

# Protezi çıkaralım mı?

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Enfeksiyon Hastalıkları ve Klinik Mikrobiyoloji

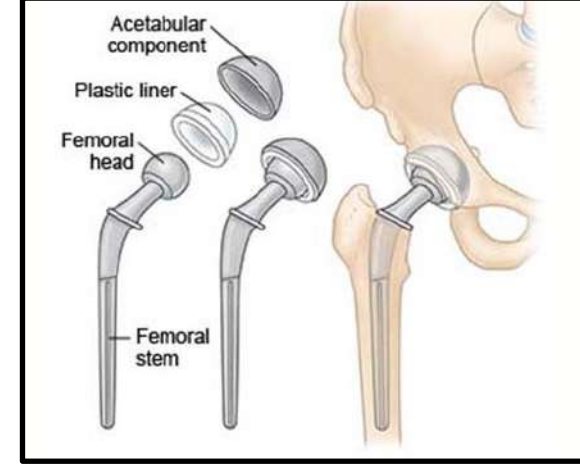


Tabii ki !

BÜYÜK CERRAHİ

HASTANIN GENEL SAĞLIĞI

DOKUNUN DURUMU



# Protez revizyon cerrahisi türleri

- Protez korunarak debridman ve antibiyotik (DAiR: Debridment Antibiotic Implant Retention)
- Tek aşamalı revizyon
- İki aşamalı revizyon ★
- Üç aşamalı revizyon
- Rezeksiyon artroplastisi, artrodez, amputasyon



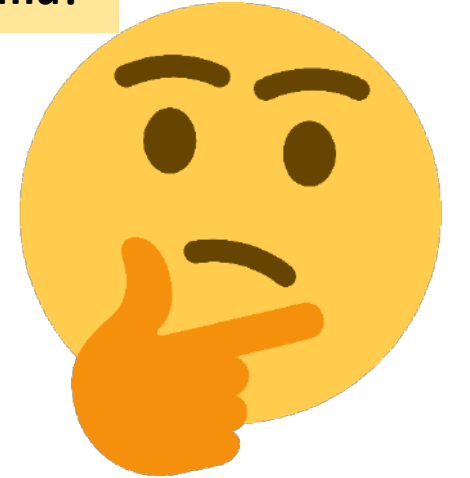
# Protez enfeksiyonu mu?



- Her zaman kolay değil....
- Akut
- Virulansı yüksek etkenler
- Kronik
- Düşük virulanslı etkenler

Aseptik kayıp  
Periprostetik kırık  
Dislokasyon  
Musküler patoloji  
Mekanik aşınma  
Metallozis  
İnflamatuvar artrit  
Kristal artropatisi  
Yabancı cisim reaksiyonu

**Yoksa ENFEKSİYON mu?**



# Tanımlar

- **Akut PE**
  - Semptomların ameliyattan sonra ilk 1 ay içinde ortaya çıkması
- **Kronik PE:**
  - Semptomların ameliyattan sonraki 1. aydan sonra ortaya çıkması
- **Hematojen veya 'per continuitatem' PE**
  - Sorunsuz bir postoperatif dönemden sonra başlayan semptomlar
  - Semptomların ne zaman başladığı net değil

**Table 2.** Classification of periprosthetic joint infection (PJI)

	Acute PJI (immature biofilm)	Chronic PJI (mature biofilm)
<b>Pathogenesis</b>		
• <b>Perioperative</b>	< 4 weeks after surgery (early)	≥ 4 weeks after surgery (delayed/low grade)
• <b>Haematogenous or 'per continuitatem'</b>	< 3 weeks duration of symptoms	≥ 3 weeks of duration of symptoms
<b>Clinical features</b>	Acute pain, fever, red/ swollen joint, prolonged post-operative discharge (>7–10 days)	Chronic pain, loosening of the prosthesis, sinus tract (fistula)
<b>Causative micro-organism</b>	High-virulence: <i>Staphylococcus aureus</i> , gram-negative bacteria (e.g. <i>Escherichia coli</i> , <i>Enterobacter</i> , <i>Klebsiella</i> , <i>Pseudomonas aeruginosa</i> )	Low-virulence: Coagulase-negative staphylococci (e.g. <i>Staphylococcus epidermidis</i> ), <i>Cutibacterium species</i>
<b>Surgical treatment</b>	Debridement and retention of prosthesis (change of mobile parts)	Complete removal of prosthesis (exchange in one or two stages)

## İyi bir anamnez!!

- Yakınmaları, başlangıcı, süresi
- Protezin takılma tarihi (primer cerrahi)
- Protezin türü
- Cerrahi seyir
- Komplikasyon
- Yara iyileşme sorunları
- Eklemde geçirilmiş diğer ameliyatlar
- Geçmişteki enfeksiyon ve antibiyoterapiler, önceki kültür sonuçları
- Komorbid durumlar
- Risk faktörleri
- İlaç alerjileri, karaciğer ve böbreklerin durumu

