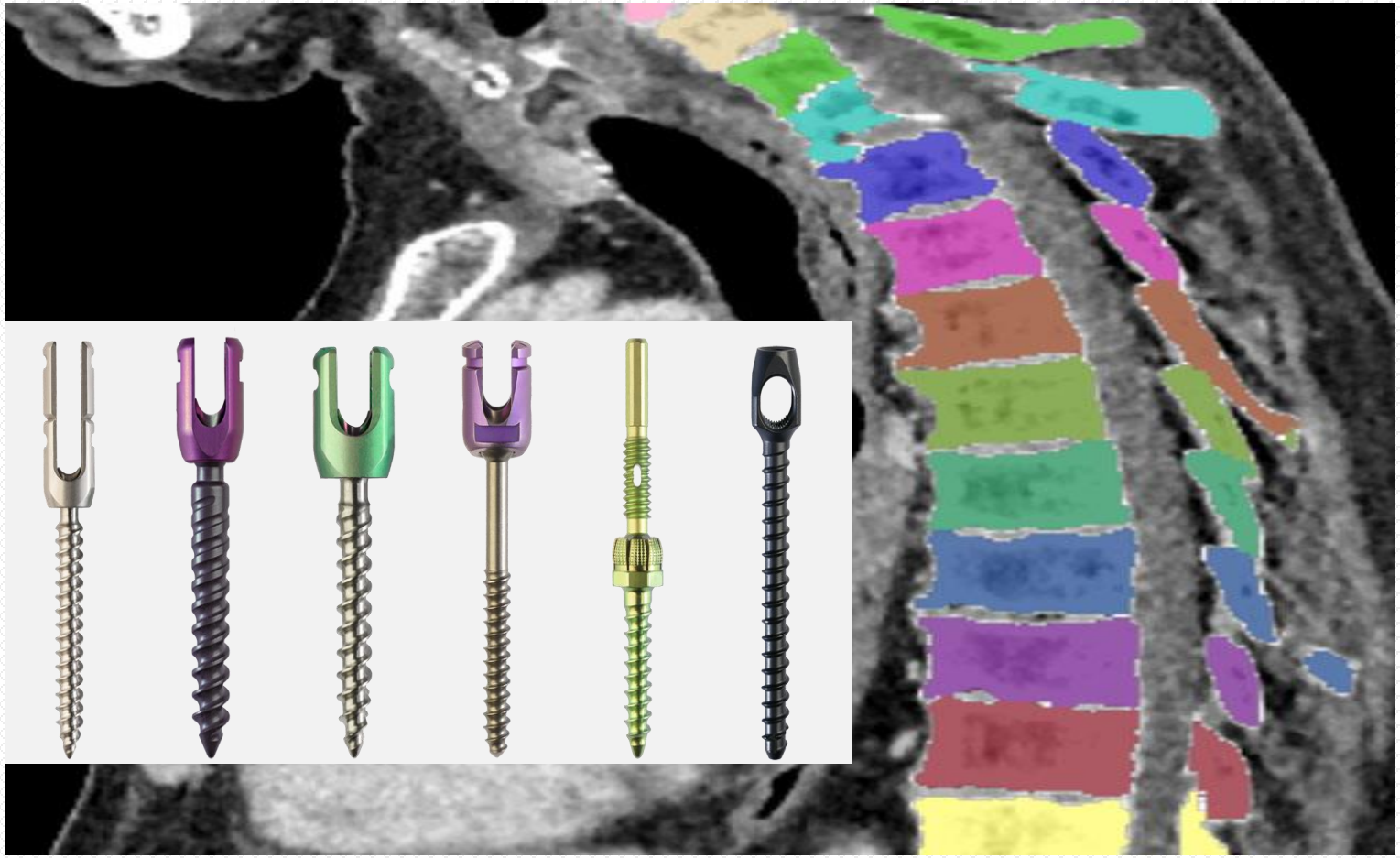
Spondilodiskite güncel yaklaşım



Dr. Süheyla Kömür

ÇÜTF Klinik Mikrobiyoloji ve Enfeksiyon Hastalıkları AD

EKMUD 2022

Review Article on Postoperative Spinal Implant Infection

Antibiotic treatment of postoperative spinal implant infections

Yannick Palmowski[1], Justus Bürger[1], Arne Kienzle[1,2], Andrej Trampuz[1]

[1]Charité-Universitätsmedizin Berlin, Corporate Member of Freie Universität Berlin, Humboldt-Universität zu Berlin, and Berlin Institute of Health, Center for Musculoskeletal Surgery, Berlin, Germany; [2]Laboratory of Adaptive and Regenerative Biology, Brigham & Women's Hospital, Harvard Medical School, Boston, MA, USA

Contributions: (I) Conception and design: Y Palmowski; (II) Administrative support: A Trampuz; (III) Provision of study materials or patients: Y Palmowski, A Trampuz; (IV) Collection and assembly of data: Y Palmowski; (V) Data analysis and interpretation: All authors; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Dr. med. Yannick Palmowski. Center for Musculoskeletal Surgery, Charité-Universitätsmedizin Berlin, Chariteplatz 1, D-10117 Berlin, Germany. Email: yannick.palmowski@charite.de.

Abstract: Postoperative spinal implant infection (PSII) is a serious complication after spinal surgery. It is associated with increased morbidity and mortality for affected patients as well as significant costs for the healthcare system. Due to the formation of biofilm on foreign material, both diagnosis and treatment of PSII can pose a considerable challenge. Modern treatment protocols allow efficient eradication and good clinical outcomes in the majority of patients. In this article, we review the current antibiotic treatment concepts for PSII including the correct choice of antibiotics and their combination. In cases of late-onset PSII where the implants can be removed, two weeks of intravenous (IV) antibiotics followed by 4 weeks of oral antibiotics seem appropriate. If the implant needs to be retained, a 2-week IV antibiotic treatment should be followed by 10 weeks of oral antibiotic therapy with biofilm activity or, in case of problematic pathogens, a long-term suppression therapy. Initial empiric antibiotic therapy should cover staphylococci, streptococci, enterococci and Gram-negative bacilli as the most common pathogens. Antibiotic adjustments according to the type of pathogen and its antimicrobial susceptibility are essential for successful eradication of infection.

Keywords: Postoperative spinal implant infection (PSII); implant-associated infection; antibiotic treatment; spondylodesis

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Pocket Guide to Diagnosis & Treatment of Spinal Infections

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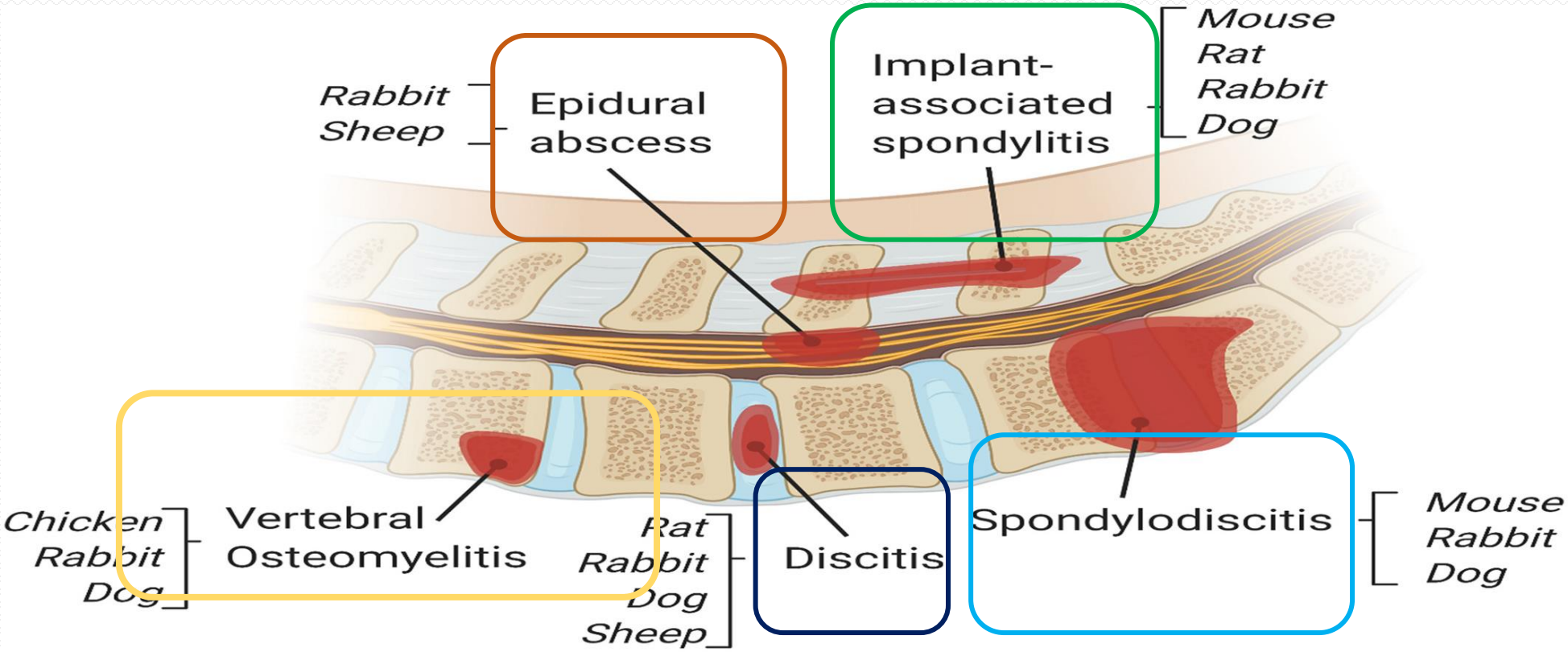
IDSA GUIDELINE

