

When Back Pain is More than Just a Pain in the Back

Spinal Infections

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Disclosures

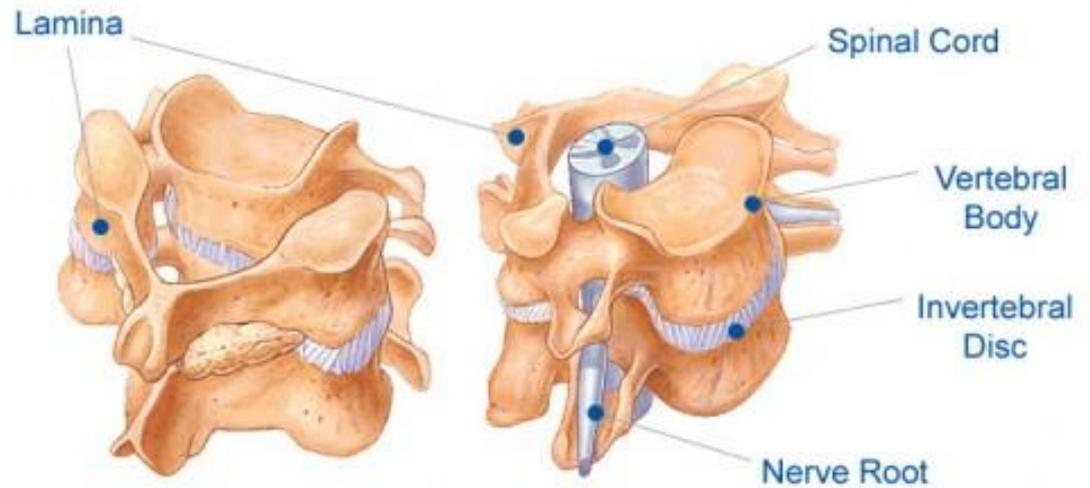
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Overview

- Anatomy and pathophysiology
- Common Organisms
- Presentation
- Diagnostic Workup
- Differential Diagnoses
- Management
- Outcomes

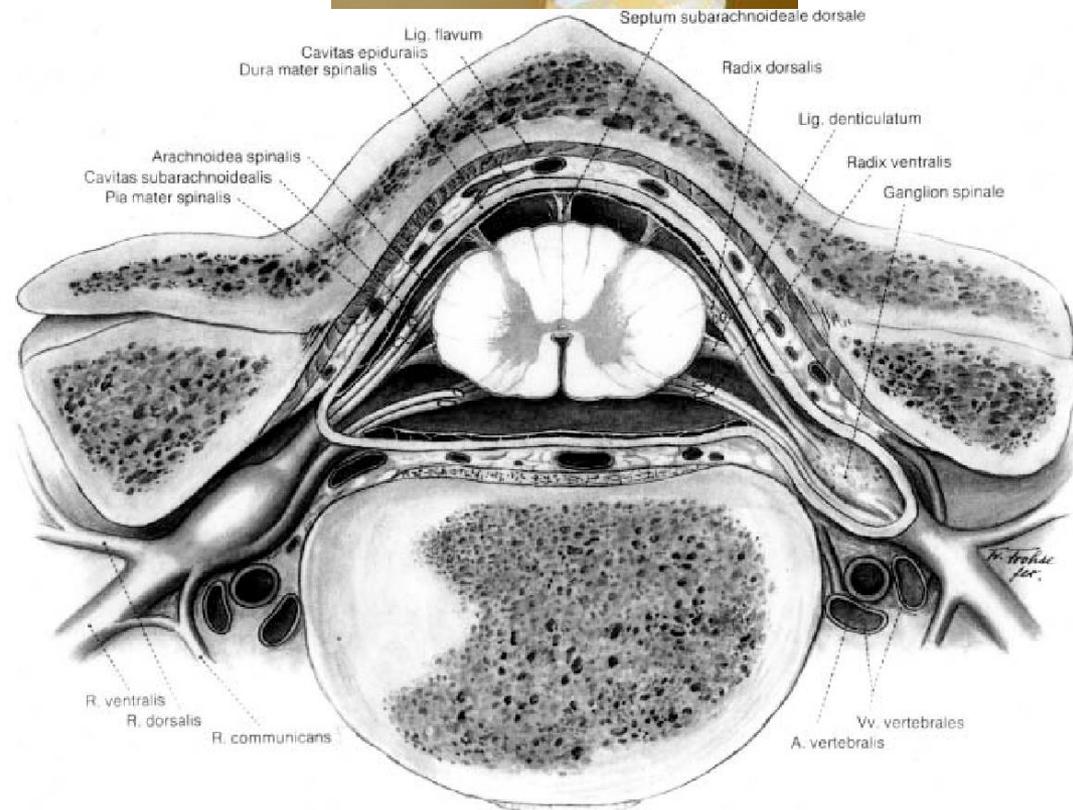
(not necessarily in this order)

- Bone
 - Posterior Elements
 - » Spinous Process, Lamina, Facet
 - Pedicle
 - Vertebral Body
- Joints
 - Intervertebral Disk
 - » Nucleus Pulposus
 - » Annulus
 - Facet
- Ligaments
 - ALL, PLL, Ligamentum Flavum, Interspinous Ligament
- Muscle
 - Quadratus lumborum, erector spinae (illiocostalis, spinalis, logissimus), multifidus, iliopsoas



Anatomy of Disease

- Discitis
- Osteomyelitis / Spondylitis
- Epidural Abscess
- Subdural Empyema
- Spinal Cord Abscess



Reihnsaus, E., H. Waldbaur and Walter Seeling. "Spinal epidural abscess: a meta-analysis of 915 patients." *Neurosurgical Review* 23 (2000): 175-204