## Fizik muayene

Sistemik bulgular  
Lokal enfeksiyon bulguları  
Eklem hareketleri  
Kaslar  
Duyu  
Damarlar

## Tetkikler

Görüntüleme yöntemleri  
Laboratuvar tetkikleri

# Laboratuvar (Ameliyat öncesi ve ameliyat sırasında)

- Periferik kan
  - CRP
  - ESH (eritrosit sedimantasyon hızı)
  - IL-6
  - D-dimer
- Sinovial sıvı
  - Lökosit sayısı ve dağılımı
  - Lökosit esteraz
  - $\alpha$ -defensin
  - CRP
  - Kültür, PCR
- Doku örnekleri
  - Histopatoloji
  - Kültür, PCR, NGS
- Protez sonikasyon sıvısı...
  - Kültür, PCR, NGS



*PCR: polimeriz zincir reaksiyonu,  
NGS: next generation sequencing-yeni nesil dizileme*

## ESH ve CRP (serumda)

- CRP daha özgül ve duyarlı
- Ameliyattan sonra CRP 2-3 hafta, ESH 6 hafta yüksek kalır

## Cutt-off değerleri:

- **Kronik PE:** Son ameliyattan en az 6 hafta sonra
  - CRP >10 mg/L
  - ESH >30 mm/saat
- **Akut PE:**
  - CRP için > 100 mg/L
  - ESH için bir cutt-off yok





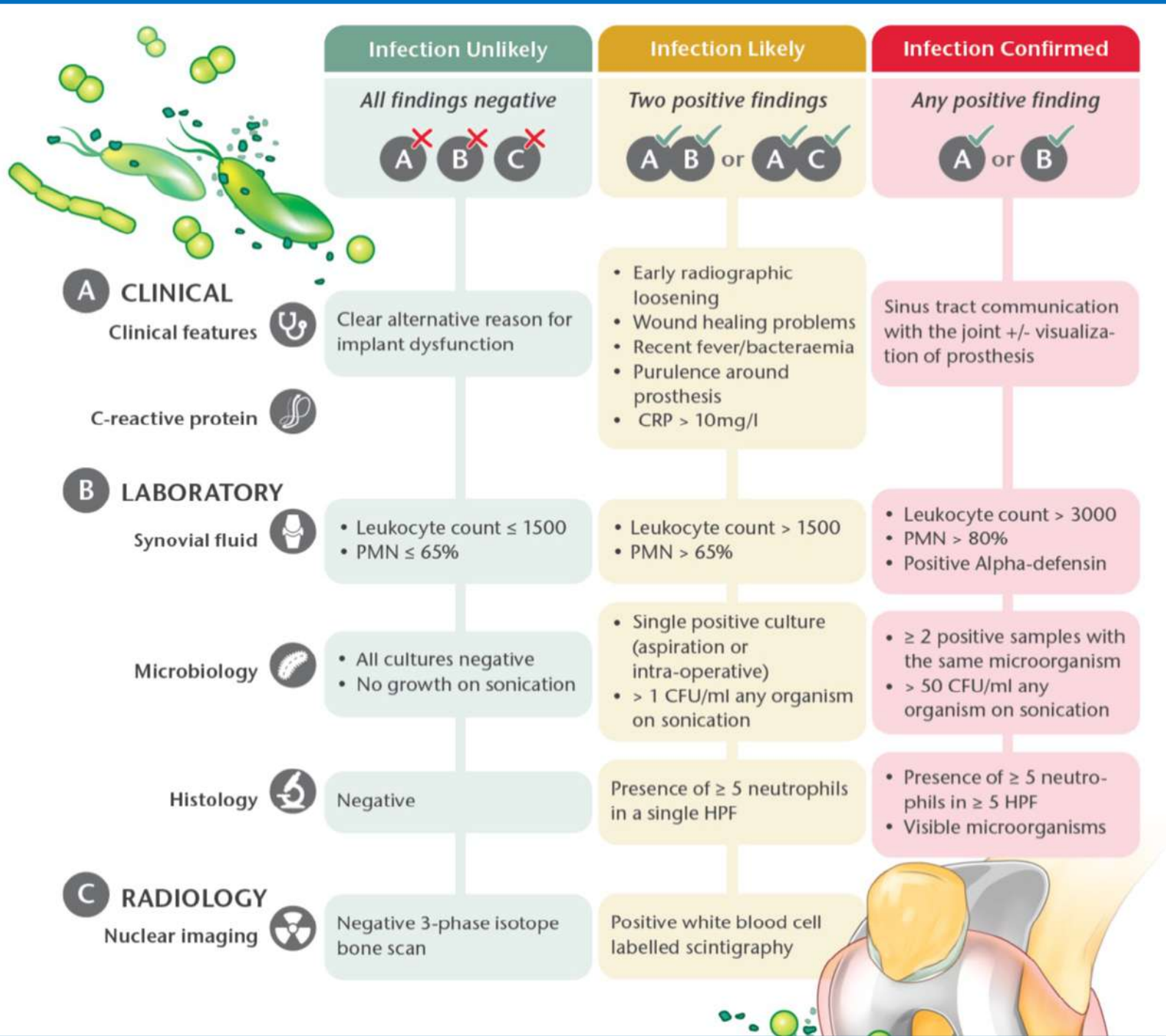
PE için önerilen tanı kriterleri				
Majör Kriterler			Karar	
Standart kültürlerden ikisinde aynı etkenin üremesi			Enfekte	
Eklemle ilişkili sinüs traktı veya protezin görülmesi				
Minör kriterler	Değer		Puan	Karar
	Akut*	Kronik		
<b>Serum</b>				Preop. ve postop. toplam puan  <b>≤6 enfekte</b>  3-5 belirsiz***  <b>&lt;3 enfekte değil</b>
CRP (mg/L) veya D-Dimer	>100 Bilinmiyor	>10 >860	2	
Sedimantasyon mm/sa	-	>30	1	
<b>Sinovial sıvıda</b>				
lökosit (hücre/mm <sup>3</sup> ) veya Lökosit esteraz veya Pozitif alfa-defensin (sinyal/cutoff)	>10.000 ++ >1.0	>3.000 ++ >1.0	3	
Sinovyada nötrofil (%)	>90	>70	2	
Tek pozitif kültür			2	
Pozitif histoloji			3	
Ameliyatta pürülans görülmesi**			3	
*Bu kriter akut enfeksiyonlarda valide edilmemiştir **Lokal doku reaksiyonunda değeri yoktur ***İleri moleküler yöntemlerden yararlanılabilir				