2015 Infectious Diseases Society of America (IDSA) Clinical Practice Guidelines for the Diagnosis and Treatment of Native Vertebral Osteomyelitis in Adults[a]

Tanım


Rabbit
Sheep
Epidural abscess
Implant-associated spondylitis
Mouse
Rat
Rabbit
Dog
Chicken
Rabbit
Dog
Vertebral Osteomyelitis
Rat
Rabbit
Dog
Sheep
Discitis
Spondylodiscitis
Mouse
Rabbit
Dog

Epidemiyoloji

- >50 yaş
- E>K
- Tüm osteomiyelitlerin %5'i
- İnsidansı artmakta
  - 2.2/100.000----1995
    5.8/100.000-----2008*
  - 6.5/100.000**

*Kehrer M. J Infect, 2014.
**Babic M. Infect Dis Clin N Am, 2017.

Olgular artıyor

- İntravasküler cihaz/ spinal implant sayısında artış

(yeni vakaların üçte biri)

- Populasyonun yaşlanması
- Renal replasman tedavisi alan hasta sayısında artış
- Diyabet
- İnfektif endokardit
- Kortikosteroid
- İmmünsüpresif tedavi alan hasta sayısında artış
- Daha çok tanı…

Güncel risk faktörleri!!!
Alternatif tıp uygulamaları sorgulanmalı

ORIGINAL RESEARCH

Spondylodiscitis complicating infective endocarditis

Andreina Carbone ,[1] Audrey Lieu,[2,3] Basile Mouhat,[1] Francesco Santelli,[4] Mary Philip,[1] Yohann Bohbot,[2,3] Laetitia Tessonnier,[5] Fanny Peugnet,[2,3] Antonello D'Andrea,[6,7] Serge Cammilleri,[5] Quentin Delpierre,[2,3] Frédérique Gouriet,[8,9] Laurence Camoin-Jau,[9,10] Mesut Gun,[2,3] Jean-Paul Casalta,[8,9] Alberto Riberi,[11] Frederic Collart,[1] Hélène Martel,[1] Florent Arregle,[1] Eric Guedj,[5] Didier Raoult,[8,9] Michel Drancourt,[8,9] Christophe Tribouilloy ,[2,3] Gilbert Habib [1,9]

- İE olgularında sıklığı %8.5-11.5

SP olanlarda;
- ileri yaş
- HT
- Otoimmün hastalık
- Enterokok ve *Streptococcus gallolyticus* daha sık

Postoperatif spinal implant ilişkili enfeksiyonun sıklığı

- % 0,5-10 (1)
- %20 (2)
- Revizyon omurga cerrahilerinde postoperatif spinal implant enfeksiyonu (PSII) %27 (3)

1. Haddad S , Núñez-Pereira S , Pigrau C , Rodríguez-Pardo D , Vila-Casademunt A , Alanay A , et al. The impact of deep surgical site infection on surgical outcomes after posterior adult spinal deformity surgery: a matched control study. Eur Spine J 2018;27:2518–28 .
2. Baranowska A, Baranowska J, Baranowski P. Analysis of Reasons for Failure of Surgery for Degenerative Disease of Lumbar Spine. Ortop Traumatol Rehabil 2016;18:117-29.
3. Sampedro MF, Huddleston PM, Piper KE, et al. A biofilm approach to detect bacteria on removed spinal implants. Spine (Phila Pa 1976) 2010;35:1218-24.

Erken tanı ve tedavi morbidite ve mortaliteyi azaltmakta

Complications of vertebral osteomyelitis

Short-term complications	Longer-term complications
▪ Epidural abscess, subdural abscess, meningitis ▪ Paraspinal abscess and extension (including psoas, retropharyngeal, mediastinal, subphrenic, retroperitoneal abscesses, or empyema) ▪ Extension of infection involving the aorta and/or vena cava ▪ Spinal cord and/or nerve root impingement with neurological consequences ▪ Vertebral body collapse ▪ Endocarditis*	▪ Residual neurological deficit(s) ▪ Chronic back pain ▪ Depression

* In general, vertebral osteomyelitis is a complication of bacteremia; associated endocarditis may or may not be present.

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Sorunlarımız

- Tanı---
- Tedavi kararı
- Tedavi süresi
- Cerrahi kararı
- Takip

Tanı : Spinal enfeksiyon şüphesi:

Yeni/şiddetlenen bel ağrısı ve aşağıdaki durumlar varsa

- Ateş
- İntravenöz araç veya hemodiyaliz
- Yeni geçirilmiş bakteriyemi
- Endokardit
- İntravenöz ilaç kullanımı
- Yeni gelişen nörolojik defisit

Berbari et al. Clin Infect Dis, 2015

Fizik muayene bulguları

- Enfekte disk aralığı ağrısı perküsyonla ↑
- Paravertebral kas hassasiyeti ve spasmı
- Omurga hareketlerinde kısıtlılık
- Spinal kord ve sinir kök basısı, menenjit

253 bakteriyel VO olgu serisinde % 43 oranında epidural ve paravertebral uzanım görülmüş

McHenry MC et al, Clin Infect Dis 2002:34;1342-50

İnflamatuvar belirteçler

- ESR CRP yüksekliği duyarlılık % 94-100
- Lökosit % 40 normal
- Tedaviye yanıtı değerlendirmede **CRP** ESR'den daha duyarlıdır. ESR uzun süre yüksek kalabilir

Lab		PVO	BVO	TBC VO
Lökosit	<10.000 mm3	8613	7100	7650
ESR	< 20 mm/saat	73	50	79
CRP	< 6 mg/L	46	55	69

Siemionow K et al, Cleve Clin J Med 2008:73;557-66
Lensen AG et al Arch Intern Med 1998,158:509-17
Turunc T et al, J of Infect 2007:53:158-163

Kan kültürü

- Kan kültürü pozitifliği daha invazif girişim ihtiyacını azaltabilir
- Pozitif kan kültürü % 30-78 (ortalama % 58)
- Kan kültürü en az iki set alınmalıdır (aerop + anaerop)

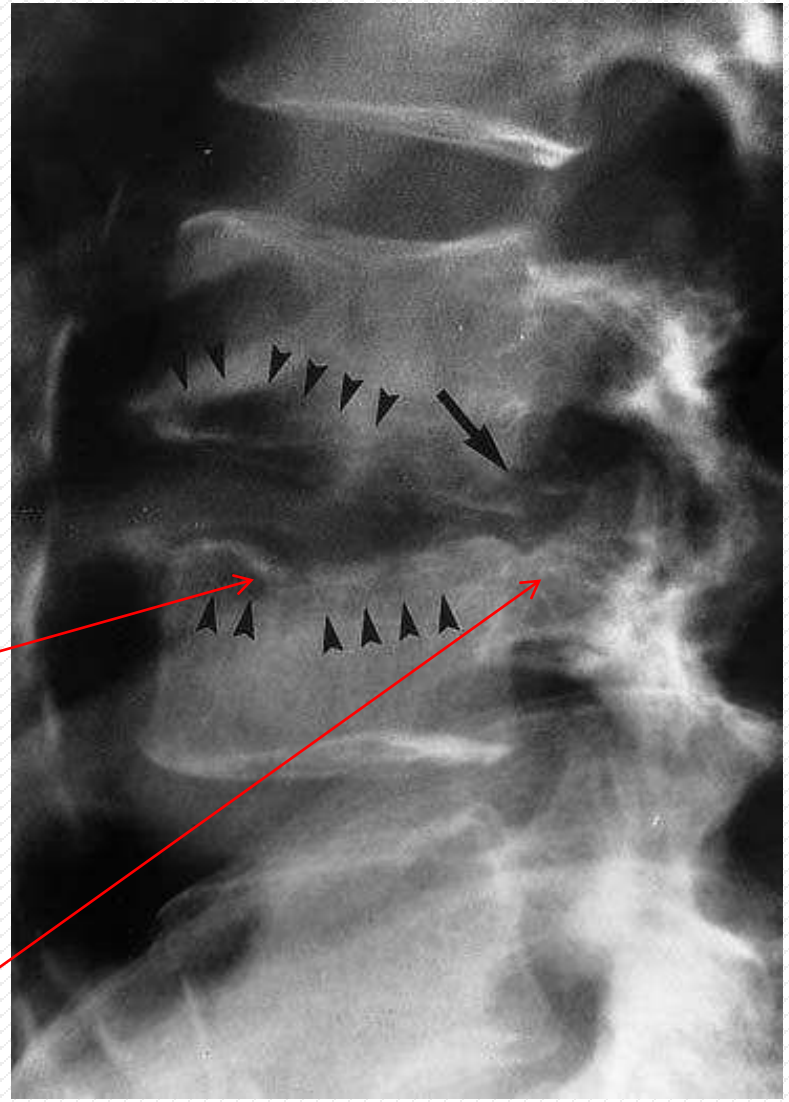
Mylona E et al, Semin Arthritis Rheum 2009;19:10-7

