

Infections of the Spine

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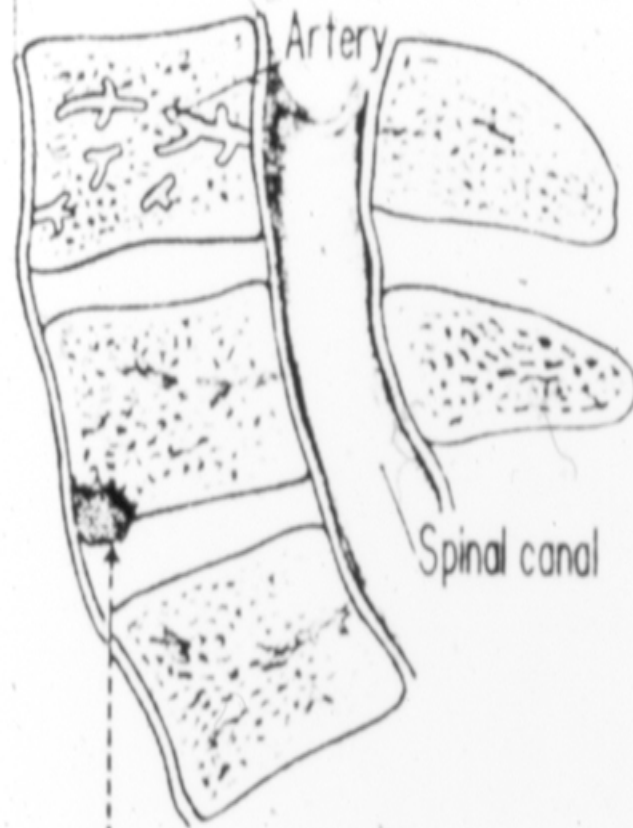
Beth Israel Deaconess Medical Center

Vertebral Osteomyelitis: 255 Episodes Pathogenesis and Time to Diagnosis

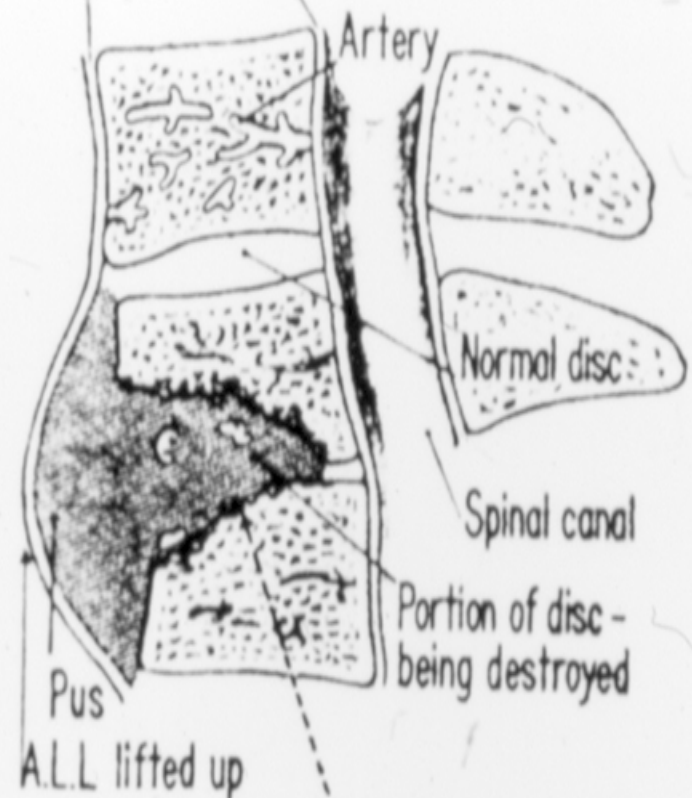
- **Pathogenesis**
 - Nosocomial 83 (33%) (surgery, procedures)
 - Contiguous abscess 7 (3%)
 - Hematogenous 130 (51%)
- **Time to Diagnosis**
 - Median 1.8 months
 - Only 71 (28%) diagnosed ≤ 1 month (average in literature 6 wks-7mos)

McHenry, CID 2002; 34:1342-1350.