**Table 1.** 2018 Evidence-Based Stepwise Algorithm for Diagnosis of PJI

	Score	Decision
Major criteria (at least one of the following)		
Two positive cultures of the same organism		
Sinus tract with evidence of communication to the joint or visualization of the prosthesis		Infected
Minor criteria (preoperative)		
Elevated CRP or D-dimer (serum)	2	$\geq 6$ Infected
Elevated ESR (serum)	1	
Elevated synovial WBC count or LE (synovial)	3	2-5 Possibly infected
Positive alpha-defensin (synovial)	3	
Elevated synovial PMN (%) (synovial)	2	0-1 Not infected
Elevated synovial CRP (synovial)	1	
Intraoperative diagnosis		
Preoperative score	-	$\geq 6$ Infected
Positive histology	3	
Positive purulence	3	4-5 Inconclusive
Single positive culture	2	
		$\leq 3$ Not infected

Data from the article of Parvizi et al. (J Arthroplasty.2018;33:1309-14.e2)<sup>61</sup>.

PJI: periprosthetic joint infection, CRP: C-reactive protein, ESR: erythrocyte sedimentation rate, WBC: white blood cell, LE: leukocyte esterase, PMN: polymorphonuclear.



# Hastamız M.A., 68 yaşında erkek

- Yaklaşık 1.5-2 aydır TDA yapılmış olan sağ dizinde ağrı
- Ağrı zaman içinde giderek artmış. Yürürken daha şiddetli.
- Primer cerrahi: 3 ay önce
- Yakınmasız dönem: 1-1.5 ay

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- Sigara içmiyor, alkol nadiren
- BPH, hipertansiyon, hiperlipidemi, depresyon
  - doksazosin, simvastatin, fluoksetin
- VKİ: 28 kg/m<sup>2</sup>

### Risk faktörleri

- Protez bölgesinde daha önce de ameliyat geçirmek
- RA veya postravmatik eklem harabiyeti
- İmmün baskılanma (hastalık / ilaç)
- Diyabet
- Yetersiz glukoz kontrolü (>200 mg/L)
- Kötü beslenme
- Obezite (BMI >40) veya kaşeksi (<18.5)
- Psöriazis
- Uzun süreli üriner kateterizasyon
- D-vit eksikliği ?
- Depresyon, anksiete
- Anemi
- Bakımevinde yaşamak
- Daha önce hastanede yatış
- Erkek cinsiyet
- Siyah ırk
- Sigara içmek (>1 paket/gün)
- Alkolizm
- İleri yaş
- Hipotermi
- Cerrahın deneyimi
- HIV enfeksiyonu ve düşük CD4+ lenfosit sayısı ????
- Kronik KC hastalığı

## Cerrahi öykü:

- Aynı dize sonuncusu 6 ay önce olmak üzere 2 kez steroid enjeksiyonu
- Preop MRSA ve MSSA açısından taranmış: Negatif
- Ameliyat günü klorheksidinli bezle vücut temizliği
  