Radyoloji

- Radyografi kemik destrüksiyonu semptomların başlangıcından 3-6 hafta sonra görülür
- Duyarlılık erken akut osteomiyelitte düşük
- Endplate düzensizliği

Disk aralığında daralma ve vertebra gövdelerinde destrüksiyon

Spinal kanala posterior bölgeden uzanan enfeksiyon



Jevtic V Eur Radiol 2004;14:E43-E52

MRI tanı için en uygun radyolojik yöntem

- MR vertebral osteomiyelit tanısında ilk tercih edilecek görüntüleme yöntemi olmalıdır
- Duyarlılık % 97
- Özgüllük % 96
- Doğruluk % 94

- Gadolinium (Gd-DTPA): epidural yada paravertebral apse tespit etmede özgüllüğü arttırır

- VO şüphesinde ilk MR yeterli bilgi sağlanamazsa 1- 3 hafta sonra tekrar edilmesi önerilir

PET BT

- Kronik osteomiyelit tespit etmede çok duyarlı

Negatif PET BT

↓

Vertebral osteomiyelit tanısı dışlamaya yeterlidir

TANI: Klinik + Görüntüleme + Mikrobiyoloi/Histoloji

DEFINITION

Vertebral osteomyelitis is confirmed, if the following 3 criteria are fulfilled:

Investigation	Criteria
Clinical features	Acute or chronic back pain
Imaging	Computed tomography (CT) or magnetic resonance imaging (MRI) consistent with vertebral osteomyelitis
Microbiology or Histology	Microbial growth in blood culture or vertebral tissue[1] Acute or chronic inflammation in vertebral tissue

POSTOPERATİF SPİNAL İMPLANT İNFEKSİYONU

	KRİTERLER
KLİNİK ÖZELLİKLER	• Yara iyileşmesinde gecikme veya sinüs traktı(fistül) • İmplant çevresinde pürülan görünüm
HİSTOLOJİ	• Peri-implant dokuda enflamasyon

MİKROBİYOLOJİ	• Anlamlı mikrobiyal üreme*;
	  • ≥2 pre-implant doku örneği
	  • Sonikasyon sıvısı (≥50 CFU/ml)

Kriterlerden 1 tanesinin olması yeterli

* Yüksek derecede virülan organizmalar (örn. *Staphylococcus aureus*, *Escherichia coli*, streptococci) veya antibiyotik alan hastalar için; bir pozitif peri-implant doku örneği veya sonikasyon sıvısında < 50 CFU/mL anlamlıydı. Mikrobiyolojik olmayan bir kriter yerine getirildiyse, üreme yok olarak kabul edildi.

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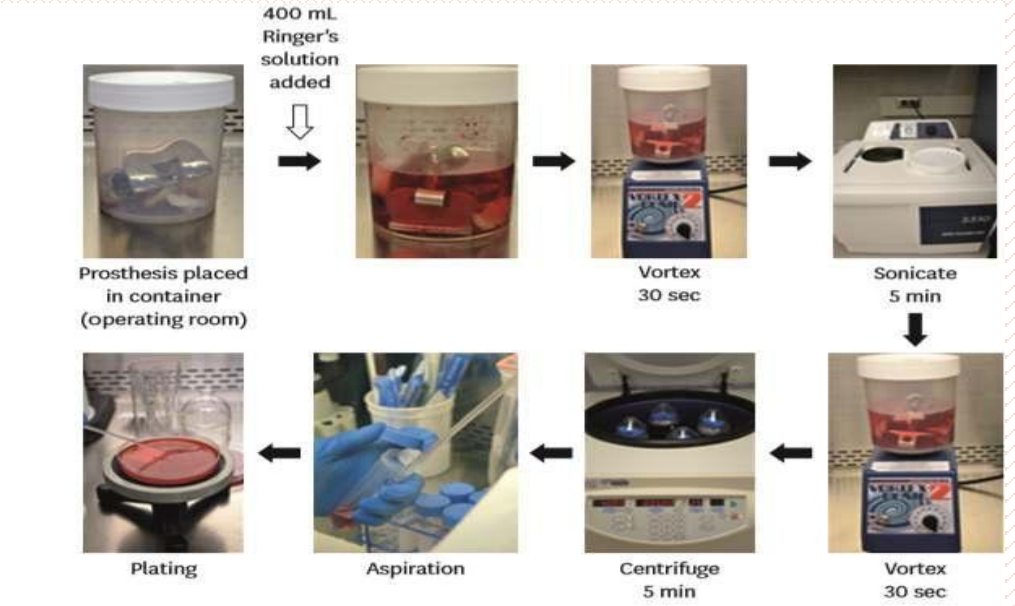
SONİKASYON

- Ses dalgaları kullanılarak enfekte protezde bulunan biyofilm tabakasının parçalanması sağlanır
- Böylece enfeksiyona neden olan mikroorganizmanın kültürde üreme oranı artırılır



Genellikle monomikrobiyal bakteriyel enfeksiyon
S. aureus en sık patojen bir çok seride>%50 (%20-84)

Enterobacteriaceae (%7-33)	*E coli* en sık ÜSE ilişkili, Proteus, Klebsiella Enterobacter
S. viridans ve enterokok (%5-20)	İE' le ilişkisi *S aureus'a* göre daha yüksek (%26 ve %3)
KNS (%5-16)	İntra kardiyak alet ilişkili bakteriyemi ve post op enfeksiyonlardan sorumlu
P aeruginosa nadir	İnravasküler kaynaklı sepsis ve IVDU
Anaeroblar (%4)	*Cutibacterium acnes* implant ilişkili enf da sık, B fragilis ve diğer anaeroblar komşuluk yoluyla (pelvik , intra abdominal enfeksiyonlardan
Salmonella enfeksiyonu nadir	Sıklıkla orak hücre anemisi ve daha nadir mikotik aort anevrizması olanlar

J Antimicrob Chemother 2010; 65 Suppl 3: iii11 –24
Joint Bone Spine 2001; 68: 504–9
QJM 2001; 94: 465–70

INVESTIGATION OF PRIMARY FOCUS

Pathogen		Primary focus	Investigation
Staphylo-coccus spp.	*S. aureus*	• Skin lesions/furunculosis • Endocarditis • Primary bacteremia	• Skin examination • Blood cultures • Transesophageal echocardiography (TEE)
	Coagulase-negative staphylococci	• Intravascular implant • Endocarditis	• Blood cultures, TEE • Intravascular implant in situ?
Strepto-coccus spp.	Viridans group (*S. mitis/oralis*)	• Oral cavity • Endocarditis	• Orthopantomogram • Blood cultures, TEE • Recent dental procedure?
	S. agalactiae, *S. dysgalactiae*	• Abdomen • Urogenital tract • Skin • Oral cavitiy	• Imaging of abdomen/pelvis • Urinalysis • Skin examination • Orthopantomogram
	S. gallolyticus (formerly *bovis*)	• Colon carcinoma /adenoma	• Colonoscopy
Entero-coccus spp.	*E. faecalis,* *E. faecium*	• Abdomen • Urogenital tract • Endocarditis	• Imaging of abdomen/pelvis • Urinalysis • Blood cultures, TEE
Gram-negative rods	*E. coli,* *Klebsiella,* *Enterobacter* spp.	• Abdomen • Urogenital tract	• Imaging of abdomen/pelvis • Urinalysis • (Colonoscopy)

Lee et al. BMC Infectious Diseases (2016) 16:735
DOI 10.1186/s12879-016-2071-4

BMC Infectious Diseases

RESEARCH ARTICLE Open Access

Comparison of gram-negative and gram-positive hematogenous pyogenic spondylodiscitis: clinical characteristics and outcomes of treatment

Ching-Yu Lee[1,5,7], Meng-Huang Wu[6,7], Chin-Chang Cheng[1,5,7], Tsung-Jen Huang[6], Tsung-Yu Huang[2], Chien-Yin Lee[1], Jou-Chen Huang[3,4] and Yen-Yao Li[1,5*]

- Gram negatif etken
  - Kanser öyküsü daha fazla,
  - İleri yaşta
  - ÜSE öyküsü
  - Konsititüsyonel semptomlar