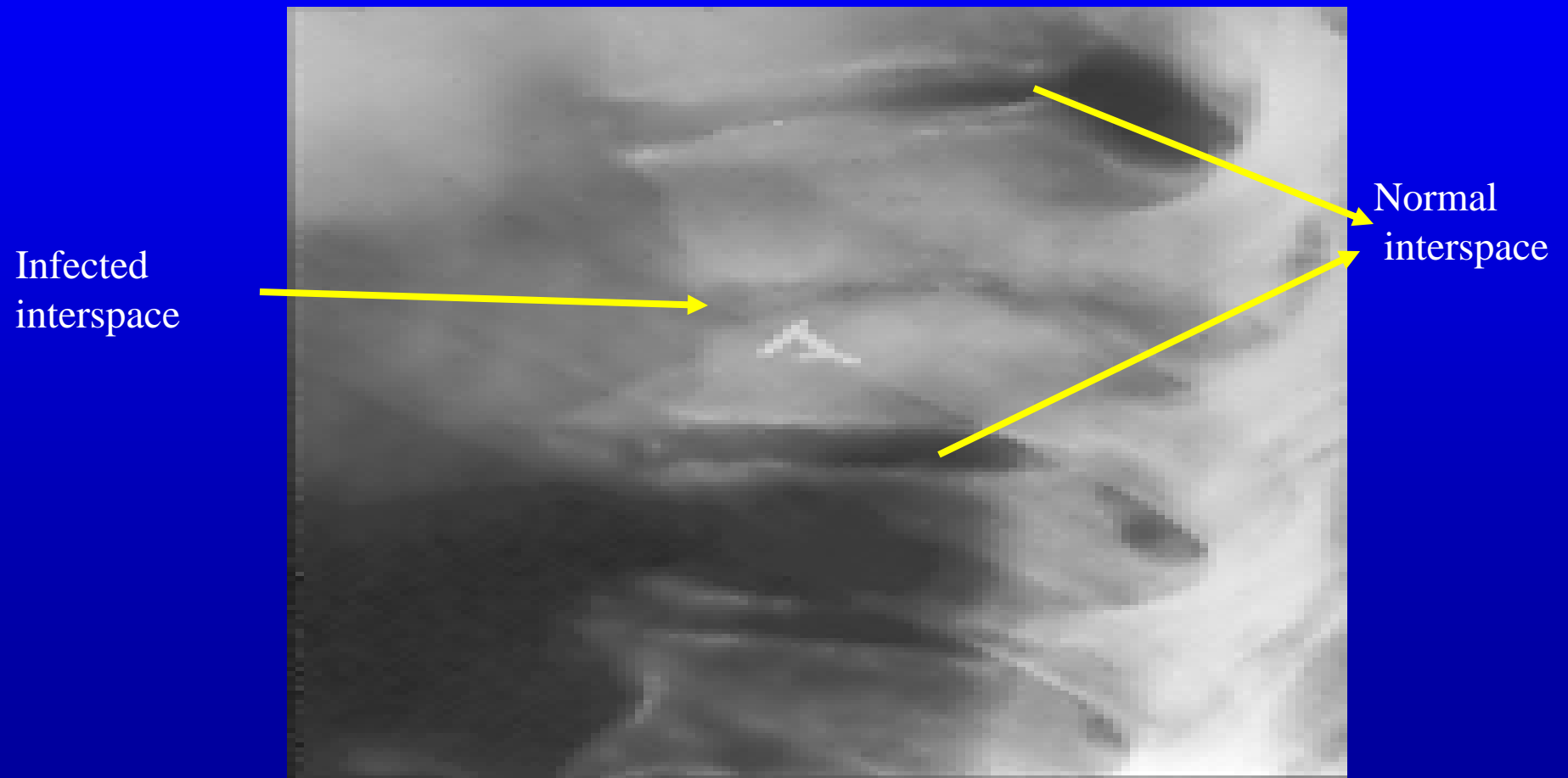
Anterior longitudinal ligament
Posterior longitudinal ligament