- Cerrahi proflaksi: Sefazolin, 24 saat
- Vankomisin kullanılmamış
- Antibiyotikli çimento kullanılmamış
- Yıkama solüsyonu: dilüe betadin ve salin
- Per-op sorun yaşanmamış
- Persistan yara drenajı olmamış

## Fizik muayene

- Boy 178 cm, kilo: 90, VKİ: 28.4 kg/m<sup>2</sup>
- Vital bulguları normal
- İnsizyon skarı temiz
- Sağ dizde minimal lokal ısı artışı mevcut
- Sağ diz aktif hareketle ağrılı, hareket açısı 0-120°
- Quadriseps, tibialis anterior, gastrocnemius soleus, extensor hallucis longus ve flexor hallucis longus kasları intakt
- Duyu kaybı yok
- Periferik nabazanlar alınıyor

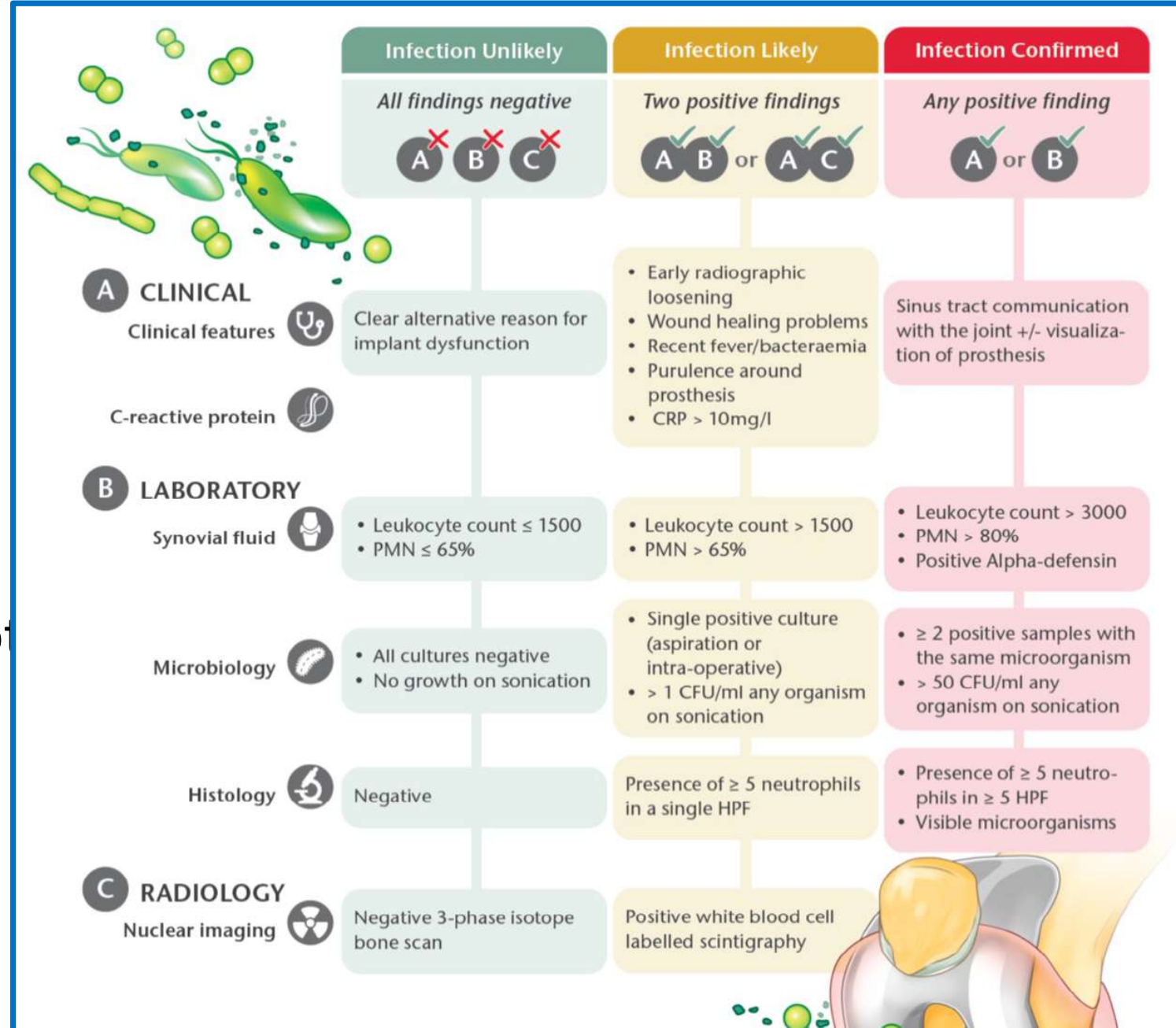
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# Laboratuvar ve görüntüleme