  Prognoz açısından fark yok

- Gram pozitif etken
  - Epidural apse
  - İlgili spinal bölgede ağrı

Etken dağılımı

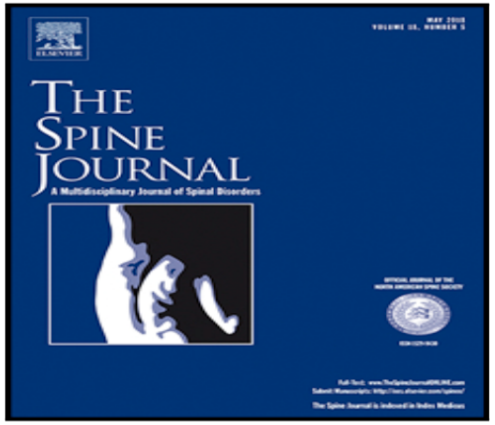
Comparison of Pyogenic Postoperative and Native Vertebral Osteomyelitis

Uh Jin Kim MD , Ji Yun Bae PhD , Seong-Eun Kim PhD , Chung-Jong Kim PhD , Seung-Ji Kang PhD , Hee-Chang Jang PhD , Sook In Jung PhD , Kyoung-Ho Song PhD , Eu Suk Kim PhD , Hong Bin Kim PhD , Wan Beom Park PhD , Nam Joong Kim PhD , Kyung-Hwa Park PhD

PII: S1529-9430(18)31251-8
DOI: https://doi.org/10.1016/j.spinee.2018.11.012
Reference: SPINEE 57835

To appear in: *The Spine Journal*

Received date: 6 April 2018
Revised date: 20 November 2018



- Postoperatif VO'da tedavi başarısızlığı, relaps daha fazla
- MRSA oranı daha yüksek

Spondilodiskitli hastaya klinik yaklaşım

-Yeni veya kötüleşen sırt ve boyun ağrısı, ateş ve/ veya kan dolaşım enfeksiyonu veya İE
-Ateş ve yeni periferik nörolojik semptomlar(±sırt ağrısı)
-Yeni *S aureus* bakteriyemisini takiben gelişen sırt ve boyun ağrısı

↓

Öykü ve FM
İnflamatuvar belirteçlere bak (ESR,CRP) Kan ve idrar kültürü
Spinal MRG

↓

MRG VO ile uyumlu mu?

← **Evet**

→ Hayır

Evet

↓

Fokal nörolojik defisit
Epidural veya paravertebral abse
Kord kompresyonu var mı?

↓

Evet

↓

Cerrahi girişim. Kültür, histopatoloji için intra-op örneklem e
Kan kültürü pozitifse, etkene yönelik tedavi
Kan kültür sonucu yoksa ampirik antib tedavi başla

↙ Kültür (-)

↓

Ampirik tedaviye devam
Histopatolojik bulgulara göre alternatif tanılar için izlem

↘ Kültür(+)

