) paraspinal soft-tissue mass in AP radiograph; involved disc space is difficult to resolve.

B) disc space obliteration and destruction of adjacent vertebral end-plates.

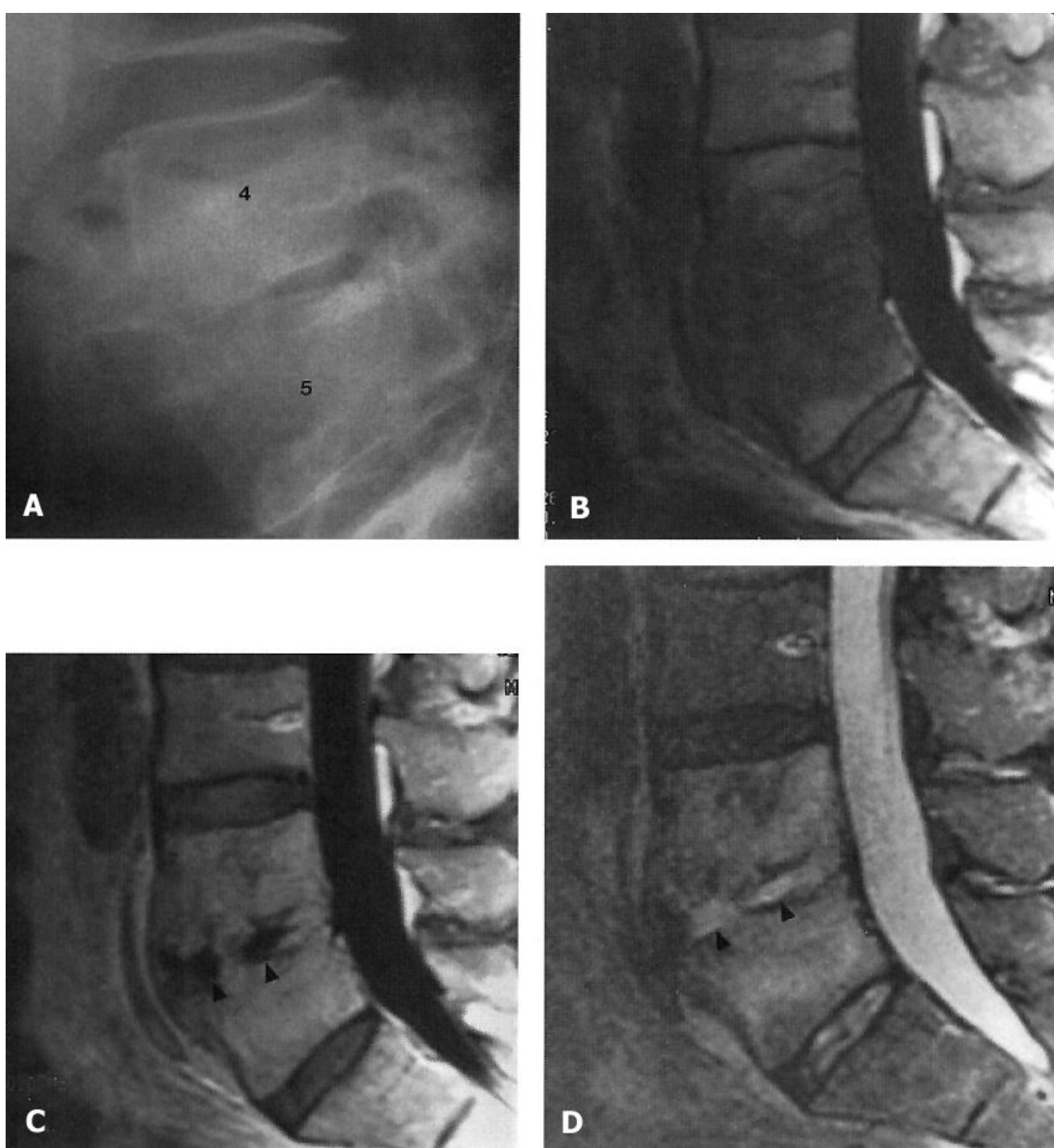


**Tuberculous spondylitis** with subligamentous extension (sagittal thoracic tomogram) - obliteration of disc space and destruction of adjacent vertebral end-plates in midthoracic spine; superior and inferior subligamentous extension is manifested by erosions of anterior vertebral body margins over several levels (*arrows*):



