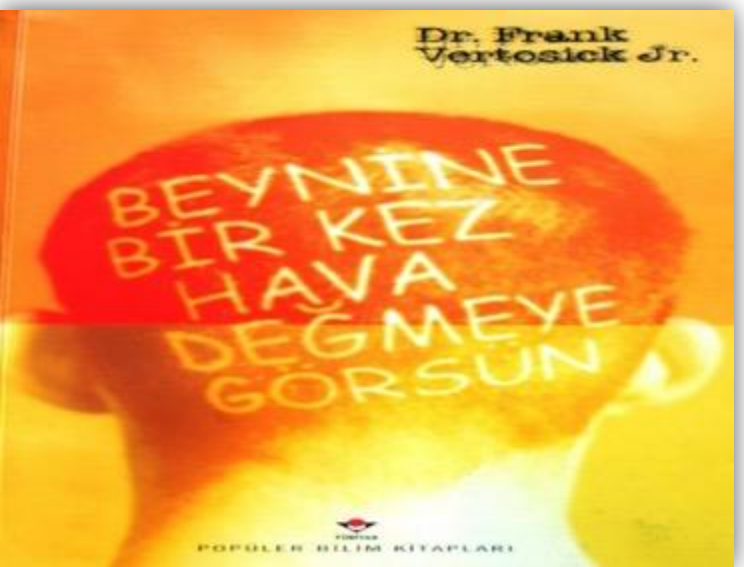
Şant Menenjiti



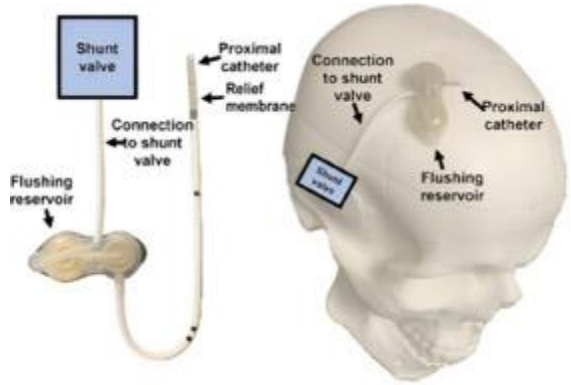
Dr Emel YILMAZ

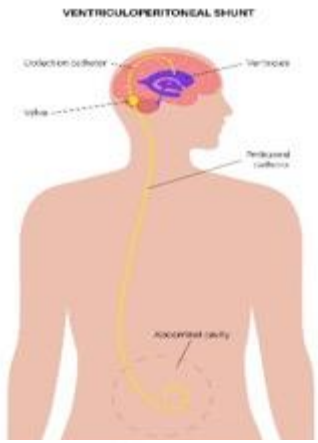
BUÜTF Enf Hast ve Kl Mikrob AD

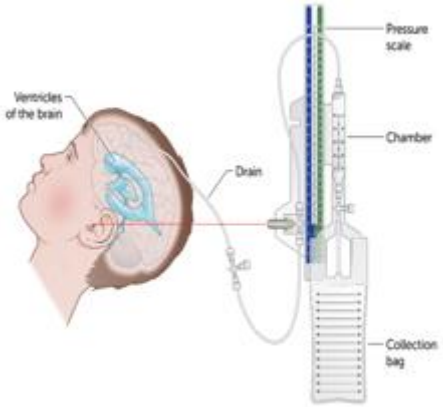
03.05.2026

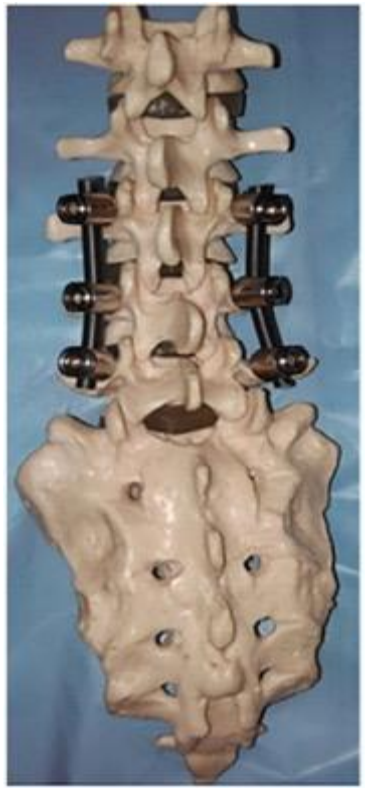
Beyin Cerrahisinde Kullanılan Yabancı Materyaller

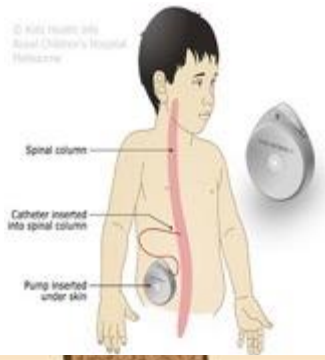
- Şant (VP, V-plavral, VA, V-lomber)
- Drenaj (EVD..)
- İntrakraniyal monitörler
- Kraniyoplasti materyalleri
- Spinal Cerrahide kulalnılan materyaller
- Stimülatörler
- Vasküler cerrahi
  - Stent
  - Koil
  - Klipler