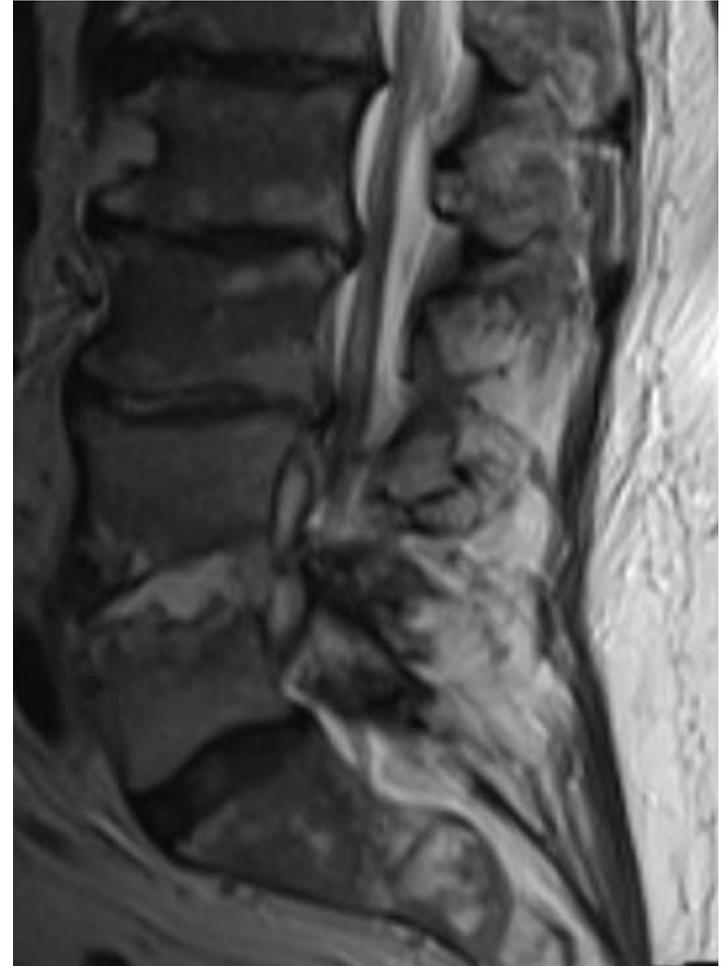
Routes of Entry

- Hematogenous Spread
- Direct Innoculation

Brief History

- Epidural Abscess
 - 1761: Morgagni alludes to pyogenic infection of spinal epidural space
 - 1820: first description, Bergamaschi
 - 1901: first successful drainage, Barth
 - 1926- Walter Dandy reported mortality rate of 83% with spinal epidural abscess

- Diagnosis can be difficult



Why does it Matter?

- Time will allow clear determination
- Risks of Waiting
 - Pain
 - Progression of Infection
 - Spinal Instability
 - Neurologic Deficit



From the Law Offices of....



According to court records, the patient was admitted to the emergency room after suffering from back pain in 2014. Dr. Sarah Barbour, a specialist in infectious diseases, was tapped to manage the patient's care, but, according to the [medical malpractice lawsuit](#), Barbour failed to notice that the woman's back pain was being caused by an infection that had reached her central nervous system.

The infection, court documents say, ate into the woman's thoracic spine, leaving her permanently disabled. The plaintiff was released from the hospital, with a discharge diagnosis of paralysis, 12 days after being admitted. She is confined to a wheelchair, her attorneys say, and still has no functional use of her legs. \$18 million in compensation (Georgia).

The jury verdict, rendered in Chatham County State Court, assessed millions in dollars of damages against a Savannah hospital, a physician specializing in infectious diseases and Southcoast Medical Group, the doctor's former employer.

Dr. Sarah Barbour, along with her former employer, Southcoast Medical Group, have been ordered to pay \$16.2 million in damages for their share in the liability. An additional \$1.8 million has been assessed against St. Joseph's / Candler, a medical consortium that owns the hospital.

2016, New York: \$2,000,000 Verdict. A 39-year old male with cerebral palsy goes to Hudson Valley Hospital with back pain. He is diagnosed with a back strain and is then discharged. Four days later, he returns with rib pain, back pain, and shortness of breath, just to be diagnosed again with a back strain. He returns the next day again, with tingling and numbness in his legs. He is admitted for pneumonia. It takes three days for him to be diagnosed with an epidural abscess with marked compression of his spinal cord. He alleges that the staff was negligent in failing to heed the signs of an epidural abscess and failing to timely diagnose the abscess. The defendants deny liability, and argue he was not experiencing symptoms of a spinal cord abscess during his first two emergency room visits, and that once his condition worsened the proper tests were done and the abscess was diagnosed. Plaintiff argues he suffers urinary incontinence and further damage to his spinal cord requiring future surgeries as a result. A jury awards the plaintiff \$2,000,000.

2015, Pennsylvania: \$12,500,000 Verdict. A 53-year old man goes to the ER with neck pain and tingling in his left arm. He is admitted to the hospital. His condition worsens as he develops a fever, urinary issues, and has trouble walking. The day after his admission, he is examined by the infectious disease specialists, who suspects an epidural abscess on his spine and orders an MRI. This is interpreted by the defendant radiologist as normal, without showing an abscess or fluid collection in the plaintiff's spine. The infectious disease specialist continues to have concerns about a cervical abscess and transfers him to a different hospital where surgery is done the next day. Plaintiff argues the delay of over 24 hours in surgical intervention allowed his abscess to put pressure on his spinal cord, leaving him permanently paralyzed in his arms and legs. The defendants argue that his condition was evaluated properly and that the radiologist stated the abscess was not visible on the MRI. A jury finds the radiologist and neurologist negligent, and awards the man \$12,500,000, which includes \$500,000 to his wife for loss of consortium.