- Hemogram normal
- ESR: 67 mm/saat
- CRP: 92 mg/L

## Suprapatellar aspirasyon Sinovyal sıvıda

- 30.740 lökosit/mm<sup>3</sup> %93 nö
- 248.000 eritrosit/mm<sup>3</sup>
- Kristal yok





# Sinovyal sıvı kültürü:

## *Pseudomonas aeruginosa*

### Etkenler

Merkezler arasında farklılıklar olsa da:

- KNS (% 30-43)
- *S. aureus* (% 12-23)
- Miks flora (% 12-19)
- Streptokoklar (% 9-10)
- Gram negatif basiller ( %3-6),
- Enterokoklar (% 3-7)
- Anaeroblar (%2-4)
- Nadiren Candida, Brusella, Mikobakteriler...
- *Cutibacterium acnes* özellikle omuz protezlerinde

% 11 olguda etken saptanamamakta

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REVIEW

## Management of prosthetic joint infections: a guidelines comparison

M. Ometti<sup>1</sup> · E. Delmastro<sup>2</sup> · V. Salini<sup>2</sup>

Table 1 DAIR indications

	IDSA	AAOS	MSIS + EBJIS
Timing	Post-operative < 1 month Symptoms < 3 weeks	THA: Post-operative/ Symptoms > 2weeks < 4weeks TKA: < 4 weeks	Post-operative < 3 months Symptoms < 3 weeks
Indications	-Well-fixed -No sinus-tract -Antibiotic-susceptibility	-Well-fixed -No sinus-tract -Antibiotic-susceptibility	-Well-fixed -No sinus-tract -Antibiotic-susceptibility
Surgical technique	Removal of modular components	Removal of modular components	Removal of modular components
Medical treatment	-Staphylococcal PJI: THA: 3 months TKA: 6 months -Non-Staphylococcal PJI: 4-6 weeks	6 weeks	THA: 3 months TKA: 6 months

IDSA—Infectious Disease Society of America; AAOS—American Academy of Orthopaedic Surgeons; MSIS—Musculoskeletal Infection Society; EBJIS—European Bone and Joint Infection Society; THA—Total Hip Arthroplasty; TKA—Total Knee Arthroplasty; PJI—Prosthetic Joint Infection

Table 2 1-stage revision indications

	IDSA	AAOS	MSIS + EBJIS
Timing	Post-operative > 1 month Symptoms > 3 weeks	Post-operative < 2 weeks	Post-operative > 3 months Symptoms > 3 weeks
Indications	-Good soft tissue conditions -Pathogen identified -Good bone stock -No sinus-tract -No Sepsis -Susceptibility to oral agents	-Non-MRSA -Cementless THA -No sinus-tract	<u>Relative contraindications:</u> -Pathogen not identified -Sinus-tract -Severe soft tissue involvement <u>Absolute contraindications:</u> -Sepsis -No susceptibility to antibiotics
Surgical technique	Antibiotic impregnated bone cement	Extensive debridement	Antibiotic impregnated bone cement
Medical treatment	-Staphylococcal PJI: 3 months -Non-staphylococcal PJI: 4-6 weeks	6 weeks	2-6 weeks

IDSA—Infectious Disease Society of America; AAOS—American Academy of Orthopaedic Surgeons; MSIS—Musculoskeletal Infection Society; EBJIS—European Bone and Joint Infection Society; MRSA—Meticillin-resistant Staphylococcus Aureus; PJI—Prosthetic Joint Infection

Table 3 2-stage revision indications

	IDSA	AAOS	MSIS + EBJIS
Timing	Post-operative > 1 month Symptoms > 3 weeks	Post-operative > 4 weeks	Post-operative > 3 months Symptoms > 3 weeks
Indications	-Highly resistant pathogen -Sepsis -Sinus-tract -Poor soft tissue conditions -Delayed reimplantation feasible	-MRSA periprosthetic infection -Within 2 weeks of surgery if cemented (no indication to debridement) -Sinus-tract	- Highly resistant pathogen -Sepsis -Sinus-tract -Poor soft tissue conditions -Infection appears obvious but no organism identified
Surgical technique	- Antimicrobial impregnated spacer -3 periprosthetic tissue samples -Articulating spacer	-Antimicrobial impregnated spacer -3 periprosthetic tissue samples	-Antimicrobial impregnated spacer -3 periprosthetic tissue samples -Articulating spacer
Medical treatment	4-6 weeks	6 weeks	2-6 weeks
Time from resection to reimplantation	2weeks-several months (Antibiotic-free period of 2-8 weeks)	(Information not found)	No antibiotic-free period
Type of prosthetic implant	Cemented / non-cemented	(Information not found)	Cemented arthroplasty with antibiotic-laden bone cement