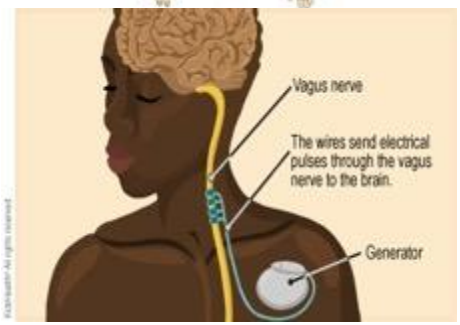

Shunt valve
Proximal catheter
Relief membrane
Connection to shunt valve
Flushing reservoir
Connection to shunt valve
Proximal catheter
Flushing reservoir

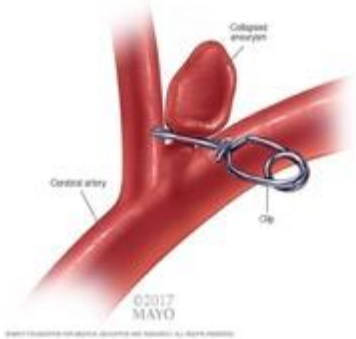

VENTRICULOPERITONEAL SHUNT

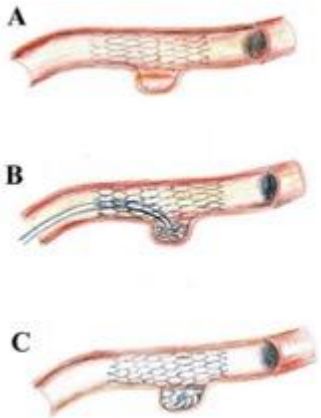

Pressure scale
Ventricles of the brain
Drain
Chamber
Collection bag

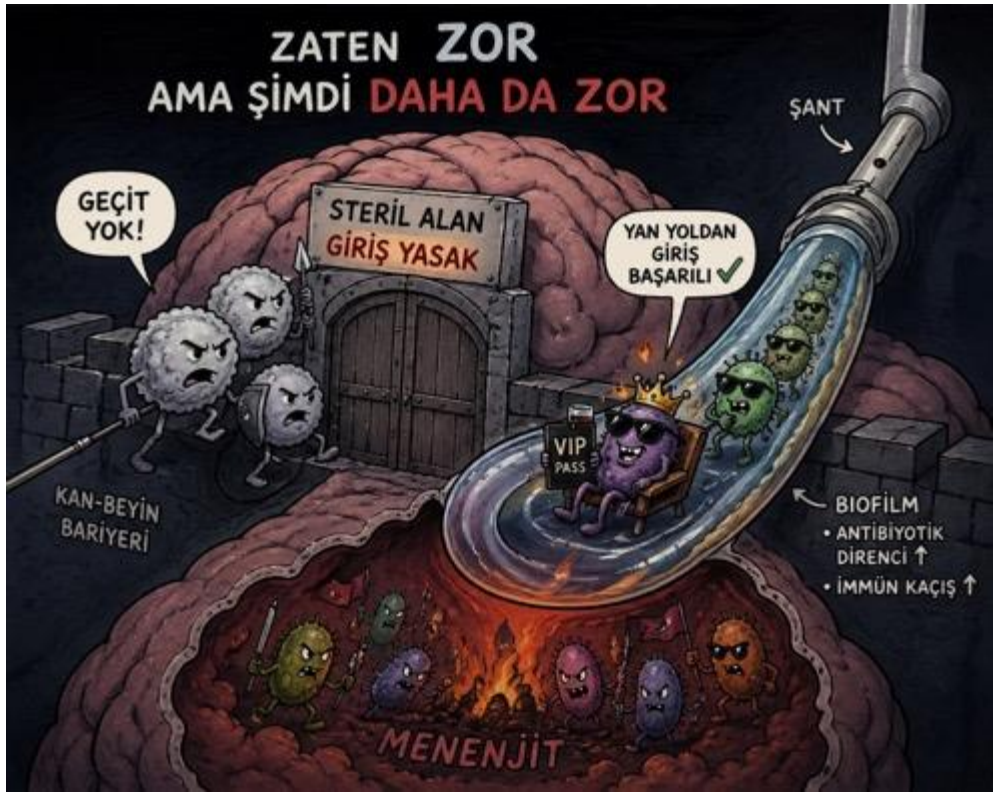



Spinal column
Catheter inserted into spinal column
Pump inserted under skin

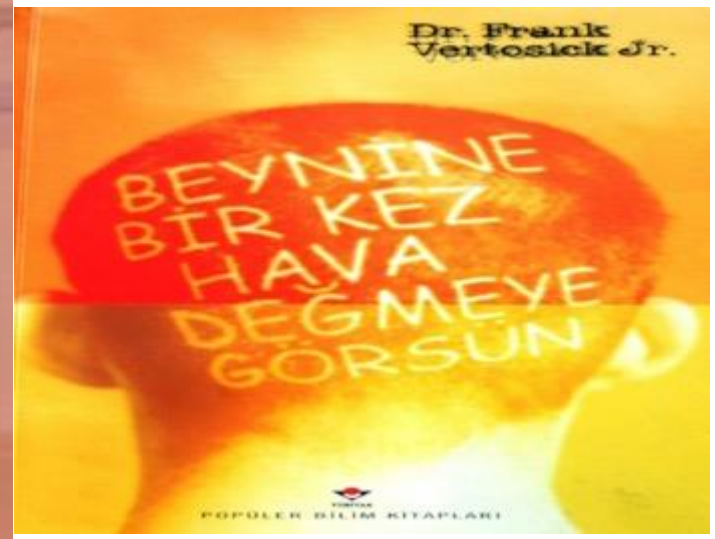

Vagus nerve
The wires send electrical pulses through the vagus nerve to the brain.
Generator