2014, Florida: \$19,250,000 Verdict. A 36-year old woman goes to the ER complaining of an infected cyst on the back of her right shoulder. It is drained and treated, and the plaintiff is discharged with antibiotics. She returns two days later, with the same complaints. The wound is repacked by another physician. A day after this she goes to a medical clinic, and is told to go back to the ER for repacking of her wound and a surgical consult. She does this, and the wound is repacked, and a surgeon instructs her to come back for another appointment in two weeks. However, before the two weeks is over, she goes back to the ER with severe radiating chest pain. She is discharged. Two days later, she returns again with the same complaints of severe radiating chest pain, and she is discharged with medicine after a pulmonary embolism is ruled out, but no CT or MRI is done. She returns the same evening again and is admitted. Paralysis begins to set in. It is then discovered that she has a spinal epidural abscess originating from the infected cyst on her shoulder three weeks earlier. Surgery is done in an attempt to relieve the pressure on her spinal cord caused by the abscess, but she ultimately suffers permanent paralysis below the waist. She argues that the delay in treatment and admission to the hospital led to a delay in diagnosing and treating her spinal abscess, causing her paralysis. The plaintiff is awarded gross damages of \$19,250,000, and her net award was \$8,000,000. The parties settled while post-trial motions were pending.

- <https://www.millerandzois.com/spinal-abscess-settlements.html>
- <http://marcianolegal.com/medical-malpractice/>

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\$18 Million In Compensation, Georgia

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Assessment of malpractice claims due to spinal epidural abscess

J. Mason DePasse, MD, Roy Ruttiman, BS, Adam E. M. Eltorai, MS, Mark A. Palumbo, MD, and Alan H. Daniels, MD

Division of Spine Surgery, Department of Orthopaedics, Warren Alpert Medical School of Brown University, Providence, Rhode Island

OBJECTIVE Spinal epidural abscesses (SEAs) can be difficult to diagnose and may result in neurological compromise or even death. Delays in diagnosis or treatment may worsen the prognosis. While SEA presents a high risk for litigation, little is known about the medicolegal ramifications of this condition. An enhanced understanding of potential legal implications is important for practicing spine surgeons, emergency medicine physicians, and internists.

METHODS The VerdictSearch database, a large legal-claims database, was queried for “epidural abscess”-related legal cases. Demographic and clinical data were examined for all claims; any irrelevant cases or cases with incomplete information were excluded. The effects of age of the plaintiff, sex of the plaintiff, presence of a known infection, resulting paraplegia or quadriplegia, delay in diagnosis, and delay in treatment on the proportion of plaintiff rulings and size of payments were assessed.

RESULTS In total, 56 cases met the inclusion criteria. Of the 56 cases, 17 (30.4%) were settled, 22 (39.3%) resulted in a defendant ruling, and 17 (30.4%) resulted in a plaintiff ruling. The mean award for plaintiff rulings was \$5,277,468 ± \$6,348,462 (range \$185,000–\$19,792,000), which was significantly larger than the mean award for cases that were settled out of court, \$1,914,265 ± \$1,313,322 (range \$100,000–\$4,500,000) ($p < 0.05$). The mean age of the plaintiffs was 47.0 ± 14.4 years; 23 (41.1%) of the plaintiffs were female and 33 (58.9%) were male. The proportion of plaintiff verdicts and size of monetary awards were not affected by age or sex ($p > 0.49$). The presence of a previously known infection was also not associated with the proportion of plaintiff verdicts or indemnity payments ($p > 0.29$). In contrast, juries were more likely to rule in favor of plaintiffs who became paraplegic or quadriplegic ($p = 0.03$) compared with plaintiffs who suffered pain or isolated weakness. Monetary awards for paraplegic or quadriplegic patients were also significantly higher ($p = 0.003$). Plaintiffs were more likely to win if there was a delay in diagnosis ($p = 0.04$) or delay in treatment ($p = 0.006$), although there was no difference in monetary awards ($p > 0.57$). Internists were the most commonly sued physician (named in 13 suits [23.2%]), followed by emergency medicine physicians (named in 8 [14.3%]), and orthopedic surgeons (named in 3 [5.4%]).

CONCLUSIONS This investigation is the largest examination of legal claims due to spinal epidural abscess to date. The proportion of plaintiff verdicts was significantly higher in cases in which the patient became paraplegic or quadriplegic and in cases in which there was delay in diagnosis or treatment. Additionally, paralysis is linked to large sums awarded to the plaintiff. Nonsurgeon physicians, who are often responsible for initial diagnosis, were more likely to be sued than were surgeons.

<https://thejns.org/doi/abs/10.3171/2016.12.SPINE16814>

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TABLE 3. Outcomes for cases with and without delayed diagnosis

Outcome	Delay in Diagnosis	No Delay
Settlement	16*	1
Court case	25	14
Plaintiff verdict	14*	3
Defense verdict	11	11

* Statistically significant difference ($p < 0.05$).

Source of Infection

In 14 cases (25%), the plaintiff had a known source of infection prior to diagnosis of SEA, such as remote *Staphylococcus* skin infection, pneumonia, or known bacteremia. When compared with the 25 cases (44.6%) with no known infection or other risk factors, there was no difference in proportion of settlements, proportion of plaintiff verdicts, or indemnity payments ($p > 0.29$).

Risk factors... Briefly

- IV drug use
- Immunosuppressed
 - AIDS, chronic steroids, EtOH abuse
- Open wounds / Trauma
- Poorly controlled DM
- Systemic/hematologic infections
 - Chronic Infections
- Hardware- Joints/Valve
- Prior Spinal Surgery