Anterior longitudinal ligament
Posterior longitudinal ligament



Vertebral Osteomyelitis after open Biopsy



MRI Vertebral Osteomyelitis with Resultant Kyphosis



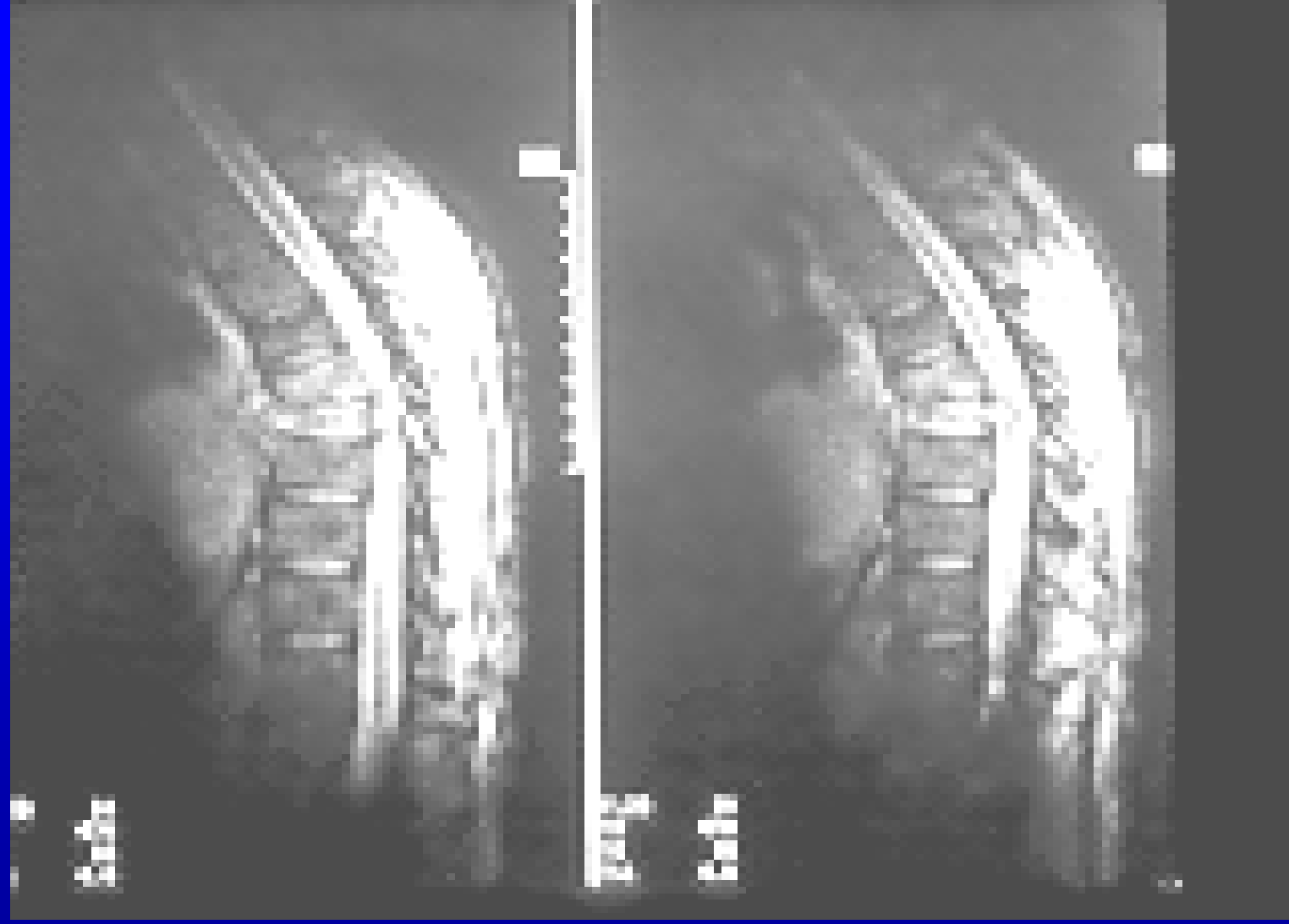
Vertebral Osteomyelitis

- Age > 50% are > 50 years-old
- Clinical presentation: Insidious onset
 - Local pain 92%
 - Local tenderness, limited range motion
 - Temp 100°F 52%
 - Atypical local symptoms: Retropharyngeal mass, pleurisy-effusion, abdominal pain, lancinating leg pain

*Evaluation of Patients With Suspected Vertebral Osteomyelitis**

Test	Number of Patients [%]		Comment
	Sensitivity (TP/TP+FN)	Specificity (TN/TN+FP)	
Plain radiogram	36/69 [51]	8/14 [57]	Not sens/spec
Tc bone scan	79/100 [79]	30/41 [73]	Not specific
Gallium scan	44/50 [88]	8/8 [100]	Combine with bone scan; use spect
In-WBC	14/46 [30]	51/52 [98]	Low sensitivity-lesion may be photopenic
CT	41/54 [76]	----	Use to guide biopsy
MRI	56/57 [98]	13/14 [93]	Identifies local complications