Collapsed aneurysm
Cerebral artery
Clip
©2017 MAYO


A
B
C


ZATEN ZOR
AMA ŞİMDİ DAHA DA ZOR
ŞANT
GEÇİT YOK!
STERİL ALAN
GİRİŞ YASAK
YAN YOLDAN GİRİŞ BAŞARILI
VIP PASS
KAN-BEYİN BARİYERİ
BIOFİLM
• ANTİBİYOTİK DİRENCİ ↑
• İMMÜN KAÇIŞ ↑
MENENJİT

2026



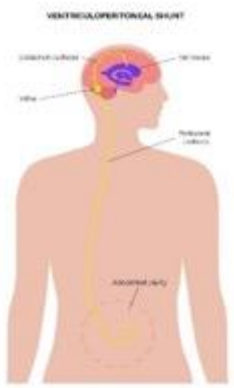
1995
1996

Neden Şant Kullanılır?

~ 60 yıldır Beyin Cerrahisi pratiğinde kullanılıyor

Şant

- Kronik BOS dolaşım bozukluğu
  - Obstrüktif (Nonkomünikan) hidrosefali
    - Aquadukt stenozu
    - Posterior fossa tümörü
  - Komünikan hidrosefali
    - SAK sonrası
    - Menenjit sonrası
  - Normal basınçlı hidrosefali
    - Yürüme bozukluğu+demans+idrar inkontinansı
  - Konjenital hidrosefali
  - Tümöre bağlı BOS akım bozukluğ
  - Travma sonrası kronik hidrosefal

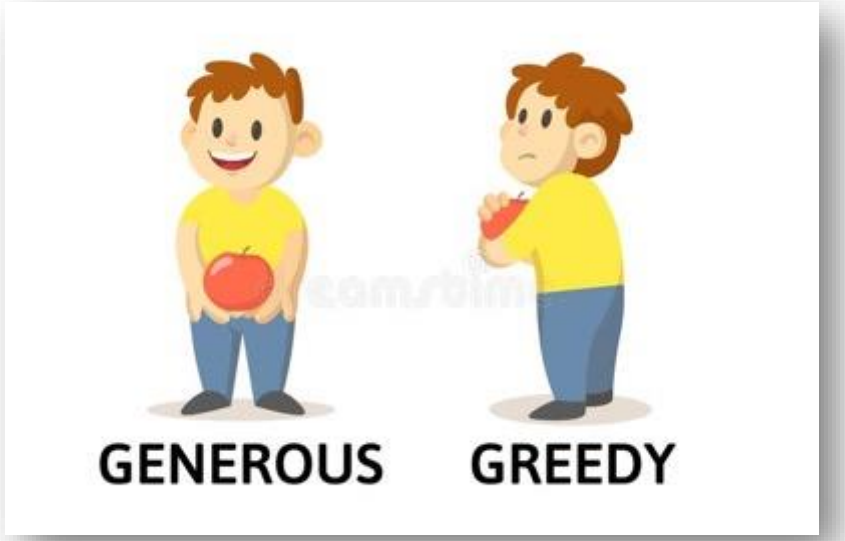


EVD

- Temel endikasyon akut ICP artışı ve geçici BOS drenaj ihtiyacı
- Menenjit/ventrikülitte tedavi amaçlı
- Şant öncesi köprü tedavi

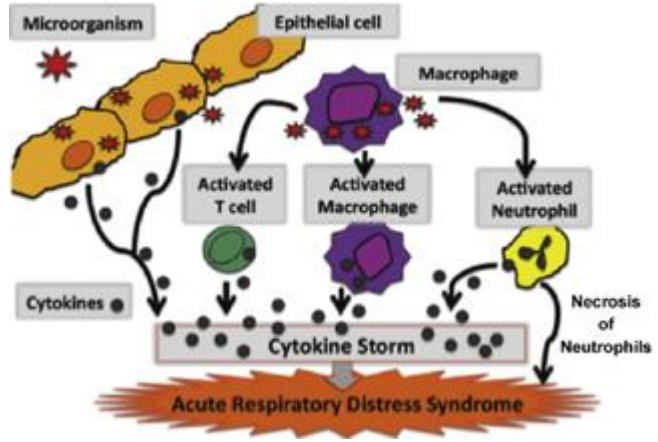
SSS İnfeksiyonları Neden Önemli

- Erken tanı ve tedavi çok önemli
- Hızlı progrese olur
- Uygun zaman ve uygun tedaviye rağmen mortalite ve morbiditesi yüksektir



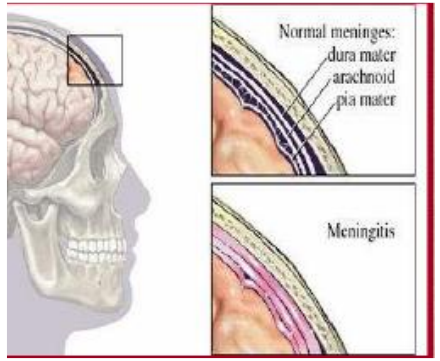
Amaç aşırı immün tepkinin hasarından korumak