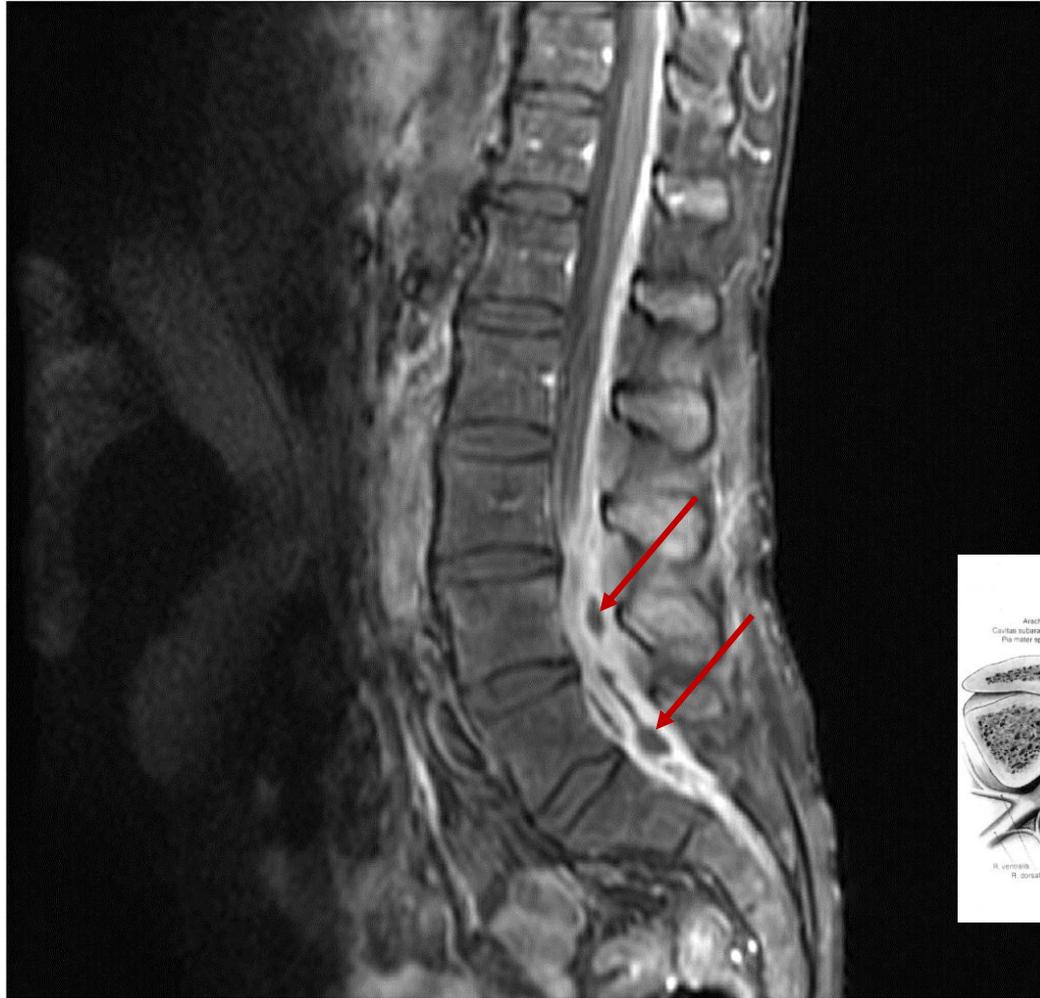
Exam Findings

- Back pain
- Meningismus occasionally
- Fever
- Neurologic signs
 - Radicular pain
 - Bowel/bladder symptoms
 - Weakness

Evaluation

- Vitals
- Labs
 - WBC
 - ESR/CRP/ Procalcitonin
- Imaging
 - Plain films
 - Nuclear Medicine studies
 - Computed Tomography
 - Magnetic Resonance Imaging
 - » CT myelo not recommended
- Fever generally present with hematogenous spread as underlying cause
 - May be rare in chronic cases
- Leukocytosis also may not be present
- High clinical suspicion – MRI with gadolinium

Imaging



Regis W. Haid, Howard H. Kaufman, Sydney S. Schochet, Gary D. Marano; Epidural Lipomatosis Simulating an Epidural Abscess: Case Report and Literature Review, *Neurosurgery*, Volume 21, Issue 5, 1 November 1987, Pages 744–747, <https://doi.org/10.1227/00006123-198711000-00029>

Categories of Spinal Infections

- (Iliopsoas muscle abscess)
- Discitis
- Osteomyelitis / Spondylitis
- Spinal epidural abscess
- Subdural Empyema
- Spinal Cord Infection

Psoas abscess

- Iliopsoas muscle (Psoas and iliacus)
 - 30% have a psoas minor as well anterior to psoas
 - T12-L5 ventral to spine
 - Primary hip flexor

 - Assess iliopsoas inflammation
 - » Active: flex hip against resistance
 - » Passive: lay unaffected side down and hyperextend affected side
- Mortality rate
 - 2.4% (primary infection), 19% (secondary infection)
 - sepsis usual cause of death

Discitis

- Inflammation of the disk space
 - Enters from the cartilaginous endplate
- Spontaneous || Post-Op
- Juvenile discitis
 - H. Flu most often
 - Primordial feeding arteries are implicated (involute in 20s)
- Back pain
 - Often focal
 - Exacerbated by movement
 - May radiate
- Paravertebral muscle spasms
- Up to 70% are afebrile
- Unlikely to cause radicular sx's or meningismus

- CBC, Inflamm markers
- Blood cx
- Percutaneous Biopsy
 - Aerobic, Anerobic, fungal, mycobacterium
- Open surgery for biopsy when dx unclear – infection persists

Imaging

- PF of low use
 - Sclerosis usually takes 4-12 weeks
 - Late finding: widening of disk space and erosion into VB
- Nuc medicine
 - May miss TB (Pott's disease)
- CT
 - Endplate fragmentation
 - Paravertebral soft tissue swelling w/ obliteration of fat planes
 - Paravertebral abscess

All 3 then discitis very likely



- Pathogens

- Staph aureus most common
- Strep albus, Strep epidermidis
- Gram (-)
 - » E Coli
 - » Proteus spp

- Abx

- Treat for 6 wks IV then PO
- OR
- Treat IV until inflammatory markers normalize (~4-6 weeks) then PO

Vertebral Osteomyelitis (VO)

- 2-4% of all cases of osteomyelitis
- 1:250,000 incidence
 - Recently rising
 - Increases with age
- 2:1 (male:female)
- Lumbar > thoracic > cervical > sacrum

-
- Diagnosis
 - Needle biopsy
 - Surgical Indication
 - Instability, kyphosis, cord compression
 - Neurologic deficit
 - Vast majority (>90%) do not require surgical intervention when detected early