## Tek aşamalı revizyon

- Yumuşak doku ve kemik rezervinin iyi olmalı, kemik grefti veya flep gerektirmemeli
- **Etkenin saptanmış ve uygun antibiyotiklere duyarlı olmalı**
  - Cement ve tedavi için
- Etkenin saptanamamış veya septik olgularda kontrendike!!
- Çabuk mobilizasyon, ancak % 0-14 nüks riski
  - **Başarılı:** Postop. yara komplikasyonu gelişmemiş, kalça PE, genel sağlığı iyi, etken MSSE, MSSA, Streptokok ise ve çimentoya konan antibiyotiğe duyarlı ise
  - **Daha az başarılı:** *P aeruginosa* ve Gram negatifler, MRSA, D grubu Streptokoklar, Enterokoklar, polimikrobiyal

## Hasta M.A:

- Kltr sonucu ıkınca antibiyotik bařlanmadı
- Bir hafta sonra revizyon cerrahisi
- **Proflaksi / tedavi (.....)**
- Eklem ii prlan grnmde
- Frozen ve histopatoloji iin rnek alınmadı
- Debridman, implantın ıkarılması
- Salin - **hidrojen peroksit** – salin - dile povidon iyodin - salin ile irrigasyon
- Povidon iyodin snger spanlarla bekletme, tekrar debridman ve yıkama
- **Antibiyotikli cement** ile yeni implant takıldı (.....)
- Femoral kanal, tibial kanal, arka kapslden birer, sinovyan 2 kltr (5 kltr)
  - Bakteri, fungal ve mikobakteri
  - Drt kltrde ***P. aeruginosa***

ORIGINAL ARTICLE

## Oral versus Intravenous Antibiotics for Bone and Joint Infection

H.-K. Li, I. Rombach, R. Zambellas, A.S. Walker, M.A. McNally, B.L. Atkins, B.A. Lipsky, H.C. Hughes, D. Bose, M. Kümin, C. Scarborough, P.C. Matthews, A.J. Brent, J. Lomas, R. Gundle, M. Rogers, A. Taylor, B. Angus, I. Byren, A.R. Berendt, S. Warren, F.E. Fitzgerald, D.J.F. Mack, S. Hopkins, J. Folb, H.E. Reynolds, E. Moore, J. Marshall, N. Jenkins, C.E. Moran, A.F. Woodhouse, S. Stafford, R.A. Seaton, C. Vallance, C.J. Hemsley, K. Bisnauthsing, J.A.T. Sandoe, I. Aggarwal, S.C. Ellis, D.J. Bunn, R.K. Sutherland, G. Barlow, C. Cooper, C. Geue, N. McMeekin, A.H. Briggs, P. Sendi, E. Khatamzas, T. Wangrangsimakul, T.H.N. Wong, L.K. Barrett, A. Alvand, C.F. Old, J. Bostock, J. Paul, G. Cooke, G.E. Thwaites, P. Bejon, and M. Scarborough, for the OVIVA Trial Collaborators\*

### CONCLUSIONS

Oral antibiotic therapy was noninferior to intravenous antibiotic therapy when used during the first 6 weeks for complex orthopedic infection, as assessed by treatment failure at 1 year. (Funded by the National Institute for Health Research; OVIVA Current Controlled Trials number, ISRCTN91566927.)

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## Intravenous antibiotic duration in the treatment of prosthetic joint infection: systematic review and meta-analysis