- SSS’de immün sistem biraz farklıdır
- Patojen spesifik antikorlar ve kompleman sistemi proteinleri oldukça düşüktür
- Bakteriyel opsonizasyon zayıf
- Fagositoz yetersiz
- Granülosit fonksiyonları perifer gibi değildir
- Az sayıda mikroorganizma bile ciddi hasar yapar

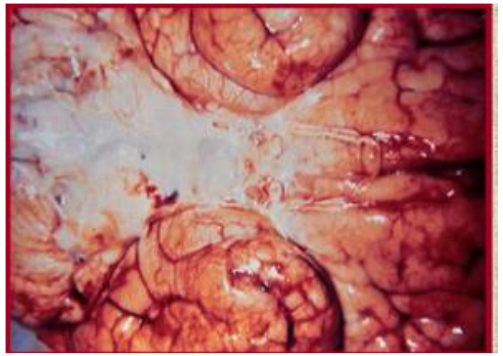


Epidemiyoloji

- Menenjit= Meninkslerin (pia ve arachnoid) inflamasyonudur
- Pleositoz



- Şant menenjiti %4-17 (yayınlarda %5-41)
- EVD menenjiti %0-22
- Lomber kateter %0,8-7



Risk Faktörleri

Şant

- Prematüre
- Uzun operasyon süresi
- Revizyon cerrahileri
- BOS kaçağı

- Hidrosefali nedeni (kanama, menenjit pürülan)

EVD

- Uzun süreli kateter kullanımı
- Kateter irrigasyonu
- Eşlik eden infeksiyon
- EVDS kateter süresi>5 gün
- Kapalı sistemin ayrılması
- Sık BOS örneği almak

Genel

- Ameliyathane şartları
  - Uygunsuz eldiven
  - Tecrübe
  - Ameliyathane odası kalabalık
  - Nöroendoskop kullanımı
  - Operasyon süresi
  - Yetersiz cilt hazırlığı
  - Tıraşlama
  - Geniş insizyon
- Sterilizasyon, dezenfeksiyon, cilt antisepsisinde uygunsuzluk
- Uygunsuz cerrahi profilaksi

Hastaya ait
DM
Kronik hastalıklar
Kortizon kullanımı
İmmünsüpresif hasta

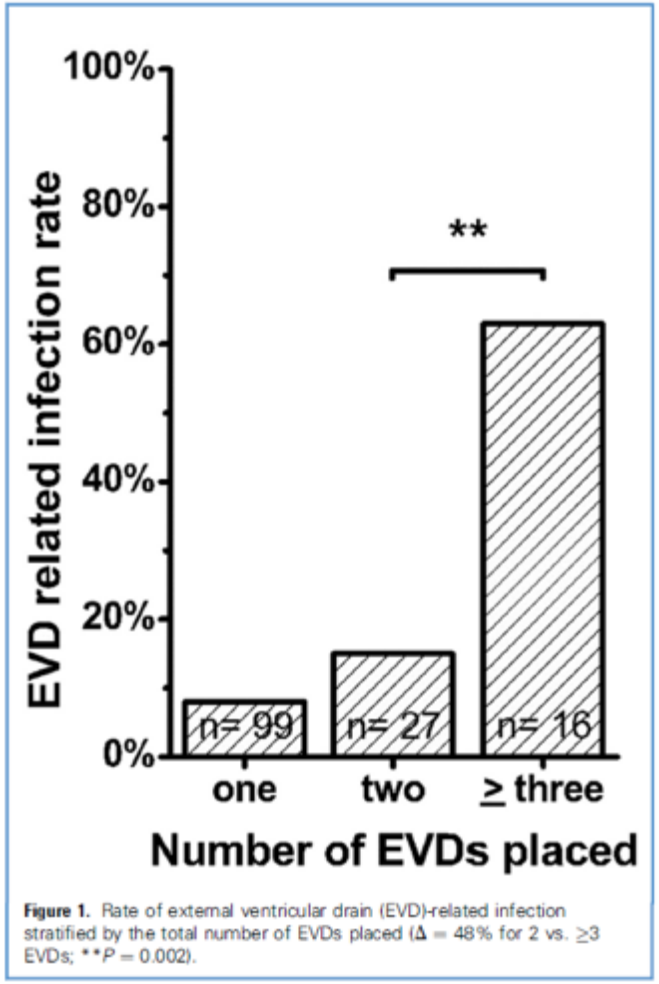


Figure 1. Rate of external ventricular drain (EVD)-related infection stratified by the total number of EVDs placed (Δ = 48% for 2 vs. ≥3 EVDs; $^{**}P = 0.002$).

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ORIGINAL ARTICLE

Check for updates

Decreasing External Ventricular Drain-Related Infection Rates with Duration-Independent, Clinically Indicated Criteria for Drain Revision: A Retrospective Study

Miki Katzir[1,4], Jason J. Lefkowitz[3], Daniel Ben-Reuven[3], Steven J. Fuchs[3], Khetam Hussein[2], Gill E. Sviri[1]

OBJECTIVE: To lower external ventricular drain (EVD)-related infection rates, in April 2013, our institution enacted a major protocol change, switching from routine EVD replacement every 5 days to EVD replacement only when clinically indicated. In the present study, we evaluated the effect of this change on nosocomial EVD-related infections.