Risk factors for VO

- IVDU
- Diabetes Mellitus
 - Unusual bacterial infections, fungal (candida)
- Chronic Hemodialysis
 - Osteo changes can occur without infection
- Immunosuppression
 - AIDS
 - Chronic Steroid Use
 - EtOH
- Infective endocarditis
- Prior spinal surgery
- ESI/Myelogram
- Elderly

Clinical

- Localized pain (90%)
- Fever (52%) <spikes and chills rare>
- Weight loss
- Paraspinal muscle spasms
- WBC
 - May be normal
- ESR/CRP elevated
- Only 17% will have neurologic symptoms

Sources

- Spontaneous
 - UTI (most common), respiratory tract, soft tissue (skin boils, IVDU), dental flora
- 37% without identifiable source
- Route of spread
 - Hemotagenous – spondylodiscitis
 - » Arterial
 - » Spinal venous epidural plexus (Batson's plexus)
 - Direct extension
 - » Surgery, LP, trauma, local infection

Organisms for VO

- Staph aureus (>50%)
- E. Coli (distant 2nd)
- IVDU: Pseudomonas and S. aureus
- UTI: E. Coli and Proteus spp
- Respiratory Tract: Strep pneumoniae
- EtOH: Klebsiella pneumoniae
- Endocarditis
 - Acute: S. Aureus
 - Subacute: Streptococcus spp.
- Tuberculosis: Mycobacterium tuberculosis
- Rare
 - Nocardia
 - **Polymicrobial** (<2.5% of pyogenic infection)
 - Mycobacterium avium complex in AIDS
- Abx minimum 6 weeks

Imaging

Modality	Sensitivity	Specificity	Accuracy
Plain films	82%	57%	73%
Bone Scan	90%	78%	86%
Gallium Scan (radioactive tracer)	92%	100%	93%
Bone Scan + Gallium Scan	90%	100%	94%
MRI	96%	92%	94%

Epidural Spinal Abscess (ESA)

- Incidence: 0.2-1.2 per 10,000 hospital admissions
- 57.6 +/- 16.6 years old (average age)
- Most common location
 - Thoracic (50%), Lumbar (35%), cervical (15%)
 - 82% posterior to cord
- Often associated with vertebral osteomyelitis (VO) and discitis

- Chronic dz with immune compromise in 60% (study of only 40 patients)
 - DM 32%
 - IVDU 18%
 - CRF 12%
 - EtOH abuse 10%

-
- WBC
 - Commonly elevated in acute period (16K) but normal in chronic (9K)
 - ESR, CRP, Procalcitonin
 - Cultures

-
- Severe pain over spine
 - Radicular symptoms, bowel/bladder dysfunction, weakness - rapidly progressive
 - Mechanism
 - Mechanical Compression
 - Venous congestion/thrombophlebitis



Surgical Indications

- Liquid abscess (vs phlegmon)
 - Target sign
- Cord compression
- Lumbar spine does not carry risk of thrombophlebitis
 - Greater tolerance to nonoperative management
- Nonoperative management of ESA requires very close vigilance

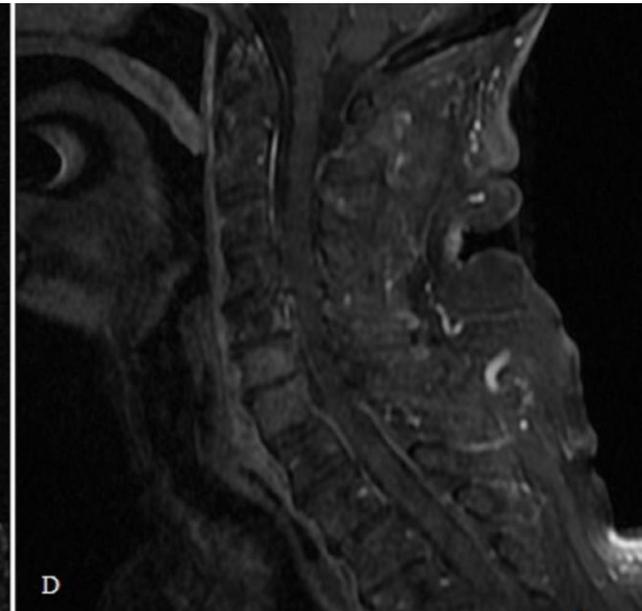
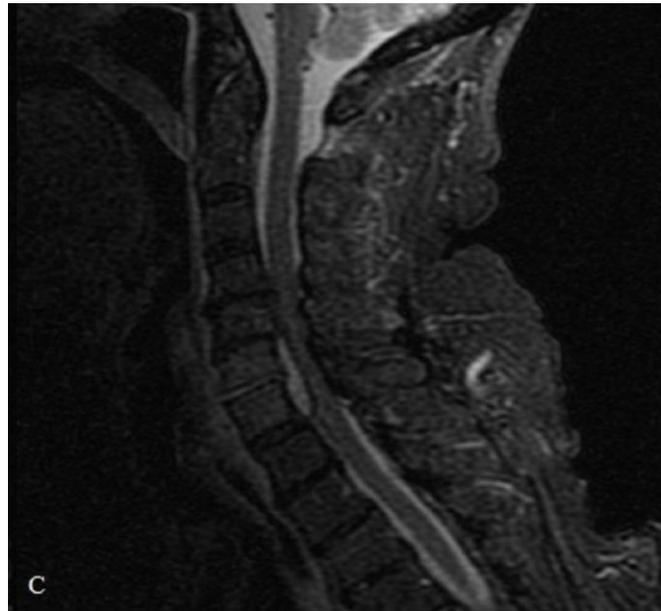
Radiographic Findings

- CT
 - Destructive bony changes
- MRI
 - Target sign



Radiographic Findings

- CT requires fair amount of bony involvement to reliably indicate infection



Bodman A, Riordan M, Chin L S. (May 23, 2016) Delayed Presentation of a Cervical Spinal Epidural Abscess of Dental Origin after a Fall in an Elderly Patient. *Cureus* 8(5): e621. doi:10.7759/cureus.621