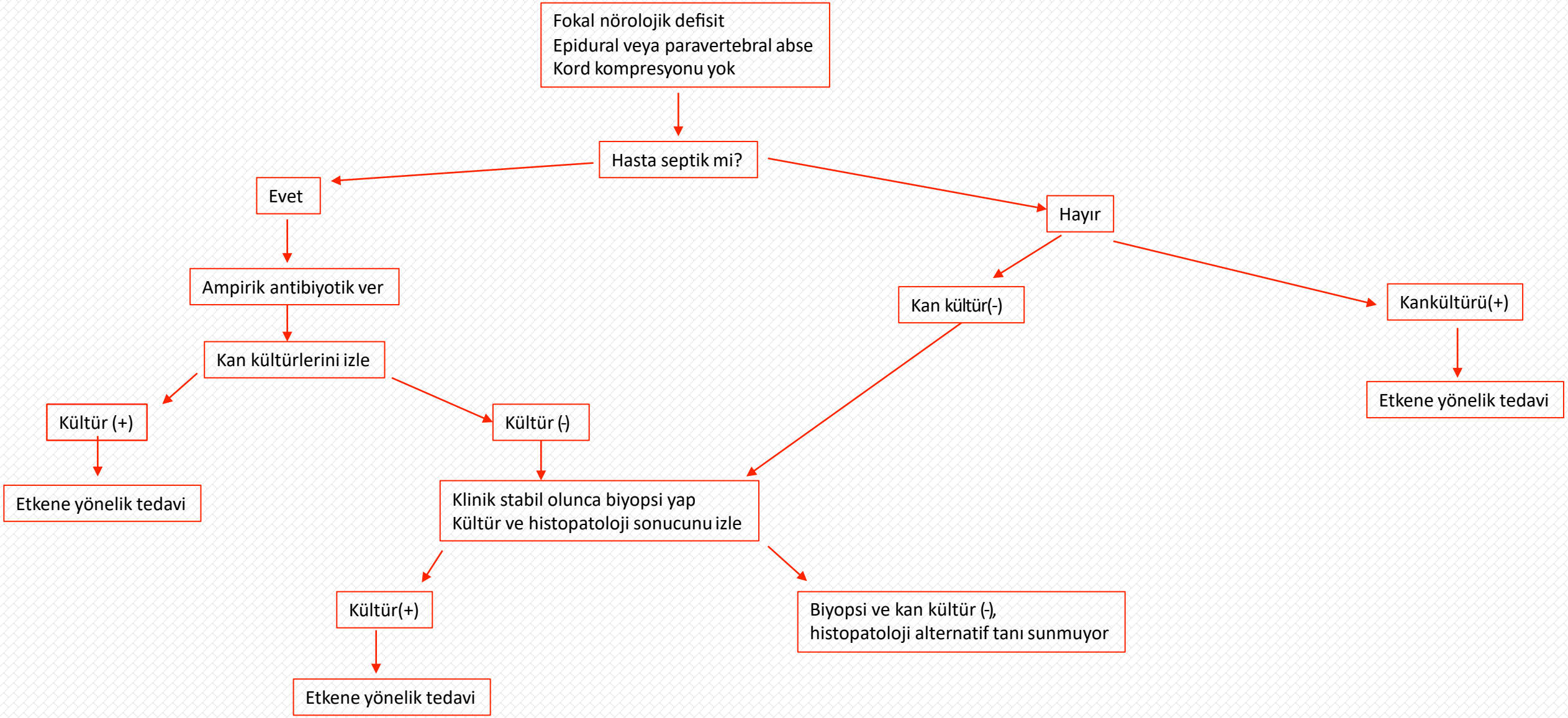
↓

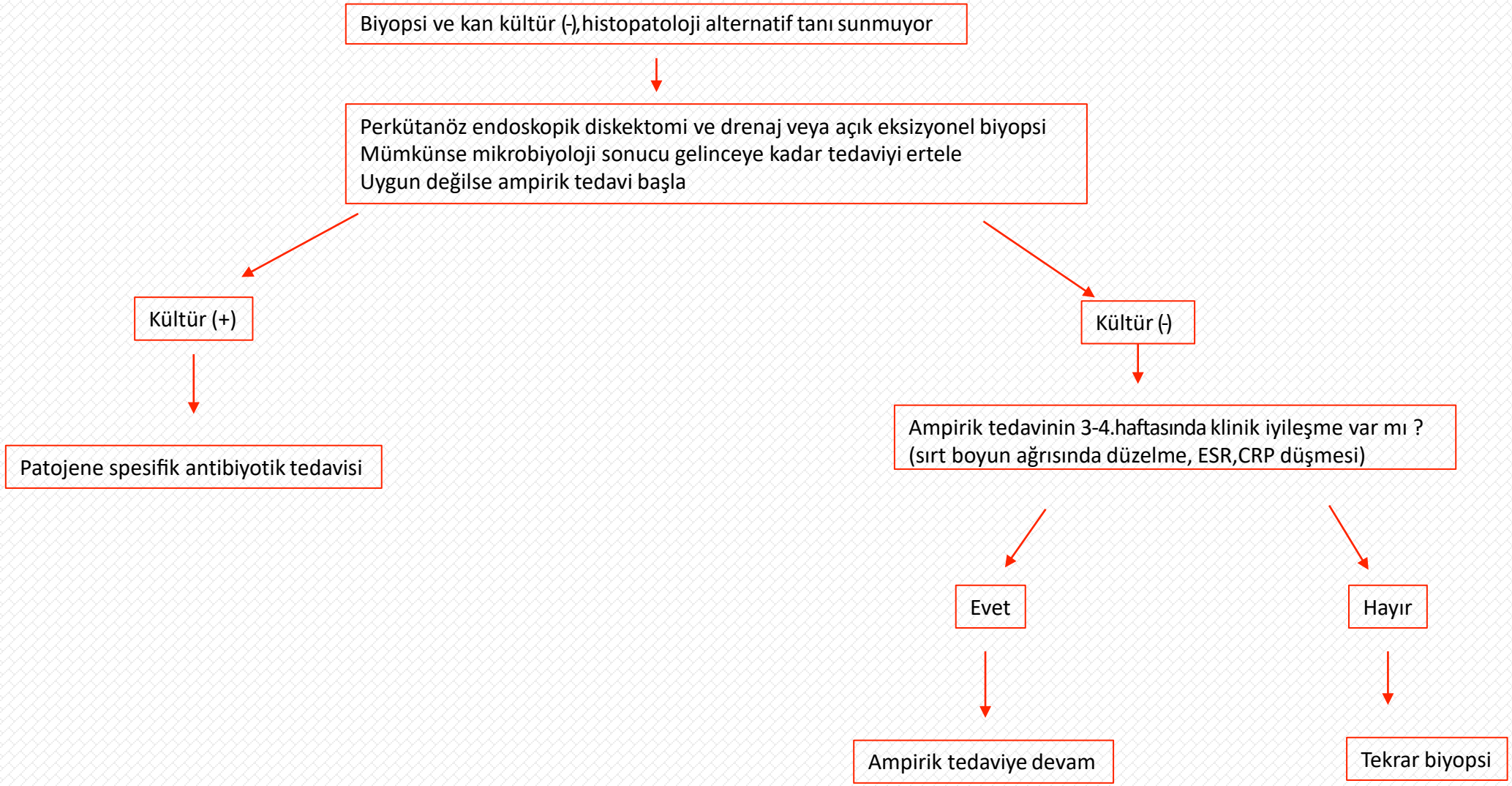
Patojen spesifik tedavi

Hayır

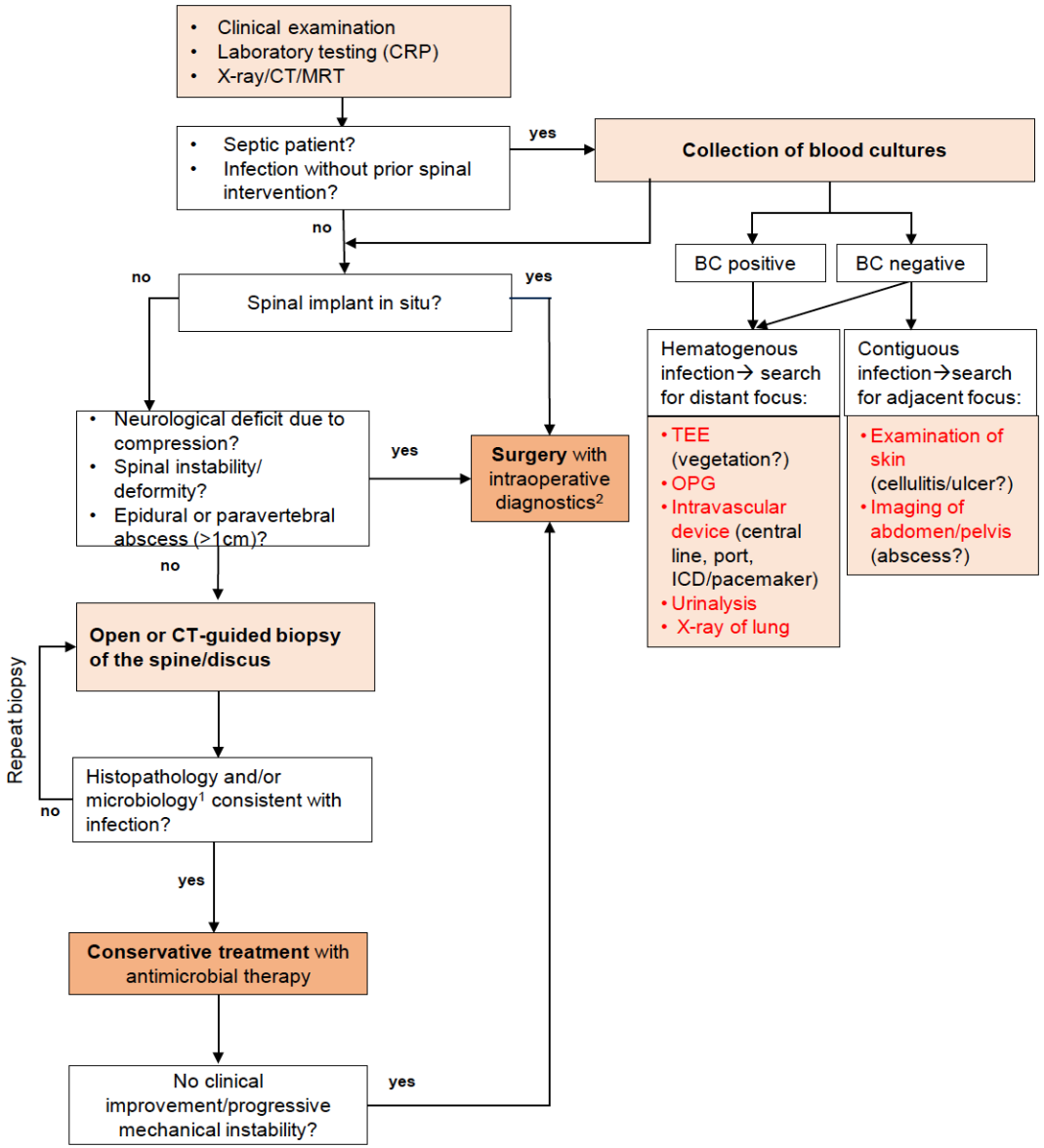
↓

Alternatif tanı için değerlendir.
Klinik VO şüphesi hala yüksekse, tekrar görüntüleme


Fokal nörolojik defisit
Epidural veya paravertebral abse
Kord kompresyonu yok
Hasta septik mi?
Evet
Hayır
Ampirik antibiyotik ver
Kan kültürlerini izle
Kan kültür(-)
Kankültürü(+)
Kültür (+)
Kültür (-)
Etkene yönelik tedavi
Etkene yönelik tedavi
Klinik stabil olunca biyopsi yap
Kültür ve histopatoloji sonucunu izle
Kültür(+)
Biyopsi ve kan kültür (-),
histopatoloji alternatif tanı sunmuyor
Etkene yönelik tedavi


Biyopsi ve kan kültür (-),histopatoloji alternatif tanı sunmuyor
Perkütanöz endoskopik diskektomi ve drenaj veya açık eksizyonel biyopsi
Mümkünse mikrobiyoloji sonucu gelinceye kadar tedaviyi ertele
Uygun değilse ampirik tedavi başla
Kültür (+)
Patojene spesifik antibiyotik tedavisi
Kültür (-)
Ampirik tedavinin 3-4.haftasında klinik iyileşme var mı ?
(sırt boyun ağrısında düzelme, ESR,CRP düşmesi)
Evet
Ampirik tedaviye devam
Hayır
Tekrar biyopsi

MANAGEMENT ALGORITHM



[1] For highly virulent organisms (e.g. *S. aureus, E. coli, streptococcus spp.)* or for patients on antibiotic therapy one positive sample confirms infection, for low-virulent organisms (e.g. *S. epidermidis, C. acnes*) ≥2 positive samples are required to confirm infection.
[2] See procedures on the following page. Histopathology, microbiology (+/- sonication), additional microbiological investigations (Mycobacteria, Brucella), if exposure/risk factors present.
TEE: transesophageal echocardiography, OPG: orthopantomogram, BC: blood cultures

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Tedavinin planlanması

- Kültür örnekleri alındıktan sonra başlanmalıdır
- Ampirik tedavi stafilokok, streptokok, enterokok ve gram negatif basilleri kapsamalıdır
- Kısa sürede yeterli doku konsantrasyonuna ulaşmak için ilk 1-2 hafta intravenöz tedavi başlanmalıdır
- Takiplerinde klinik ve laboratuvar yanıt alındığında oral tedaviye geçilebilir
- Oral tedavi süresine etken patojene ve hastanın kliniğine göre karar verilir
- Etken patojen belirlendiği anda deeskalasyon yapılmalıdır

Ampirik tedavi

Clinical situation	Primari focus	1st choice	Alternative
Hematogenous vertebral osteomyelitis (without implant)	Without known primary focus	Ampicillin/Sulbactam[a] 3 x 3 g	+ Fosfomycin 3 x 5 g (severe infection)
	Infectious endocarditis suspected	Ampicillin/Sulbactam[a] 4 x 3 g + Gentamicin[e] 1 x 240 mg	Ampicillin/Sulbactam[a] 4 x 3 g + Fosfomycin 3 x 5 g
	Primary focus in urogenital tract or abdomen suspected	Piperacillin/Tazobactam 3 x 4.5 g	Meropenem 3 x 1 g
	Allergy to penicillins: - non-Type 1	Cefuroxim 3 x 1.5 g	Meropenem 3 x 1 g
	- Type 1 (anaphylaxis)	Vancomycin[d] 2 x 1g + Fosfomycin 3 x 5g	Daptomycin 1 x 8 mg/kg+ + Fosfomycin 3 x 5g
Post-interventional spinal infection (+/- implant)	First revision	Ampicillin/Sulbactam[a] 3 x 3g + Fosfomycin 3 x 5g	Cefuroxim 3 x 1.5 g + Vancomycin[d] 2x1g
	Multiple previous revisions	Piperacillin/Tazobactam 3 x 4.5g + Fosfomycin 3 x 5g	Vancomycin[d] 2 x 1g + Fosfomycin 3 x 5 g

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https://pro-implant.org/tools/pocket-guide

Table 2. Parenteral Antimicrobial Treatment of Common Microorganisms Causing Native Vertebral Osteomyelitis