*Compiled from 7 studies



Causative Organisms in 255 Episodes of Vertebral Osteomyelitis In 253 Patients[#]

Causative Organism(s)	No. of Episodes (%)
<i>Staphylococcus aureus</i>	123 (48)
Coagulase-negative staphylococci	17 (7)
Gram-negative bacilli	59 (23)
Streptococci	24 (9)
Polymicrobial infection	20 (8)
Miscellaneous*	12 (5)

[#]Excludes culture negative cases (often 15% or series)

**N. asteroides*, *P. acnes*, *B. melitensis*, MAI, *N. Meningitidis*, *Bacillus* species, *Corynebacterium JK*, *Candida*, and *L. monocytogenes*

REMEMBER: *M.Tbc*, fungi/yeast, *Brucella* if epidemiology is suggestive
McHenry, CID 2002; 34:1342-1350.

Treatment of Vertebral Osteomyelitis

- Antibiotics

Relapse rates 15% with 6 weeks

Prefer \geq 8 weeks of Rx

- Immobilization

Bed Rest until pain allows then mobilization with support. **Pain persist and may even increase with mobility**

- Surgery in 40 %

For abscess, cord sx, stabilize spine, failed medical therapy

Corpectomy and Titanium Cage Placement for Vertebral Osteomyelitis 2001-2005

- 15 pts –corpectomy with cage and rhBMP-2 plus moreclized auto or allograft. 2 level 13 pts and 6 level 1 pt
- 9 S. aureus, 2 CNS, 1 peptostrep, Cocci, Candida, Tbc each
- 7 epidural abscess, 6 myelopathy, severe kyphosis
- Fusion in all cases
- At least 6 weeks antibiotics, long term suppression ???
- Surgery: neuro deficit, spinal deformity/instability, SEA, persistent pain /antibiotic failure, soft tissue abscess
- No pus - One step anterior debridement-fusion
- Purulent site-anterior debridement-immobilization-delayed secondary debridement-anterior fusion after 7-14 days antibiotic therapy.

Aryan et al J Neurosurg Spine 2007;6: 23-30

***Propionibacterium acnes* Vertebral Osteomyelitis**

Nine cases – 2 or more positive cultures*

Not implant related

Variable	
Prior surgery	6
Days of symptoms	135 (44-474)
Temp (max) @ Dx	37.4 (36.9-38.5)
WBC @ Dx	9.1 (6.1-14.8)
Median ESR @ Dx	9 (6-115)
CT/MRI negative	5
Treatment (β -lactam or Vanco)	42 days (28-50)
Debridement \pm fusion	5
Relapse (with implants)	2 (2.5; 4.5 yrs)

***Anaerobic media exclusively 8/9 pts; all penicillin-susceptible
Kowalski, et al., Clin Ortho Rel Res 2007; 461:25-30.**

Candida Vertebral Osteomyelitis

- **Risk:** Candidemia, IVDA (22%)
- **Symptoms/Signs, Onset, Labs, Imaging:** similar to vertebral osteo in general
- **Organisms:** C.albicans (62%), tropicalis (19%), glabrata (14%)

Miller and Mejicana, CID 2001; 33:523

Candida Vertebral Osteomyelitis

- **Results** (43% surgery, 57% antifungals only)
 - 85% cured
 - 15% mortality - not attributable
- **Recommend:**
 - Ampho B 0.5-1.0 mg/kg/d x 4-6 weeks
 - Followed by azole 2-6 months
 - Role of the echinocandins not known

Miller and Mejicano, CID 2001; 33:523.