Source of Infection

- Hematogenous

- Skin infection

- » Furuncle(boil) found in only 15%

- Parenteral injections

- » IVDU

- Bacterial endocarditis

- UTI

- Resp infection

- Pharyngeal/Dental abscess



- Direct Extension

- Decubitus Ulcer

- Psoas Abscess

- Trauma / Open wound

- Pharyngeal Infection

- Mediastinitis

- Pyelonephritis w/ abscess

- Dermus sinus tract

- Post Procedure

- Laminectomy (0.67%)

- ESI, LP, epidural catheter etc

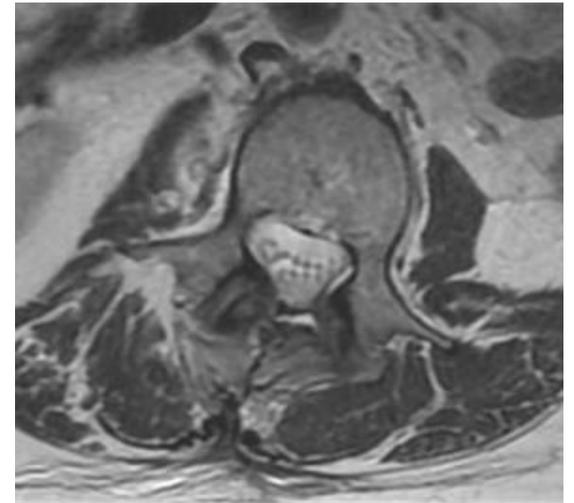
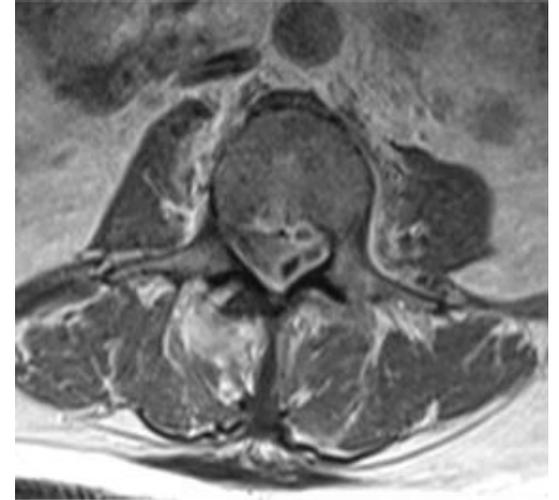
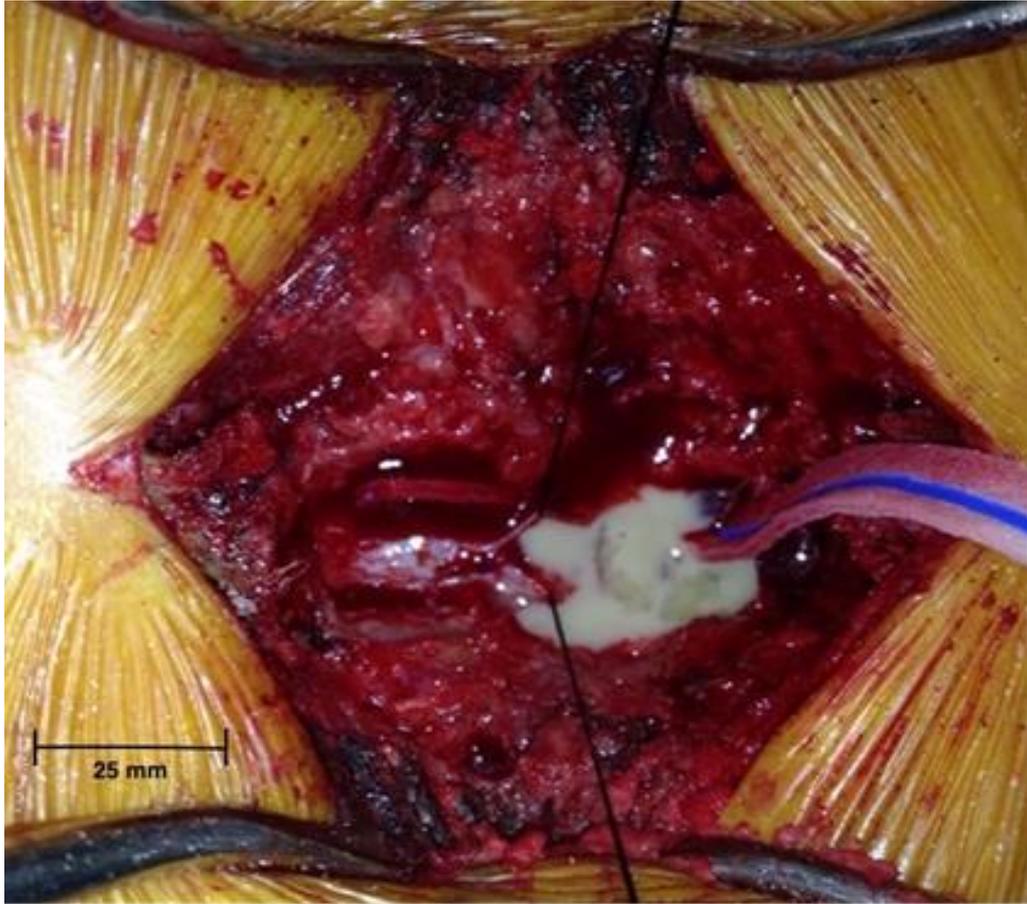
Organisms

- Staph aureus (>50%)
- Aerobic and anaerobic streptococcus spp (2nd most common)
- Escherichia Coli
- Pseudomonas aeruginosa
- Diplococcus pneumoniae
- Serratia marcescens
- Chronic Infections
 - TB
 - Fungal: cryptococcus, aspergillosis, brucellosis
 - Parasitic: Echinococcus
- Multiple organisms ~10%
- Anaerobes ~8%