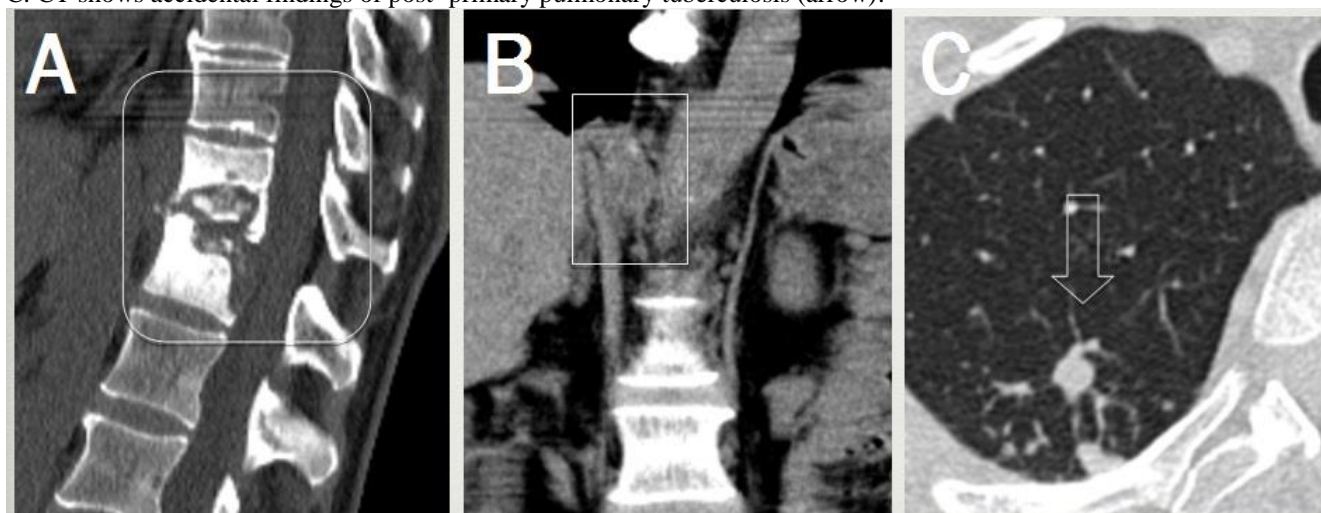
**Pyogenic spondylitis:**

- A) lateral X-ray at L4-L5 - marked narrowing of disc space, loss of sharp vertebral end-plate margins, and mild reactive sclerosis in L4 vertebral body.
- B) T1-MRI - extensive abnormal low signal within adjacent vertebral bodies and intervening disc, with loss of hypointense border at vertebral margins.
- C) postcontrast T1-MRI - pronounced enhancement of involved vertebra and portions of infected disc; no epidural involvement.
- D) fat-suppressed T2-MRI - edema in vertebral bodies, abnormally bright signal in infected disc - corresponding to areas of low signal intensity in postgadolinium MRI (*arrowheads*).



**Tuberculous spondylitis** in 46-year old male.

- A. CT shows contact interdisk Th11-Th12 vertebral body destruction, with large and spongy sequestrs, prevertebral and epidural extension (surrounds a large square).
- B. CT shows paravertebral tight, with calcination abscess near the right crus of diaphragm (surrounds a small square).
- C. CT shows accidental findings of post- primary pulmonary tuberculosis (arrow):



**TREATMENT**

1. Infection control
2. Patient comfort (bed rest, brace)
3. Prevention of further deformity.
  - correction with debridement and **corpectomy** may be indicated.
  - *implanted instruments* should be isolated from site of infection.

## INFECTIOUS DISKITIS

### ETIOLOGY

- usually **iatrogenic** (complication of previous surgery or needle puncture of intervertebral disks) - most often **staphylococci**!

### CLINICAL FEATURES

- 1) severe **pain**, aggravated by palpation; partially relieved by recumbency.
- 2) **muscle spasm**.
- 3) **fever**
  - interspace infections *must* be observed closely – risk of **extradural abscesses**!

### DIAGNOSIS

Early in course:

- **X-rays** and **CT** are normal!
- **gallium scans** may be falsely positive because of recent surgery.

Later in course - **destructive changes** along edges of disk space, **narrowing** of intervertebral space.

- **CT** demonstrates these changes early.

**Needle biopsy** of involved interspace identifies causative bacteria (cultures are often sterile → **direct surgical biopsy**).

### TREATMENT

- 1) **bed rest**, medication for pain and muscle spasms.
  - 2) **antibiotic therapy** (empirically – against staphylococci).
  - 3) *no response to conservative therapy* → **open surgery** (remove infected material from interspace).
- when infection is controlled, interspace will eventually narrow → **spontaneous fusion**.

BIBLIOGRAPHY for ch. “Infections of Nervous System” → follow this [LINK >>](#)