Microorganism	First Choice[a]	Alternatives[a]	Comments[b]
Staphylococci, oxacillin susceptible	Nafcillin[c] sodium or oxacillin 1.5–2 g IV q4–6 h or continuous infusion or Cefazolin 1–2 g IV q8 h or Ceftriaxone 2 g IV q24 h	Vancomycin IV 15–20 mg/kg q12 h[d] or daptomycin 6–8 mg/kg IV q24 h or linezolid 600 mg PO/IV q12 h or levofloxacin 500–750 mg PO q24 h and rifampin PO 600 mg daily [122] or clindamycin IV 600–900 mg q8 h	6 wk duration
Staphylococci, oxacillin resistant [123]	Vancomycin IV 15–20 mg/kg q12 h (consider loading dose, monitor serum levels)	Daptomycin 6–8 mg/kg IV q24 h or linezolid 600 mg PO/IV q12 h or levofloxacin PO 500–750 mg PO q24 h and rifampin PO 600 mg daily [122]	6 wk duration
Enterococcus species, penicillin susceptible	Penicillin G 20–24 million units IV q24 h continuously or in 6 divided doses; or ampicillin sodium 12 g IV q24 h continuously or in 6 divided doses	Vancomycin 15–20 mg/kg IV q12 h (consider loading dose, monitor serum levels) or daptomycin 6 mg/kg IV q24 h or linezolid 600 mg PO or IV q12 h	Recommend the addition of 4–6 wk of aminoglycoside therapy in patients with infective endocarditis. In patients with BSI, physicians may opt for a shorter duration of therapy. Optional for other patients [124, 125]. Vancomycin should be used only in case of penicillin allergy.
Enterococcus species, penicillin resistant[e]	Vancomycin IV 15–20 mg/kg q12 h (consider loading dose, monitor serum levels)	Daptomycin 6 mg/kg IV q24 h or linezolid 600 mg PO or IV q12 h	Recommend the addition of 4–6 wk of aminoglycoside therapy in patients with infective endocarditis. In patients with BSI, physicians may opt for a shorter duration of aminoglycoside. The additional of aminoglycoside is optional for other patients [124, 125].
Pseudomonas aeruginosa	Cefepime 2 g IV q8–12 h or meropenem 1 g IV q8 h or doripenem 500 mg IV q8 h	Ciprofloxacin 750 mg PO q12 h (or 400 mg IV q8 h) or aztreonam 2 g IV q8 h for severe penicillin allergy and quinolone-resistant strains or ceftazidime 2 g IV q8 h	6 wk duration Double coverage may be considered (ie, β-lactam and ciprofloxacin or β-lactam and an aminoglycoside).
Enterobacteriaceae	Cefepime 2 g IV q12 h or ertapenem 1 g IV q24 h	Ciprofloxacin 500–750 mg PO q12 h or 400 mg IV q12 hours	6 wk duration
β-hemolytic streptococci	Penicillin G 20–24 million units IV q24 h continuously or in 6 divided doses or ceftriaxone 2 g IV q24 h	Vancomycin IV 15–20 mg/kg q12 h (consider loading dose, monitor serum levels)	6 wk duration Vancomycin only in case of allergy.
Propionibacterium acnes	Penicillin G 20 million units IV q24 h continuously or in 6 divided doses or ceftriaxone 2 g IV q24 h	Clindamycin 600–900 mg IV q8 h or vancomycin IV 15–20 mg/kg q12 h (consider loading dose, monitor serum levels)	6 wk duration Vancomycin only in case of allergy.
Salmonella species	Ciprofloxacin PO 500 mg q12 h or IV 400 mg q12 h	Ceftriaxone 2 g IV q24 h (if nalidixic acid resistant)	6–8 wk duration

Optimal antibiyotik süresi

- Minimum 6 hf süreyle tedavi

Antibiotic treatment for 6 weeks versus 12 weeks in patients with pyogenic vertebral osteomyelitis: an open-label, non-inferiority, randomised, controlled trial

*Louis Bernard, Aurélien Dinh, Idir Ghout, David Simo, Valerie Zeller, Bertrand Issartel, Vincent Le Moing, Nadia Belmatoug, Philippe Lesprit, Jean-Pierre Bru, Audrey Therby, Damien Bouhour, Eric Dênes, Alexa Debard, Catherine Chirouze, Karine Fèvre, Michel Dupon, Philippe Aegerter, Denis Mulleman, on behalf of the Duration of Treatment for Spondylodiscitis (DTS) study group**

Lancet 2015; 385: 875–82

- Klinik başarı 6 hafta grubunda %90.9 (160/192), 12 hf grubunda %90.9 (159/175)

- Tedavi süresi klinik izlem ve sonuçlara göre bireyselleştirilmeli

Int J Infect Dis 2005; 9:127–38
Curr Infect Dis Rep 2002; 4:439–45

Parenteral'den oral tedaviye

- Parenteral 2 hafta sonrası
  - Enfeksiyon komplike değil ve komorbidite yoksa
  - Parenteral tedaviye yanıt iyi ise
  - Etkenin duyarlı olduğu bilinen antibiyotikle tedavi
  - Oral tedavi uyumu iyi ve takibi mümkün hasta

Oral tedavi

- Oral tedavi süresi 6-12 hafta-

(enflamasyon parametreleri normal olduktan sonra 6 hf)

Clinical Infectious Diseases

EDITORIAL COMMENTARY

IDSA Infectious Diseases Society of America · hivma hiv medicine association · OXFORD

Pyogenic Vertebral Osteomyelitis and Antimicrobial Therapy: It's Not Just the Length, but Also the Choice

Oscar Murillo[1] and Jaime Lora-Tamayo[2]

[1]Department of Infectious Diseases, Hospital Universitari de Bellvitge, IDIBELL, Barcelona; and [2]Unit of Infectious Diseases, Hospital Universitario 12 de Octubre, Instituto de Investigación 12 de Octubre, Madrid, Spain

(See the Major Article by Park et al on pages 1262–9.)

- Drene edilmemiş apse varlığı
- MDR (MRSA!) etken
- KBY

→ Relaps riski → En az 8 hafta tedavi

Spinal implant Enfeksiyonu Hedefe Yönelik Eradikasyon Tedavisi

Pocket Guide to Diagnosis & Treatment of Spinal Infections

PRO-IMPLANT FOUNDATION

Version 3: March 2020

Microorganism (red: difficult-to-treat)	**Antibiotic** (check pathogen susceptibility before)	**Dose**[b] (blue: renal adjustment needed)	**Route**
***Staphylococcus* spp.**			
- Oxacillin-/methicillin-susceptible	Flucloxacillin[a]	4 x 2 g	i.v.
	(+/- Fosfomycin)	(3 x 5 g)	i.v.
	for 2 weeks, followed by (according to susceptibility)		
	Rifampin[c] +	2 x 450 mg	p.o.
	- Levofloxacin or	2 x 500 mg	p.o.
	- Cotrimoxazole or	3 x 960 mg	p.o.
	- Doxycycline or	2 x 100 mg	p.o.
	- Fusidic acid	3 x 500 mg	p.o.
- Oxacillin-/methicillin-resistant	Daptomycin or	1 x 8 mg/kg	i.v.
	Vancomycin[d]	2 x 1 g	i.v.
	(+/- Fosfomycin)	(3 x 5 g)	i.v.
	for 2 weeks, followed by an oral **rifampin** combination as above		
- Rifampin-resistant	Intravenous treatment according susceptibility for 2 weeks (as above), followed by long-term suppression for ≥1 year (e.g. Doxycycline)		
***Streptococcus* spp.**	Penicillin G[a] or	4 x 5 million U	i.v.
	Ceftriaxone	1 x 2 g	i.v.
	for 2-3 weeks, followed by:		
	Amoxicillin or	3 x 1000 mg	p.o.
	Doxycycline (suppression ≥1 y.)	2 x 100 mg	p.o.
***Enterococcus* spp.**			
- Penicillin-susceptible	Ampicillin +	4 x 2 g	i.v.
	Gentamicin[e]	1 x 120 mg	i.v.
	(+/- Fosfomycin)	(3 x 5 g)	i.v.
	for 2-3 weeks, followed by:		
	Amoxicillin	3 x 1000 mg	p.o.
- Penicillin-resistant or allergy to penicillin	Vancomycin[d] or	2 x 1 g	i.v.
	Daptomycin	1 x 10 mg/kg	i.v.
	+ Gentamicin[e]	1 x 120 mg	i.v.
	(+/- Fosfomycin)	(3 x 5 g)	i.v.
	for 2-4 weeks, followed by		
	Linezolid (max. 4 weeks)	2 x 600 mg	p.o.
- Vancomycin-resistant (VRE)	Individual; removal of the implant or life-long suppression necessary (e.g. with Doxycycline)		

[a] **Penicillin allergy** NON-type 1 (e.g. skin rash): cefazolin (3 x 2 g i.v.). In case of anaphylaxis (= type 1-allergy such as Quincke´s edema, anaphylactic shock) or cephalosporin allergy: vancomycin (2 x 1 g i.v.) or daptomycin (1 x 8 mg/kg i.v.) Ampicillin/sulbactam is equivalent to amoxicillin/clavulanic acid (3 x 1.2 g or 3 x 2.2 g i.v.)