Treatment

- Obtain specimen
 - IR guided biopsy/drainage
 - Surgical drainage
 - » Abscess vs Phlegmon
 - » Level
 - » Extent of Compression
 - » Instability
- Broad spectrum antibiotics
 - **Vancomycin + Flagyl + third generation Cephalosporin** (cefepime when suspect pseudomonas)
 - » Switch to PCN (nafcillin, rocephin) if MRSA ruled out
- Follow-up – eval Abx success <radiographic, lab, exam>





DOI: [10.4236/ojmn.2017.73012](https://doi.org/10.4236/ojmn.2017.73012)

Outcome

- **Fatal in 4-31%**
 - Worse outcome for older and those paralyzed prior to surgery
- Severe neurologic deficits rarely improve
 - Exception: Pott's disease
- Mortality due to original focus of infection or complication of residual paralysis (e.g. PE)

Differential Diagnosis

- Epidural hematoma
- Spinal Tumor
- Meningitis
- Transverse Myelitis

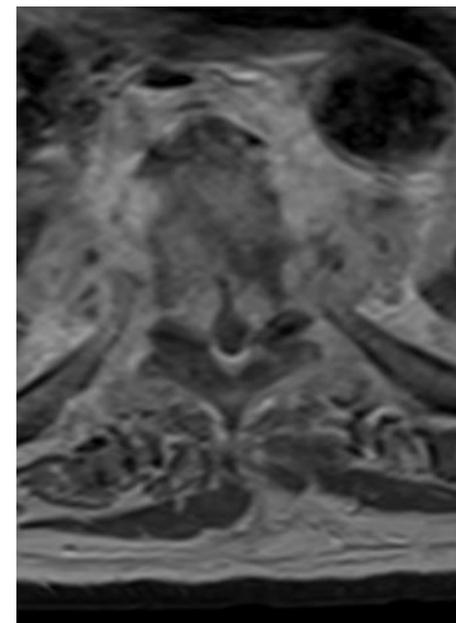
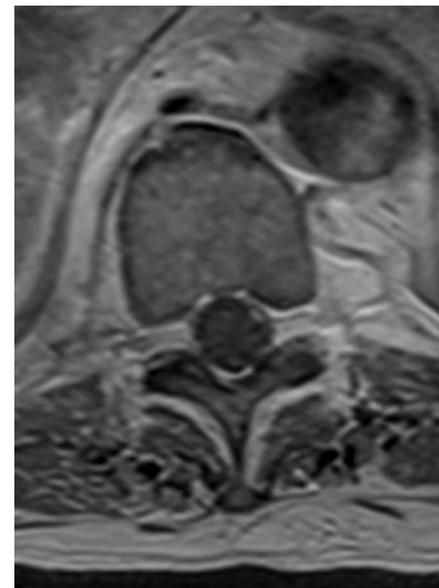
- Bone tumors can resemble VO
 - Infection centers on disk space often
 - Tumors often spare disk space

Cases

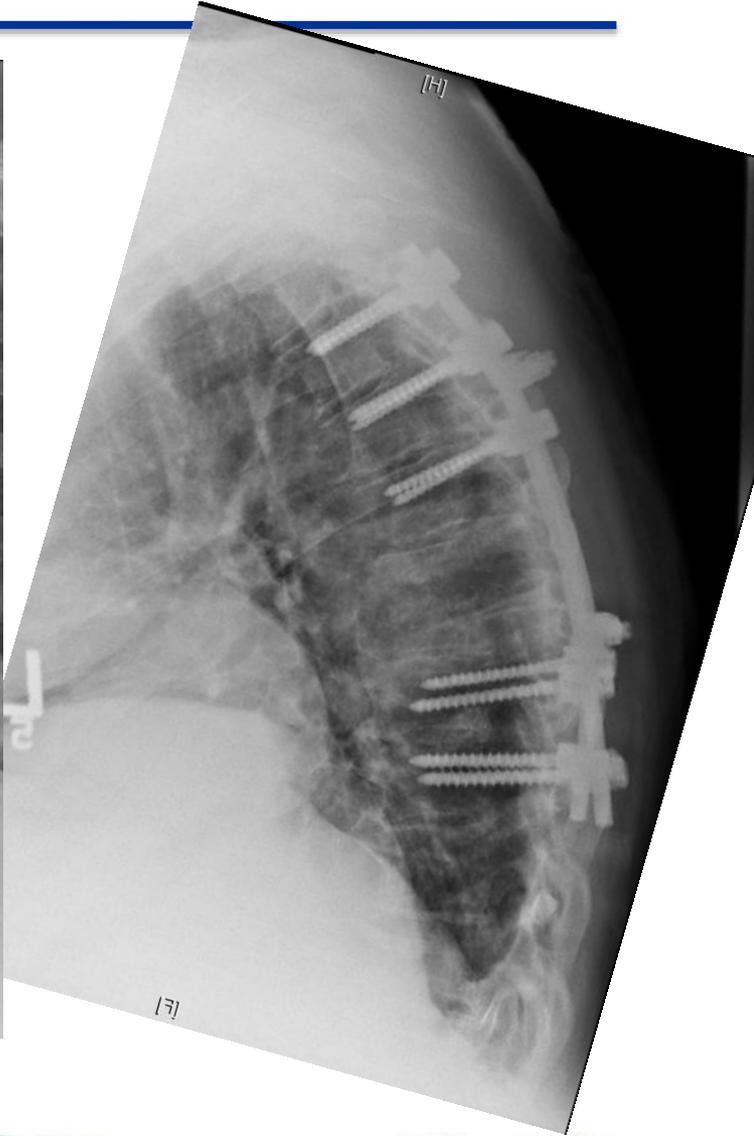


- Workup for PE
- Remote lumbar laminectomy with foot drop
- Obesity, DM, chronic focal back pain
- Afebrile

Cases



Source: ABSCESS
Site: EPIDURAL
Pseudomonas aeruginosa



Case #2

49-year-old
recurrent infections (bacteremia and sepsis)