METHODS: We performed a retrospective cohort study to compare the EVD-related infection rates between 2 groups (group A, elective EVD replacement; group B, clinically indicated EVD replacement). We analyzed the data from 142 patients (group A, $n = 43$; group B, $n = 99$), with a total of 227 EVDs for 5 years and 3 months (1721 catheter

EVD-related infections, underscoring the importance of drain changes only when clinically indicated and that, as soon as clinically permitted, catheters should be removed.

INTRODUCTION

The external ventricular drain (EVD) is the reference standard for measuring intracranial pressure (ICP) and serves as a life-saving device, allowing drainage of cerebrospinal fluid (CSF).[1] The frequent indications for EVD insertion include severe head injury, shunt malfunction, acute increased ICP

Katzir M et al. World Neurosurg. 2019; 131: e474-e481

Etiyoloji

Box 1
Microbiology of cerebrospinal fluid shunt infections

Common
- Coagulase-negative *Staphylococci*
- *Staphylococcus aureus*
- Enteric gram-negative bacilli[a]

2/3'ü

Less common
- *Cutibacterium acnes*
- Viridans group *Streptococci*

Rare
- Other streptococci[b]
- *Enterococcus* spp.
- *Candida* spp.
- *Corynebacterium* spp.

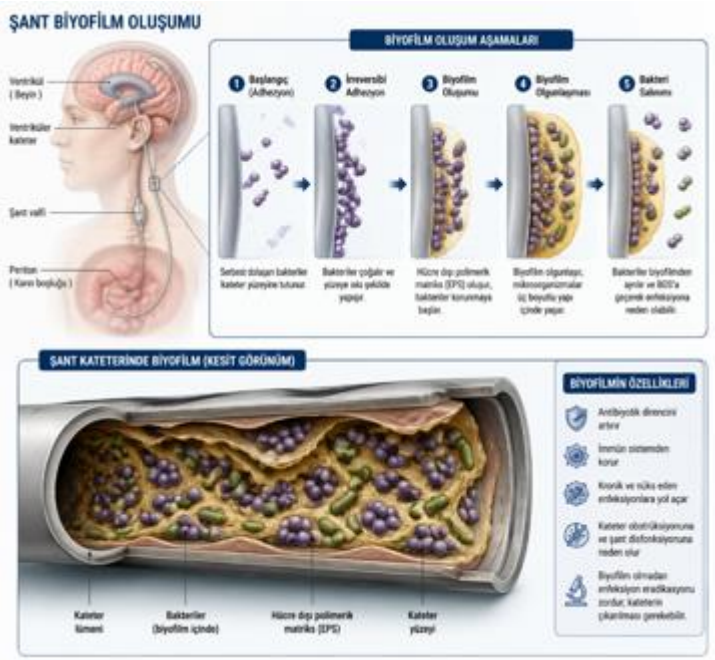
[a]Usually *Escherichia coli*, *Klebsiella* species, *Pseudomonas aeruginosa*, and *Proteus* species.

[b]Usually group B Streptococcus, *Streptococcus pyogenes*, or *Streptococcus pneumoniae*.

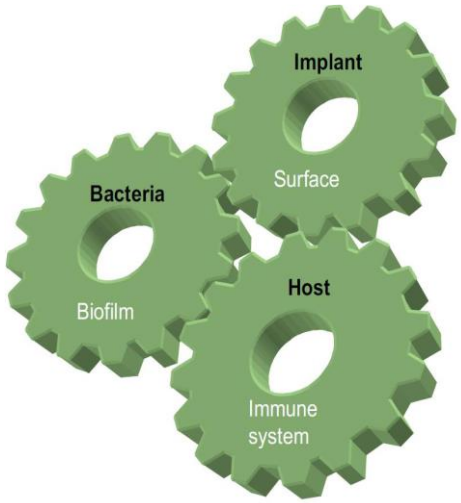
Simon D T. Infect Dis Clin N Am 2024; 38: 757-75.