Nour Bouji<sup>1</sup>, Sijin Wen<sup>2</sup>, and Matthew J. Dietz<sup>1</sup>

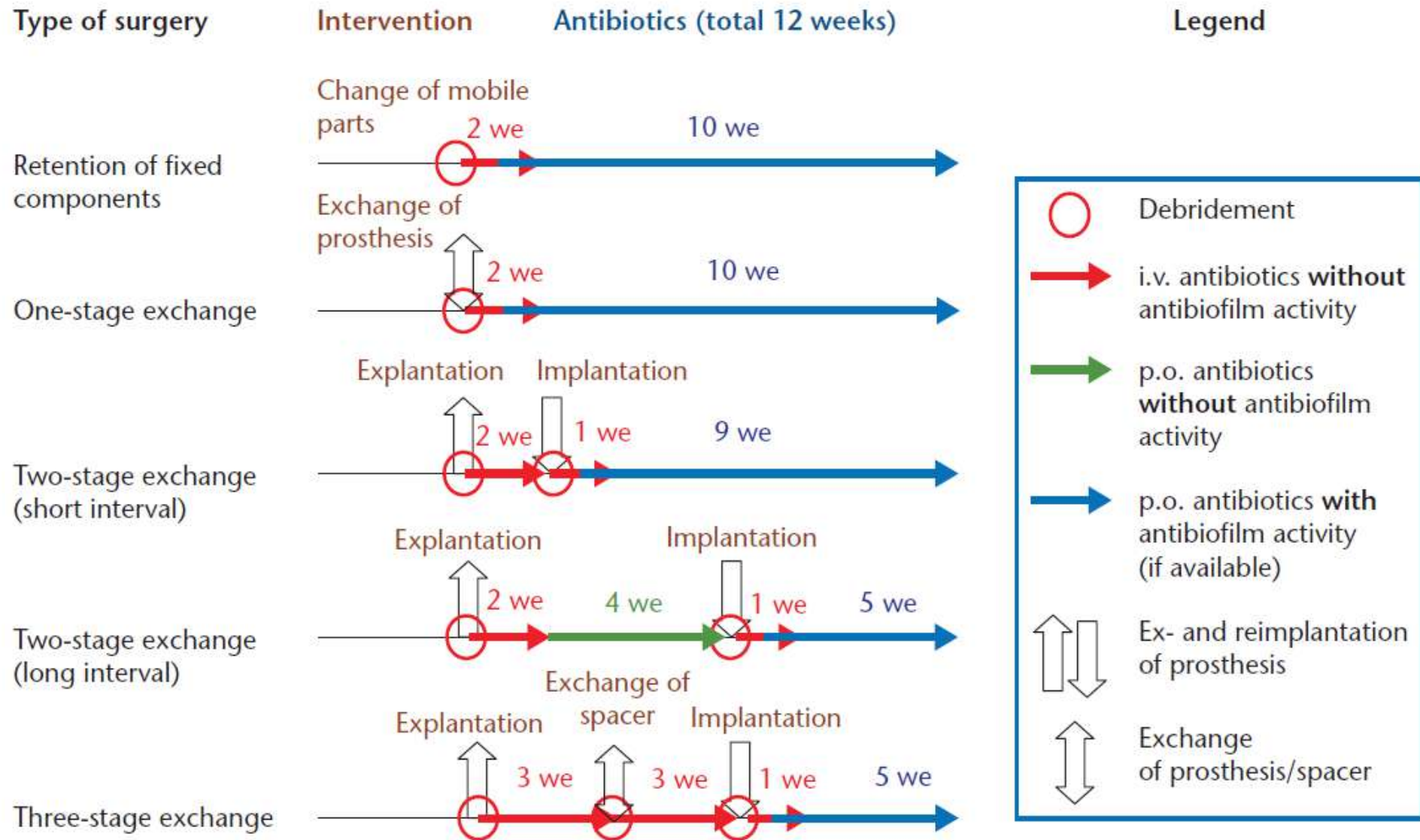
<sup>1</sup>Department of Orthopaedics, School of Medicine, West Virginia University, Morgantown, WV 26506, USA

<sup>2</sup>Department of Epidemiology and BioStatistics, School of Public Health, West Virginia University,  
Morgantown, WV 26506, USA

otics and reflecting a more homogenous population ( $I^2 = 51\%$ ,  $p = 0.06$ ). **Conclusion:** This study highlights the limited data available for evaluating IV antibiotic duration in the setting of PJI. We found that a shorter duration of IV antibiotics was non-inferior to a longer duration, with an improved OR of 2.45 for treatment success, likely shortening inpatient stay as well as lessening side effects and antimicrobial resistance with a lower cost to patients and overall healthcare.



## SURGICAL PROCEDURES



**Fig. 3** Overview of surgical procedures for PJI. Reproduced with permission from the Pocket Guide to Diagnosis & Treatment of PJI, PRO-IMPLANT Foundation (version 9, October 2019).

# ANTİBİYOTİKLER

## Biyofilme etkili

- Rifampisin
- Kinolonlar
- Daptomisin
- Linezolid
- Fosfomisin
- Kolistin

**Biyofilim yapan mikroorganizmalar:**

Stafilokok, Streptokok, Enterokok, E. coli,  
Klebsiella, Pseudomonas, Candida

## Oral seçenekler

- Florokinolonlar
- Rifampisin
- Fusidik asit
- Linezolid
- Trimetoprim-sulfametoksazol
- Doksisisiklin
- Klindamisin
- Metronidazol
- $\beta$ -Laktamlar

Micro-organism (red: difficult-to-treat)	Antibiotic <sup>a</sup> (check susceptibility before)	Dose <sup>b</sup>	Route
<b>Gram-negative</b>			
- Enterobacteriaceae ( <i>E. coli</i> , <i>Klebsiella</i> , <i>Enterobacter</i> etc.)	Ciprofloxacin <sup>h</sup>	2 x 750 mg	p.o.
- Non-fermenters ( <i>Pseudomonas aeruginosa</i> , <i>Acinetobacter</i> spp.)	Piperacillin/tazobactam or Meropenem or Ceftazidim + Tobramycin (or gentamicin) for 2–3 weeks, followed by: Ciprofloxacin	3 x 4.5 g 3 x 1 g 3 x 2 g 1 x 300 mg 1 x 240 mg 2 x 750 mg	IV IV IV IV IV p.o.
- Ciprofloxacin-resistant	Depending on susceptibility: meropenem 3 x 1 g, colistin 3 x 3 million U and/or fosfomycin <sup>d</sup> 3 x 5 g IV, followed by oral suppression.		