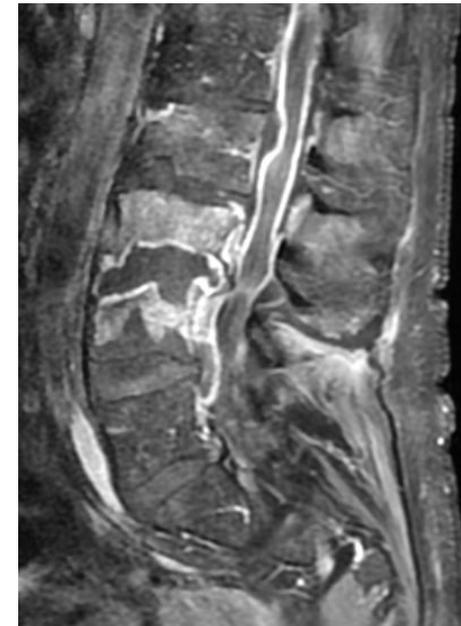
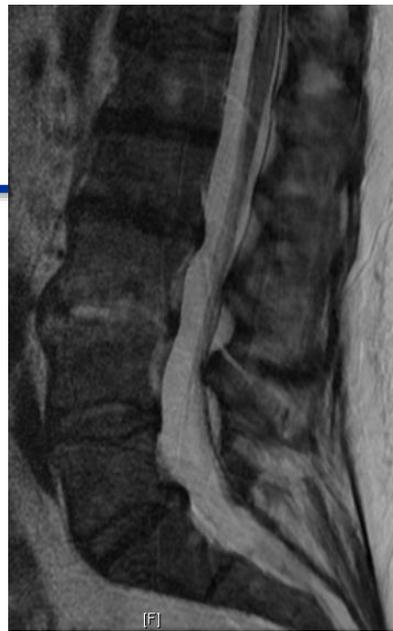
osteomyelitis and diskitis several months ago
(left) and underwent right BKA.

(right) months later with continuing back pain
despite antibiotics.

weakness involving his left leg

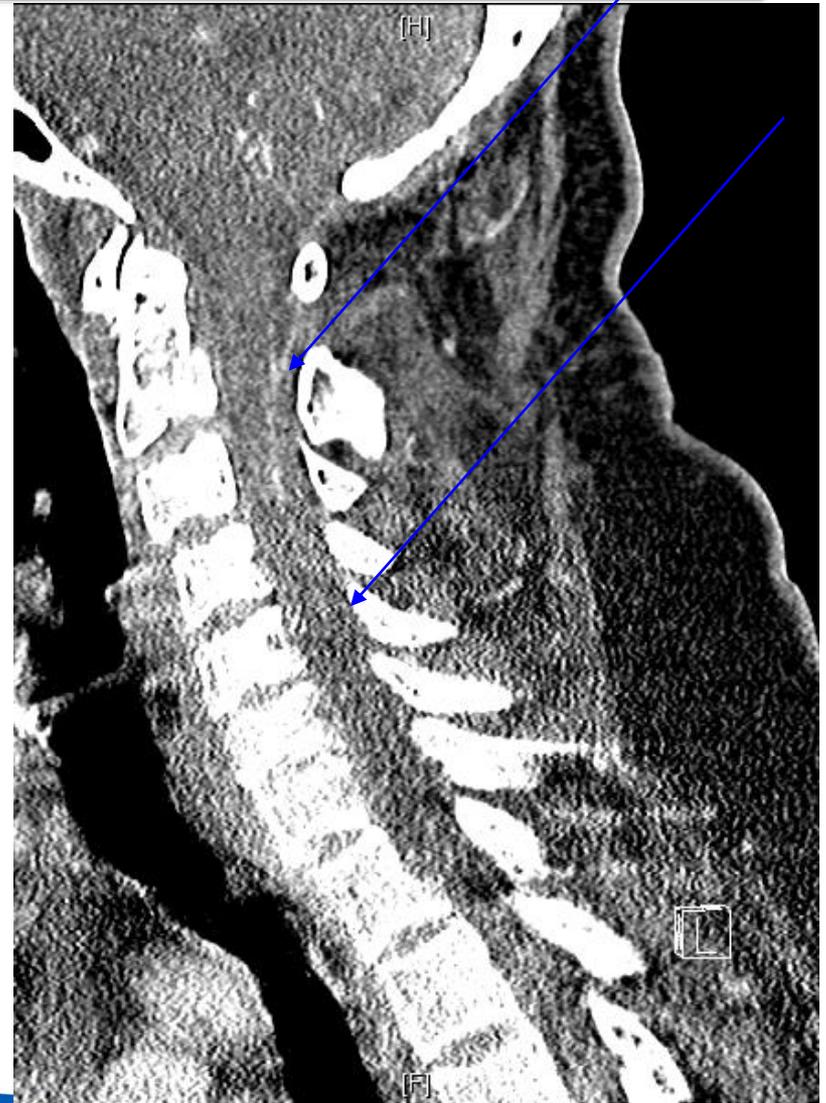
recently had a drain placed in his psoas abscess.

MRSA, pseudomonas



Case #3

- Hx neurocystercosis s/p VPS 10 yrs ago
- Neck pain
- Gram + bacteremia
- Couldn't tolerate MRI d/t neck pain





Case #4

80-year-old gentleman

fevers and back pain

no lower extremity weakness.

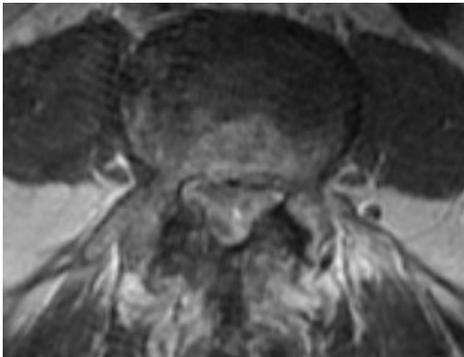
Imaging: marked degenerative changes at L4-5 with stenosis and incompetence facets, appears to be chronic and longstanding.

significant ventral epidural fluid extending from this area of stenosis up to the level of T12.

CRP was elevated into the 200 range

white count was also elevated

febrile to 102 degrees.



Questions?

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