Imaging in Follow-Up of Spine Infection

- Bone changes persist / may worsen @ 3 mos – infection evolution, not failure, check ESR/CRP
- Soft tissue changes on MRI at 4-8 wks, prognostic information

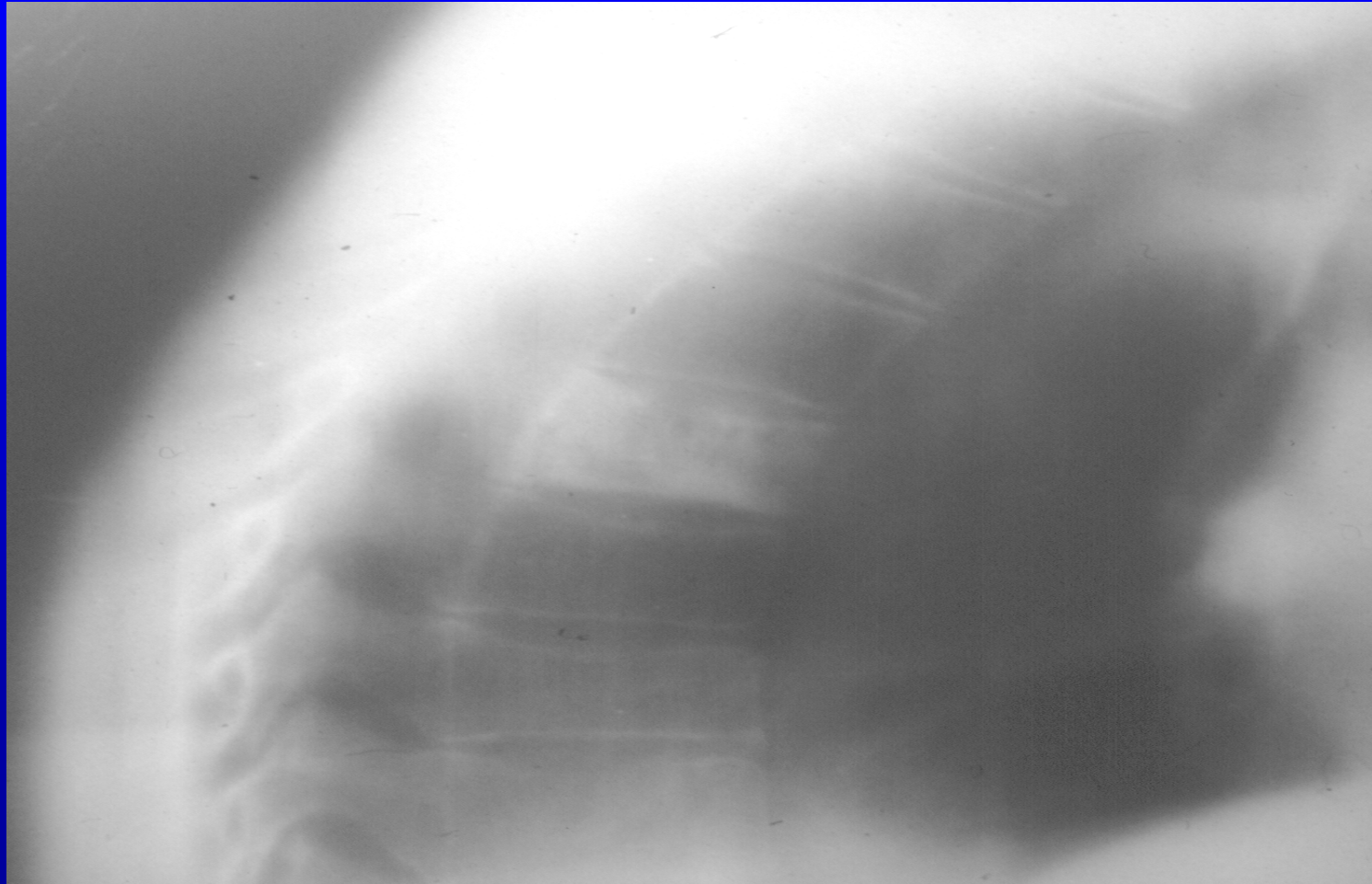
	<u>Clin Cure</u>	<u>Micro Cure</u>
Improved (n=27)	100%	100%
Equivocal (n=38)	78%	89%
Worse (n=14)	29%	56%