[b] **Laboratory testing** 2x weekly: leukocytes, CRP, creatinine/eGFR, liver enzymes (AST and ALT). Dose-adjustment according to renal function and body weight (<40 or >100kg)

[c] **Rifampin** is administered only when a newimplant is in situ. Add it orally to i.v.-treatment as soon as wounds are dry; in patients aged >75 years, rifampin is reduced (2 x 300 mg).

[d] Check **Vancomycin** concentration at least 1x/week(take blood before next dose); therapeutic range: 15-20 µg/ml

[e] Give gentamicin only, if **gentamicin high-level (HL)** is tested susceptible (consult your microbiology laboratory). In gentamicin HL-resistant *E. faecalis* or patients with impaired renal function: gentamicin is exchanged with ceftriaxone 1 x 2 g i.v. or Fosfomycin 3 x 5 g i.v.

[f] Add **i.v. treatment** (piperacillin/tazobactam 3 x 4.5 g or ceftriaxon 1x 2 g or meropenem 3 x 1 g i.) in the first postoperative days (until wound is dry)

[g] In patients weighing <80 kg: a loading dose of 70 mg on day 1, then **reduce to 50 mg** from day 2.

Spinal implant Enfeksiyonu Hedefe Yönelik Eradikasyon Tedavisi

Pocket Guide to Diagnosis & Treatment of Spinal Infections

PRO-IMPLANT FOUNDATION

Version 3: March 2020

Gram-negative			
- Enterobacteriaceae (*E. coli, Klebsiella, Enterobacter* etc.)	Ciprofloxacin[f]	2 x 750 mg	p.o.
- Nonfermenters (*Pseudomonas aeruginosa, Acinetobacter* spp.)	Piperacillin/tazobactam or	3 x 4.5 g	i.v.
	Meropenem or	3 x 1 g	i.v.
	Ceftazidim/Cefepime	3 x 2 g	i.v.
	+Tobramycin	1 x 300 mg	i.v.
	(or gentamicin)	1 x 240 mg	i.v.
	for 2-3 weeks, followed by:		
	Ciprofloxacin	2 x 750 mg	p.o
- multiresistant	Depending on susceptibility: a combination of meropenem 3 x 1 g i.v., colistin 3 x 3 million U i.v. and/or fosfomycin 3 x 5 g i.v., consider oral suppression (if Cipro-R)		
Anaerobes			
- Gram-positive (*Cutibacterium, Peptostreptococcus, Finegoldia magna*)	Penicillin G[a] or	4 x 5 million U	i.v.
	Ceftriaxon	1 x 2 g	i.v.
	for 2 weeks, followed by:		
	Rifampin[c] +	2 x 450 mg	p.o.
	Levofloxacin or	2 x 500 mg	p.o.
	Amoxicillin	3 x 1000 mg	p.o.
- Gram-negative (*Bacteroides*)	Ampicillin/sulbactam[a]	3 x 3 g	i.v.
	for 2 weeks, followed by		
	Metronidazol	3 x 400 mg or 500 mg	p.o.
Candida spp.	Caspofungin[g] or	1 x 70 mg	i.v.
- Fluconazole-susceptible	Anidulafungin	1 x 100mg (1. Day 200mg)	i.v.
	for 2 weeks, followed by:	1 x 400 mg	p.o.
	Fluconazole (suppression for ≥1 year)		
- Fluconazole-resistant	Individual (e.g. with voriconazole 2 x 200 mg p.o.); removal of the implant or long-term suppression		
Culture-negative	Ampicillin/sulbactam[a]	3 x 3 g	i.v.
	for 2 weeks, followed by:		
	Rifampin[c] +	2 x 450 mg	p.o.
	Levofloxacin	2 x 500 mg	p.o.

[a] **Penicillin allergy** NON-type 1 (e.g. skin rash): cefazolin (3 x 2 g i.v.). In case of anaphylaxis (= type 1-allergy such as Quincke´s edema, anaphylactic shock) or cephalosporin allergy: vancomycin (2 x 1 g i.v.) or daptomycin (1 x 8 mg/kg i.v.) Ampicillin/sulbactam is equivalent to amoxicillin/clavulanic acid (3 x 1.2 g or 3 x 2.2 g i.v.)

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[d] Check **Vancomycin** concentration at least 1x/week(take blood before next dose); therapeutic range: 15-20 µg/ml

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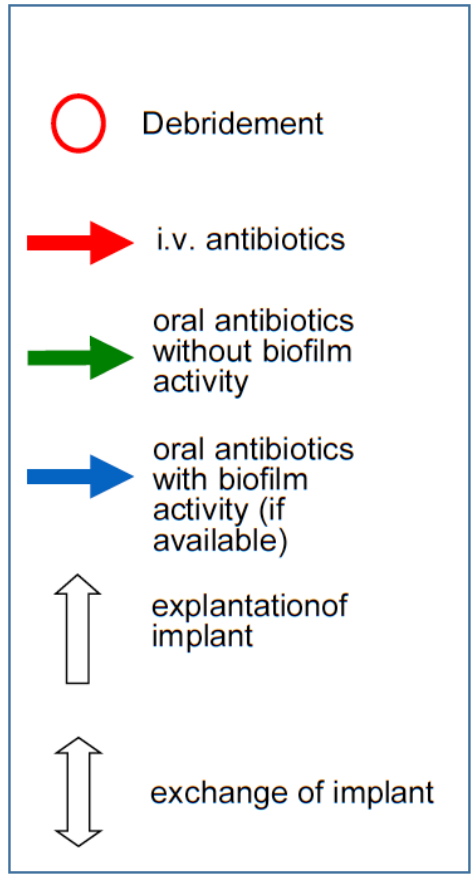
[f] Add **i.v. treatment** (piperacillin/tazobactam 3 x 4.5 g or ceftriaxon 1x 2 g or meropenem 3 x 1 g i.) in the first postoperative days (until wound is dry)

[g] In patients weighing <80 kg: a loading dose of 70 mg on day 1, then **reduce to 50 mg** from day 2.

SURGICAL PROCEDURES FOR IMPLANT ASSOCIATED SPINAL INFECTIONS

Procedure/strategy	Antibiotic treatment	Total duration
Removal & vertebral osteomyelitis treatment		6 W
Retention & eradication		12 W
One stage exchange & eradication		12 W
Retention & suppression until removal		weeks – months



Spinal implant ilişkili VO antibiyotik tedavi süresi

- İmplantın çıkarılabildiği vakalarda;
  - Genel görüş antibiyotik tedavisine yaklaşık 6 hafta devam edilmesi yönündedir
  - 6 haftadan uzun tedavi süreleri ek fayda sağlamayabilir[1-3]

- İmplantın çıkarılamadığı vakalarda;
  - Geçmişte 6 aydan 2 yıla kadar çok uzun süreli tedaviler uygulanmaktaydı
  - Mevcut çalışmalarla 12 haftalık daha kısa süreli antibiyotik tedavileri ile iyi sonuçlar gösterilmiş [1,2]

1. Sobottke R, Seifert H, Fatkenheuer G, et al. Current diagnosis and treatment of spondylodiscitis. Dtsch Arztebl Int 2008;105:181-7.
2. Jaramillo-de la Torre JJ, Bohinski RJ, Kuntz C 4th. Vertebral osteomyelitis. Neurosurg Clin N Am 2006;17:339-51, vii.
3. Rutges JP, Kempen DH, van Dijk M, et al. Outcome of conservative and surgical treatment of pyogenic spondylodiscitis: a systematic literature review. Eur Spine J 2016;25:983-99.