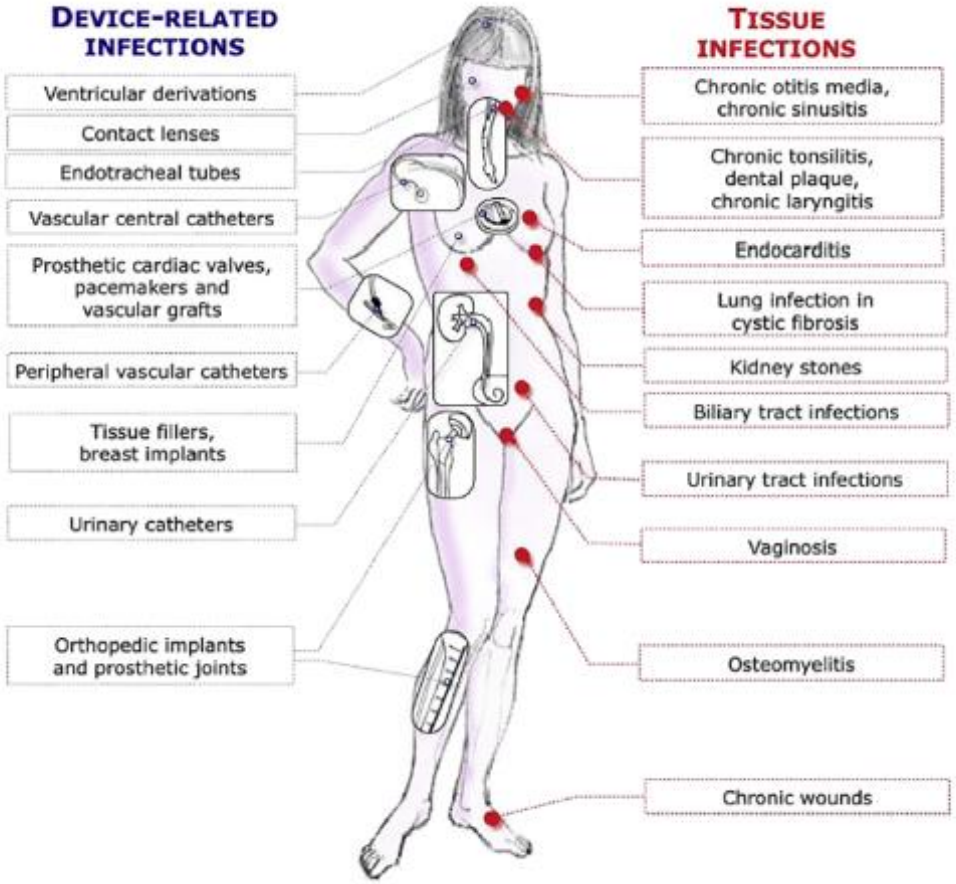
Patogenez

- En sık cerrahi sırasında şantın kolonizasyonu (%72)
- Distal uçtan retrograd bulaş
  - Translokasyon
  - Bağırsak perforasyonu
- Cilt bulaşı
  - Rezervuara iğne girişi
  - İlaç enjeksiyonu
  - Kateter trasesi boyunca erozyon
- Hematolojik yayılım
  - Başka enfeksiyon odağı
  - Özellikle VA şant



Biyofilm = yaşayan katman





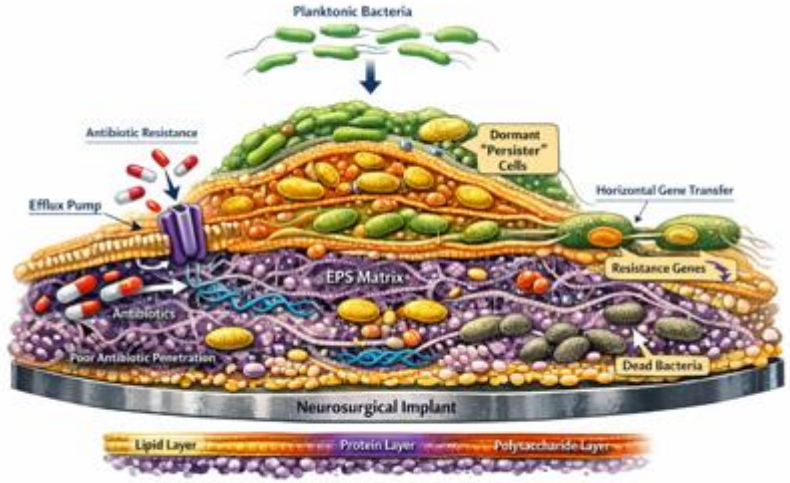


FIG. 1. Typical biofilm infections (3) (reproduced with permission).

Klinik Bulgu ve Semptomlar

Ateş	%40-70
Baş ağrısı	%30-60
Ense sertliğ	
Bilinç değiş	
Kernig’s	
Brudzinski’s	
Kusma	
Nöbet geçirme	%5-20
Fokal bulgular	%5-15
Papil ödemi	<%10

Menenjit triadı
Ancak 3’ü birlikte nadir

Distal uçta baş ağrısı olmayabilir
e spesifik ne de

Meningeal irritasyon bulguları daha az
Cihaz disfonksiyonu ve mental değişiklik daha fazla

subakut, silik,
pesifik

Bakteriyel menenjit klasik bulguların yokluğunda dışlanamaz
Tedavi kararı klinik karardır

Klinik

- Lokalizasyona bağlı bulgular olabilir
  - Proksimal uçta
    - Vetrikülit-menenjit
    - Şant obstrüksiyonu (disfonksiyonu şeklinde karşımıza çıkar)
    - Nadiren intrakraniyal apse/ampiyem
  - Distal uçta
    - Peritonit/plörit
    - Ateş,
    - İştahsızlık
    - Akut batın tablosu (defans, hassasiyet)
    - Psödokist (kitle etkisi)
- İnsizyon hattında pürülan akıntı
- Şantın subkutan trasesi boyunca inflamasyon

Komünikan hidrosefali, Virülansı düşük bakteride ve
Sadece şant infeksiyonunda;
MIB olmayabilir!!!!

Simon D T. Infect Dis Clin N Am 2024; 38: 757-75.