- Inflammatory marker modify prognostic import

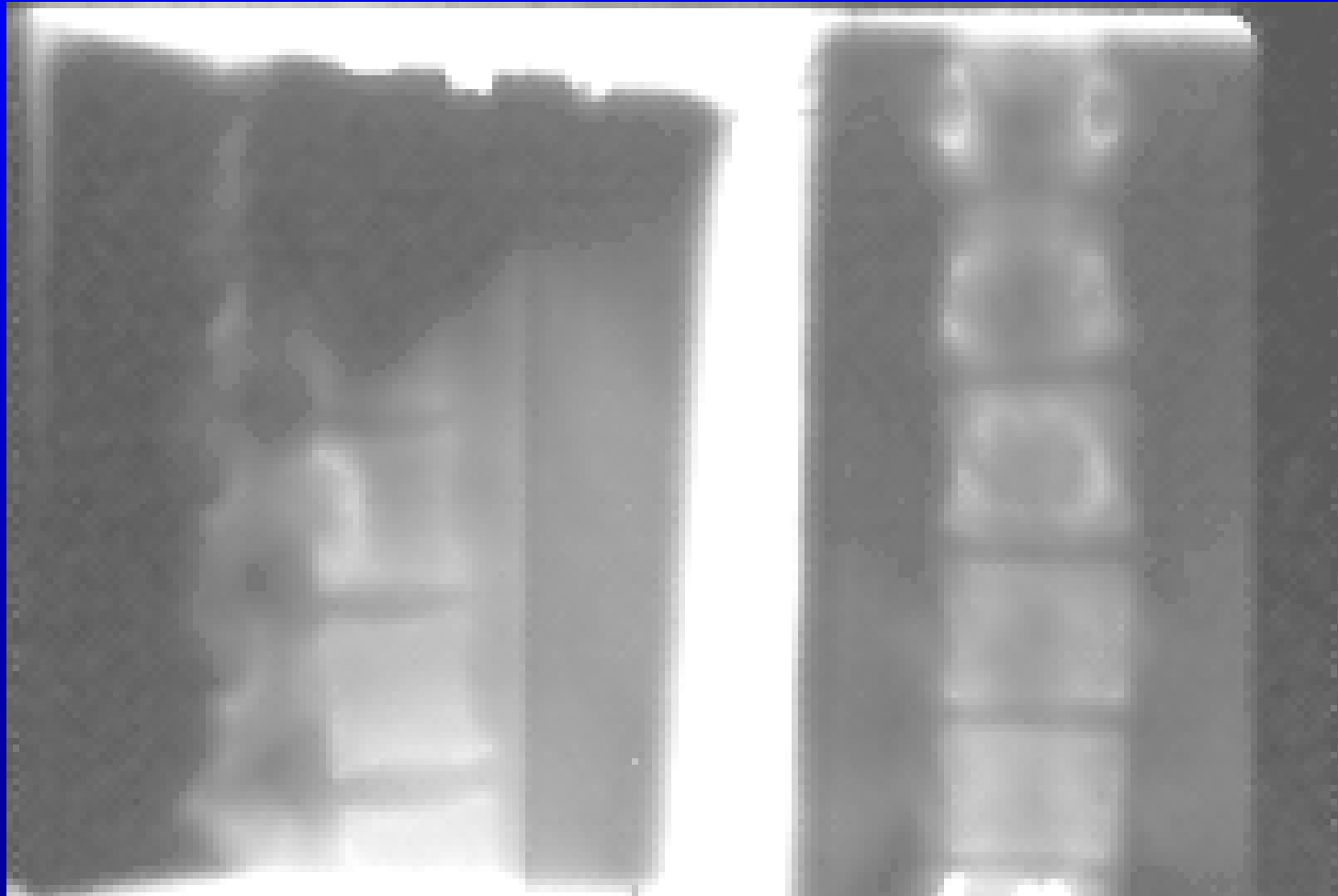
Zarrouk, et al., Rheum 2007; 46:292-295.

Kowalski, et al., CID 2005; 43:172-178.

Back pain and fever - Is this vertebral osteomyelitis



Back pain and pathologic dx of osteo – is dx correct



Does the patient have Osteomyelitis

1. Yes
2. No

CASE 2a

- 57 y/o woman with **diabetes** (Type 1) with foot ulcer, MSSA bacteremia **Feb 2004**
- **March 2004** back pain, CT c/w vertebral osteomyelitis and discitis @T10-11
- Treated with nafcillin but increased LFTs, so changed to vancomycin 1 g q12h
- **April 2004** back surgery, debridement, metallic cage placed, cultures MSSA
- Continued vancomycin, trough 15 - 17ug/ml
- Persistent back pain, low grade fever
- ESR 84 → 30 CPR 18.9 → 6.4