Takip

- Klinik bulgular
- ESR, CRP
- Görüntüleme

- İlk 4 haftada semptomların düzelmemesi, ESR'nin yarı yarıya düşmemesi tedavi başarısızlığı ile ilişkili
- Ağrının devamı, rezidüel nörolojik defisitler veya radyolojik bulgular tek başına tedavi başarısızlığı olarak değerlendirmede yeterli değil

Berbari et al. 2015 Infectious Diseases Society of America (IDSA) Clinical Practice Guidelines fort he Diagnosis and Treatment of Native Vertebral Osteomyelitis in Adults. CID 2015;61(6):e26-46

Tedavi cevabı

International Journal of Infectious Diseases 108 (2021) 487–493

Contents lists available at ScienceDirect

International Journal of Infectious Diseases

journal homepage: www.elsevier.com/locate/ijid

Clinical characteristics of pyogenic vertebral osteomyelitis, and factors associated with inadequate treatment response

Cornelia Geisler Crone[a,*], Malte Mose Tetens[a], Aase Bengaard Andersen[a], Niels Obel[a,b], Anne-Mette Lebech[a,b]

- 2016-2019 arası VO—106 hasta
- Başvuru anında
  - %87 bel ağrısı yakınması,
  - %14 sepsis,
  - % 13 spinal cerrahi öyküsü
- %39 *S.aureus*, %9 *E.coli*

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- % 31 tedavi başarısızlığı
- Relaps %13 –ilk 2 yılda
- Bir yıllık kaba mortalite %12
- Tedavi başarısızlığı için risk faktörleri:
  - Spinal cerrahi
  - Ağır sepsis
  - *E.coli* enfeksiyonu

Ahn *et al. BMC Musculoskeletal Disorders* (2020) 21:428
https://doi.org/10.1186/s12891-020-03446-4

BMC Musculoskeletal Disorders

Takip

RESEARCH ARTICLE Open Access

The correlation between follow-up MRI findings and laboratory results in pyogenic spondylodiscitis

Kyung-Sik Ahn[1], Chang Ho Kang[1*], Suk-Joo Hong[2], Baek Hyun Kim[3] and Euddeum Shim[3]

- MR tanı aracı ancak altın standart bir takip metodu yok
- MR ve CRP/ESR karşılaştırılmış
- CRP yumuşak doku, ESR kemik değişiklikleri ile korele
- Takipte CRP/ESR artışı olursa kontrol MR faydalı olabilir

Takip

diagnostics

MDPI

Article

Assessment of Therapeutic Response in Pyogenic Vertebral Osteomyelitis Using ^{18}F-FDG-PET/MRI

Ikchan Jeon [1,*], Eunjung Kong [2], Sang Woo Kim [1], Ihn Ho Cho [2] and Cheol Pyo Hong [3]

1 Department of Neurosurgery, Yeungnam University College of Medicine, Daegu 42415, Korea; sw902@ynu.ac.kr
2 Department of Nuclear Medicine, Yeungnam University College of Medicine, Daegu 42415, Korea; kongej@yu.ac.kr (E.K.); ihcho@med.yu.ac.kr (I.H.C.)
3 Department of Radiological Science, Catholic University of Daegu, Gyeongbuk 38430, Korea; chong@cu.ac.kr
* Correspondence: jicns@ynu.ac.kr or jicns@hanmail.net

Received: 29 September 2020; Accepted: 6 November 2020; Published: 8 November 2020

- PET ; tedavi sonrası erken dönemde, tedavinin kesilmesi aşamasında yol gösterici olabilir

diagnostics

MDPI

Article

Assessment of Therapeutic Response in Pyogenic Vertebral Osteomyelitis Using ^{18}F-FDG-PET/MRI

Ikchan Jeon [1,*], Eunjung Kong [2], Sang Woo Kim [1], Ihn Ho Cho [2] and Cheol Pyo Hong [3]

[1] Department of Neurosurgery, Yeungnam University College of Medicine, Daegu 42415, Korea; sw902@ynu.ac.kr
[2] Department of Nuclear Medicine, Yeungnam University College of Medicine, Daegu 42415, Korea; kongej@yu.ac.kr (E.K.); ihcho@med.yu.ac.kr (I.H.C.)
[3] Department of Radiological Science, Catholic University of Daegu, Gyeongbuk 38430, Korea; chong@cu.ac.kr
* Correspondence: jicns@ynu.ac.kr or jicns@hanmail.net

Received: 29 September 2020; Accepted: 6 November 2020; Published: 8 November 2020

check for updates

Table 4. Comparison of clinical and radiological features between the groups C and NC.

Factors	Group C (n = 39)	Group NC (n = 14)	p Value	Total (n = 53)
		Initial		
ESR (mm/h)	63.67 ± 29.13 (6–120)	61.79 ± 20.76 (30–98)	0.826	63.17 ± 26.99 (6–120)
CRP (mg/dL)	10.33 ± 9.33 (0.03–33.79)	8.71 ± 8.06 (0.11–28.00)	0.569	9.90 ± 8.97 (0.03–33.79)
VAS	7.51 ± 0.99 (5–9)	7.79 ± 0.89 (6–9)	0.371	7.58 ± 0.97 (5–9)
		When assessing therapeutic response		
ESR (mm/h)	50.44 ± 29.82 (8–120) $^{+}$	61.79 ± 32.07 (10–120)	0.236	53.43 ± 30.54 (8–120) $^{+}$
CRP (mg/dL) *	1.05 ± 1.28 (0.02–5.93) $^{+}$	3.23 ± 3.29 (0.02–11.47) $^{+}$	0.030	1.63 ± 2.20 (0.02–11.47) $^{+}$
VAS *	4.10 ± 0.99 (2–6) $^{+}$	5.79 ± 1.67 (3–8) $^{+}$	0.003	4.55 ± 1.41 (2–8) $^{+}$
$PvoSUV_{max}$ *	4.55 ± 1.43 (2.10–8.42)	7.54 ± 2.97 (3.52–14.19)	0.002	5.34 ± 2.34 (2.10–14.19)
Δ $PvoSUV_{max}$-$NmlSUV_{max}$ *	2.69 ± 1.44 (0.00–6.81)	5.22 ± 3.23 (1.02–12.75)	0.013	3.36 ± 2.32 (0.00–12.75)
Δ $PvoSUV_{max}$-$NmlSUV_{mean}$ *	3.00 ± 1.46 (0.06–7.08)	5.59 ± 3.23 (1.17–12.97)	0.011	3.69 ± 2.34 (0.06–12.97)

Group C, cured; Group NC, non-cured; ESR, erythrocyte sedimentation rate; CRP, C-reactive protein; VAS, visual analog scale; PVO, pyogenic vertebral osteomyelitis; SUV_{max}, maximum standardized uptake value of

Rehabilitasyon

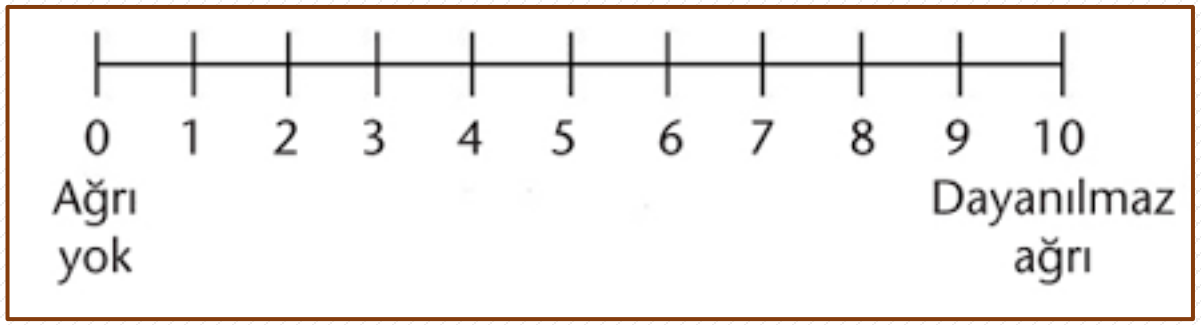
- Rehabilitasyona erken başlamak önerilmekte
- Akut-subakut-kronik fazlara göre planlamalar
- Korse ile immobilizasyon
- Ağrı yönetimi

Ağrının takibi

- **Vizüel analog skala**

Tedavi yanıtı izleminde

Tedavinin kesilme kararında



Takip

› Neurosurg Focus. 2020 Aug;49(2):E16. doi: 10.3171/2020.5.FOCUS20267.

Do we underdiagnose osteoporosis in patients with pyogenic spondylodiscitis?

Christoph Bettag [1], Tammam Abboud [1], Christian von der Brelie [1], Patrick Melich [1 2], Veit Rohde [1], Bawarjan Schatlo [1]

Affiliations + expand

PMID: 32738793 DOI: 10.3171/2020.5.FOCUS20267

- Osteoporoz ile risk faktörleri benzer
- Osteoporoz açısından yeterli tarama yapılmıyor
- Medikal-cerrahi tedavi başarısında osteoporoz tedavisi etkili
- Özellikle implant başarısızlığında osteoporoz neden olabilir
- Rutin tarama

OPEN

Implementation of a multidisciplinary infections conference improves the treatment of spondylodiscitis

(2021) 11:9515

D. Ntalos[1]✉, B. Schoof[1], D. M. Thiesen[1], L. Viezens[1], H. Kleinertz[1], H. Rohde[2], A. Both[2], A. Luebke[3], A. Strahl[4], M. Dreimann[1] & M. Stangenberg[1]

- Tek birim (149) X multidisipliner (212)
- Multidisipliner takip- haftalık görüşmelerle
  - Ortopedi, mikrobiyolog, enfeksiyon hst, patolog
  - Total antibiyotik tedavi süresi daha kısa (66 ± 31 vs 104 ± 31, $p < 0.001$)
  - Tek aşamalı cerrahi ve transpediküler vida işlemi daha sık
  - Antibiyotik ve cerrahi tedavi stratejilerinde önemli değişikliklere neden olmuş

Spondilodiskit bir ekip işi…

- Enfeksiyon Hastalıkları
- Mikrobiyoloji
- Beyin Cerrahi
- Ortopedi
- Fizik tedavi
- Algoloji
- Radyoloji
- Nükleer Tıp