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www.efortopenreviews.org

## Hasta M.A.

Seftazidim 3x2 gr i.v. 4 hafta + Amikasin 1000 mg/gün 2 hafta  
Ardından 12 hafta (3 ay) oral 2x750 mg siprofloksasin

Tedavisi kesilirken ESH: 38 mm/saat, CRP: 8 mg/L

Postop 20. ayda yakınması yok, nüks yok



# Diagnosis and Management of Prosthetic Joint Infection: Clinical Practice Guidelines by the Infectious Diseases Society of America<sup>a</sup>

**Douglas R. Osmon,<sup>1</sup> Elie F. Berbari,<sup>1</sup> Anthony R. Berendt,<sup>2</sup> Daniel Lew,<sup>3</sup> Werner Zimmerli,<sup>4</sup> James M. Steckelberg,<sup>1</sup> Nalini Rao,<sup>5,6</sup> Arlen Hanssen,<sup>7</sup> and Walter R. Wilson<sup>1</sup>**

<sup>1</sup>Division of Infectious Diseases, Mayo Clinic College of Medicine, Rochester, Minnesota; <sup>2</sup>Bone Infection Unit, Nuffield Orthopaedic Centre, Oxford University Hospitals NHS Trust, United Kingdom; <sup>3</sup>Division of Infectious Diseases, Department of Internal Medicine, University of Geneva Hospitals, <sup>4</sup>Basel University Medical Clinic, Liestal, Switzerland; <sup>5</sup>Division of Infectious Diseases, Department of Medicine, and <sup>6</sup>Department of Orthopaedic Surgery, University of Pittsburgh School of Medicine, Pennsylvania, and <sup>7</sup>Department of Orthopedics, Mayo Clinic College of Medicine, Rochester, Minnesota

**Proceedings of the International  
Consensus Meeting on  
Periprosthetic Joint Infection**

Chairman

Javad Parvizi

Thorsten Ge

*Bone Joint J* 2013;95-B:1450-

THE JOURNAL OF  
**Arthroplasty**

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PROCEEDINGS OF THE SECOND INTERNATIONAL CONSENSUS  
MEETING ON MUSCULOSKELETAL INFECTION

<https://www.sciencedirect.com/journal/the-journal-of-arthroplasty/vol/34/issue/2/suppl/S>



# Diagnosis and Prevention of Periprosthetic Joint Infections

## Evidence-Based Clinical Practice Guideline

*Adapted by:*

The American Academy of Orthopaedic Surgeons Board of Directors

March 11, 2019

The American Academy of Orthopaedic Surgeons (AAOS)

The American Association of Hip and Knee Surgeons

The American Society for Clinical Pathology

The American Society for Microbiology

The Infectious Disease Society of America

The Hip Society

The Knee Society

The Society of Nuclear Medicine and Molecular Imaging

The College of American Pathologists

The American College of Radiology



## ■ ARTHROPLASTY

# The EBJIS definition of periprosthetic joint infection

A PRACTICAL GUIDE FOR CLINICIANS

**M. McNally,  
R. Sousa,  
M. Wouthuyzen-  
Bakker,  
A. F. Chen,  
A. Soriano,  
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### Aims

The diagnosis of periprosthetic joint infection (PJI) can be difficult. All current diagnostic tests have problems with accuracy and interpretation of results. Many new tests have been proposed, but there is no consensus on the place of many of these in the diagnostic pathway. Previous attempts to develop a definition of PJI have not been universally accepted and there remains no reference standard definition.

### Methods

This paper reports the outcome of a project developed by the European Bone and Joint Infection Society (EBJIS), and supported by the Musculoskeletal Infection Society (MSIS) and the European Society of Clinical Microbiology and Infectious Diseases (ESCMID) Study Group for Implant-Associated Infections (ESGIAI). It comprised a comprehensive review of the literature, open discussion with Society members and conference delegates, and an expert panel assessment of the results to produce the final guidance.

### Results

This process evolved a three-level approach to the diagnostic continuum, resulting in a definition set and guidance, which has been fully endorsed by EBJIS, MSIS, and ESGIAI.

### Conclusion

The definition presents a novel three-level approach to diagnosis, based on the most robust evidence, which will be useful to clinicians in daily practice.

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# Pocket Guide to Diagnosis & Treatment of Periprosthetic Joint Infection (PJI)



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