CASE 2b

- **May 2004** readmitted with worsening back pain
- Sporadic fever, ESR 30 → 63, CRP 10.4
- Blood culture sporadic positive MSSA
- LFT mild increase AST, increased Alk phos
- MSSA from blood had vancomycin MIC 4-8 µg/ml
- Ortho spine surgery concerned that spine is unstable at T10-11

Case 2c

You advise:

- 1) Remove device restart nafcillin
- 2) Retain device, continue vancomycin and add rifampin
- 3) Retain the device treat with daptomycin 6mg/kg plus rifampin
- 4) Retain the device restart nafcillin then add rifampin

CASE 2d

- Reinitiated nafcillin May 2004 to July 2004
- Stable LFT's
- Initiated rifampin 600 mg qd June 2004
- D/C Nafcillin, levofloxacin 500 qd p.o. August 2004, rifampin continued
- August 2004 pain improved
- ESR 30 → 18, CRP 11.3-0.8
- Stopped rifampin December 2004 (6 mos)
- Levofloxacin or moxifloxacin continued
- D/C All antibiotics June 2006

CASE 2e

- All antibiotics stopped June 2006
- Total therapy :
 - IV nafcillin or vanco 2 mos
 - IV nafcillin plus oral rifampin 2 mos
 - Levoflox plus rifampin orally 6 mos
 - Levoflox or moxifloxacin 1.5 yrs
- F/U – no back pain, doing well

Case 3a

- 43 y/o woman with draining R flank sinus
- In 1977 Harrington rods inserted in thoracic/lumbar spine for scoliosis, revised in 1999. No complications.
- Did well 2005 noted lump R posterior flank. Non tender, no constitutional Sx nor musculoskeletal symptoms
- March 2006 local trauma to R flank, mass became red, tender, aspirated pus, culture neg.
- I and D cultures *E. faecalis* (sens Amp, Vanc, not HL resist gent) Rx with Vanco/gent x 1 wk then Vanco x 2.5 mos. Partial healing but persisting sinus with drainage

Case 3b

- In **July 06**, reevaluate, MRI cystic mass below sinus extending toward spine. Explored and debrided. Cultures including special cultures (held abtics 24 hrs) neg. Rx Dapto 6mg/kg and rifampin 600 qd. For 3 months. Sinus persisted, brief flare constitutional symptoms
- **Nov 06** had persisting sinus, debrided track to rods, pus along the rods, packed open, treated dapto and rifampin, healed but sinus persisted in flank.
- **1/29/07** on dapto/rif with persisting sinus, no constitutional sx. Exam nl except sinus. WBC 6900, Hgb 11.2 Plate312, ESR 31 CRP 11.3 mg/dl, Creat 0.8

Case 3c

You advise:

- 1) Debride soft tissue sinus, treat pen/genta x 6 wks then long course amoxicillin orally**
- 2) Debride soft tissue, treat with vanco/gent then oral amoxicillin**
- 3) Debride and remove rods at origin sinus track, pen/gent x 6wks followed by amoxicillin orally**
- 4) Debride and remove all rods/screws, treat pen/gent x 6wks then amoxicillin orally**

Microbiology Spine Implant Infection

Microbiology	Early* (N=30)	Late† (N=51)
S aureus	13	15
Coag-neg staph	6	13
Gram-neg bacilli	10	1
Streptococci	5	11
Peptostreptococci	2	1
Corynebacteria	2	2
P acnes	2	9
Candida	---	3
Lactobacillus	---	1
Culture negative	1	8

*7 polymicrobial.

†12 polymicrobial.

Kowalski et al. CID 2007;44(April 1).

Outcome of Early Spine Implant Infection

Total		30
Implant removed		1
Antibiotics only		1
Debride - retain- antibiotic – no suppression		6
Fail		5 (83%)
Debride – retain – antibiotic - suppression		22
Fail		5 (23%)
Non-failure		17
On suppression		7
Off suppression 468 d (169-687)		10
Antibiotic therapy	IV 41 d (27-43)	
	Oral 303 d (147-672)	

Kowalski et al. CID 2007;44(April 1).