Table 1
Pertinent history and physical examination

Important Medical and Surgical History	
Indications for insertion	
Dates of insertion and revision(s)	
Medications and allergies	
History of prior shunt malfunction: symptoms, cause, and correction	
History of prior shunt infections: symptoms, organisms, and therapy	
Important Elements of the Physical Examination	
Head, Eye, Ear, Nose, Throat	Head circumference in infants Characteristics of fontanelles and position of sutures in infants Burr holes: size, number, location, and features (soft, tense, tender) Scalp infections
Neurologic	Papilledema, optic atrophy Pupil size and reactivity, extraocular motor function Mental status: alertness, orientation
Neck	Tenderness Meningismus Adenopathy
Abdomen	Tenderness Ascites Masses
Skin	Surgical incision site(s) Catheter length and connections: fluid collections or inflammation
Catheter	Position of reservoir, valve, distal catheter

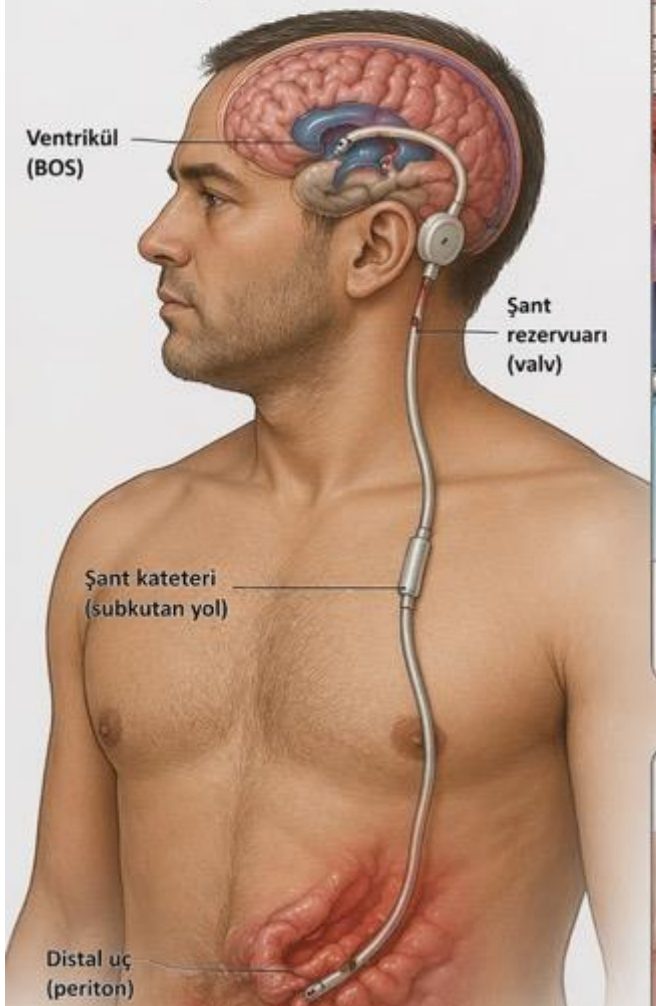
VA şant
Ag+Ab kompleksine bağlı glomerülonefrit
Aralıklı bakteriyemi
Endokardit

’Shampoo clue’’ şampuan bulgusu saç yıkaması sonrası her maniplasyonda ateş

Simon D T. Infect Dis Clin N Am 2024; 38: 757-75.

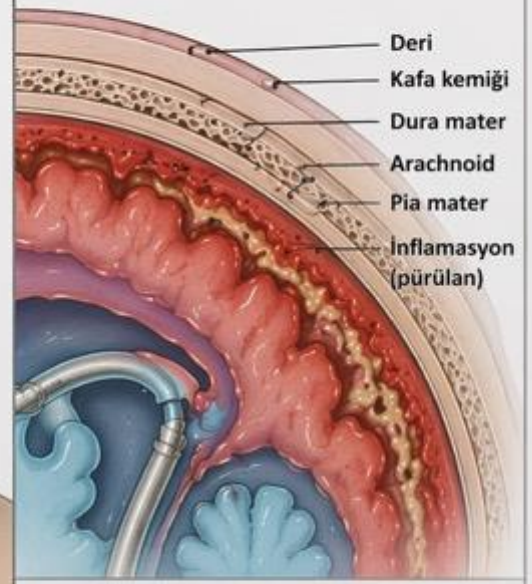
ŞANT MENENJİTİ (ERİŞKİN)

Fokal enfeksiyon bulguları



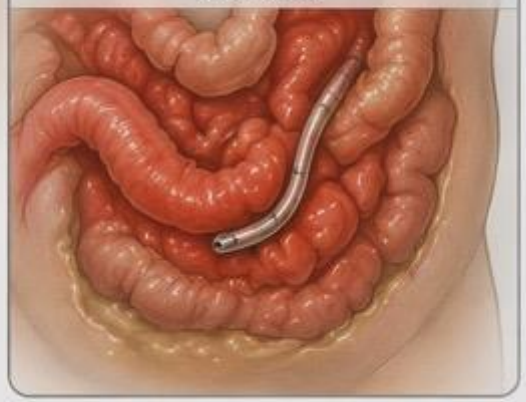
Diğer olası sistemik bulgular
- Ateş
- Baş ağrısı, bulantı, kusma
- Mental durum değişikliği
- Ense sertliği
- BOS incelemesinde pleositoz, yüksek protein, düşük glukoz, pozitif kültür

ŞANT MENENJİTİ



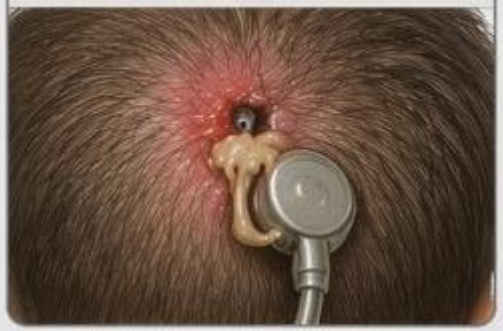
Şant kateteri boyunca veya meninkslerde bakteriyel enfeksiyon ve inflamasyon (pürülan menenjit) gelişir.