Outcome of Late Spinal Implant Infection

Total		51
Antibiotics only		6
Failed		4 (67%)
Debride – retain – antibiotics		13
Suppressed - failed/total		4/8
Non-suppressed - failed/total		3/5
Debride – remove – antibiotics		32
Failed		7 (22%)
New implant -cured		10
Cured		15
Antibiotic therapy		
IV 42 d (36-44)		
Oral 410 d (61-667)		

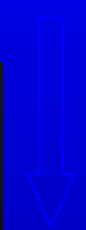
Kowalski et al. CID 2007;44(April 1).

Prosthesis Sonication Provides Increased Sensitivity for Prosthetic Joint Infection

Add 400 ml
Ringer's
Solution
(laboratory)



Prosthesis
Placed in
Container
(operating room)



Vortex
30 sec



Sonicate
5 min



Vortex
30 sec



0.5 ml
Aerobic &
Anaerobic
Culture
Plates

Sonication of Removed Hip and Knee Prostheses for Diagnosis of Infection (Aseptic Failure 252; PJI 79)

	Cultured Material		
	Sonicate*	Tissue**	Synovial Fluid
Sensitivity (%)	78.5	60.8	56.3
Specificity (%)	98.8	99.2	98.1

14/79 sonicate only positive: CN Staph 5, S. aureus 3, Enterococcus 2, Strep 1, Candida 1, Proprionibacteria 2

17 sonicate negative

*** > 5 CFU/plate; ** = 2 specimens positive**

PERFORMS BEST IF OFF RX 14 DAYS

Trampuz, et al., NEJM 2007; 357:654.

Spinal epidural abscess due to Brucella

Osteo

Abscess

SAGITAL T1POSTFS
C: 10ML MAGNEVIST
Sec: 13/14
Im: 5/21
Seq: L3.4 (300)

256 x 224

1948 Jun 12 F 1807766
Acq: 10125992
2006 Dec 15
AcqTm: 17:33:06

A

P

ET: 3
TR: 500.0
TE: 8.4
USC512
3.0hkr/0.0cp
Lin
W: 2255 L: 196

h

DF09: 22.0 x 21.9cm

Spinal Epidural Abscess

Review of 915 Patients 1954-97

- Any age – 70% between 31-70 years
- **Pathogenesis** : hematogenous seeding, contiguous spread, direct introduction.
- **Pathology**: pressure injury vs vascular injury with infarction
- **Clinical stages** (Heusner -1948 NEJM): stage I- back pain, stage II - meningeal irritation/radiculopathy, stage III- weakness stage IV- paresis/paralysis

Spinal Epidural Absces

Review of 915 Patients 1954-97

- **Other Sx** – Back pain 75%, fever 66%, other site of infection or comorbidity
- Increased WBC, ESR, CRP commonly
- Most common thoracic and lumbar –any segment. Often 1-2 segments but can be extensive (posterior space not segmented)
- **Dx** : high index of suspicion
CT with contrast + myelography
MRI with gad – 90% sensitivity

Reihsaus et al . Neurosurg Rev 2000; 232: 175

Spinal Epidural Abscess

Microbiology

Organism	Number (%)
S. aureus	551 (72)
Coag neg Staph	35 (5)
S. pneumoniae/pyogenes	19 (2)
Other streptococci	41 (5)
Enterobacteriaceae	38 (5)
Anaerobic GNR	5 (.5)
Mixed	27 (3)
Other (P. aeruginosa, M. tbc)	34 (5)
Fungi	13 (2)

Sterile - 61 (8%) –prior Rx Reihnsaus et al . Neurosurg Rev 2000; 232: 175

Spinal Epidural Abscess

Treatment and Outcome

- **Antibiotics plus surgical – 567/639 (89%)***
- **Antibiotic alone – 72/639 (11%)***
- **Antibiotics plus surgery (28) vs Antibiotic alone (25) - outcome similar****
- **Outcome (1991-97) relates to neurologic status at dx and duration of status: full recovery 41%, mild residual 29%, paresis/paralysis 16%, death 15%***

•Reihsaus et al . Neurosurg Rev 2000; 232: 175.

•**Siddiq et al Arch Int Med 2004;164:2409-12

Spinal Epidural abscess

Candidates for Medical Therapy

- **Know microbiology and have effective tolerable antimicrobial**
- **Stage I or II clinically**
- **MRI suggest - no loculated pus, but “phlegmon”**
- **Mass effect is limited**
- **Location over the cauda equina**
- **Extensive number of segments involved**
- **Comorbidity precludes surgery**