Distal uç enfeksiyonu (peritonit)

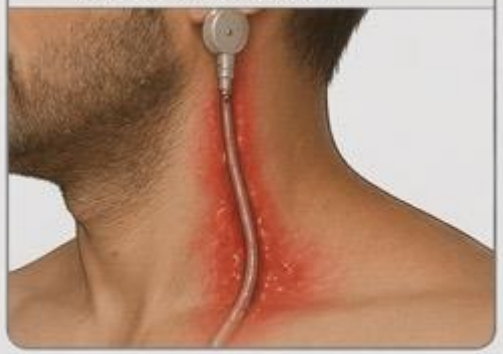


1. Distal bölgede ağrı (ör: periton)

2. Yara yerinden pürülan akıntı



3. Şantın subkutan seyri boyunca inflamasyon (eritem, ısı artışı, şişlik)



Tanı

Önce şüphelenmek

- BOS analizi
  - Lökosit artışı
  - Protein artışı
  - Glukoz düşüklüğü
- BOS incelemesi (kültür)
- Kan kültürü (V-peritoneal-VA)
  - VA >%90 üreme olur
  - VP >%80 üreme olmaz
- CRP, PCT (normal olabilir!!!)
  - Pozitif prediktif değeri yüksek
  - Negatif prediktif değeri düşük
- MR ve BT görüntüleme

BOS'da pleositoz

- Serebellar köşe tümörü
- Operasyon
- Tümör operasyonu
- Ratke's cleft kist operasyonu (kist duvarındaki kolesterol kristalleri)
- Posterior Fossa Sendromu
- Jeneralize nöbet (<80/ mm^3)
- **Yabancı cisim (şant)**

LP'de BOS normal olabilir

-Ventriküler BOS ile Lomber BOS arasında ileti olmayabilir

-Sadece şant infeksiyonu olabilir

Şant Enfeksiyon Tanısı

Düzeltilmiş lökosit sayısı
1 lökosit≡ 700 eritrosit
BOS WBC/Kan WBC X BOS RBC/Kan RBC

Table 1. Criteria for the diagnosis of CSF shunt infection

The criteria for CSF shunt infection include both of the following items:

(A) A positive cerebrospinal fluid (CSF) or CSF shunt tip culture in patients with clinical presentation of acute bacterial meningitis, or with signs or symptoms of shunt malfunction or obstruction;

(B) At least one of the following parameters of bacterial inflammation of the CSF:

(1) a leukocyte count of >0.25 × 10^9/L with predominant polymorphonuclear cells;

(2) a CSF lactate concentration of >3.5 mmol/L;

(3) a glucose ratio (CSF glucose/serum glucose) of <0.4;

(4) a CSF glucose value of <2.5 mmol/L if no simultaneous blood glucose is observed.

250/mm3

BOS PCT >1ng/mL

<45 mg/dL

Tunkel AR Clin Infect Dis 2017; 64: e34-e65.

Table 3. Laboratory analysis of CSF samples from patients with CSF shunt–associated infection.

Variable	Finding
Leukocyte count	
$>5 \times 10^6$ cells/L, no. (%) of episodes	48/60 (80)
Median value, $\times 10^6$ cells/L (range)	61 (0.3–5010)
Granulocyte count	
$\geq 1 \times 10^6$ cells/L, no. (%) of episodes	46/60 (77)
Median value, $\times 10^6$ cells/L (range)	32 (0–3006)
Lactate level	
>1.9 mmol/L, no. (%) of episodes	34/42 (81)
Median value, mmol/L (range)	4 (1–14)
Total protein level	
>0.45 g/L, no. (%) of episodes	36/62 (58)
Median value, g/L (range)	0.8 (0.1–36)
CSF-to-blood glucose ratio	
<0.5, no. (%) of episodes	16/31 (52)
Median value (range)	0.4 (0.1–1)

NOTE. Denominators indicate the episodes for which data were available.

Hücre artışı, Glukoz düşüklüğü, Protein artışı
HER ZAMAN bakteriyel menenjit değil
Malignite ve vazospazmda da olabilir

Conen A et al. CID 2008; 47: 73-82

Table 2. Inflammatory Markers in Serum and Cerebrospinal Fluid for Diagnosing Ventriculitis

	n	Mean ± Standard Deviation	Area Under the Curve (95% CI)	Cutoff	Sensitivity (95% CI)	Specificity (95% CI)	Positive Likelihood Ratio (95% CI)	Negative Likelihood Ratio (95% CI)
CSFIL-6 (pg/mL)	15	7588 ± 4580	0.852 (0.738–0.967)	3100	86.7 (62.1–96.3)	82.1 (64.4–92.1)	4.8 (2.14–11.0)	0.16 (0.04–0.60)
$_{CSF}$PMN (%)	16	72.2 ± 16.1	0.786 (0.638–0.933)	62.0	81.3 (57.0–93.4)	71.4 (45.4–82.8)	2.8 (1.27–4.67)	0.26 (0.10–0.82)
CSF/S IL-6 Ratio	15	247 ± 176	0.798 (0.665–0.930)	50.0	86.7 (62.1–96.3)	67.9 (49.3–82.1)	2.7 (1.52–4.79)	0.20 (0.05–0.73)
sIL6 in (pg/mL)	16	80.5 ± 151	0.579 (0.417–0.741)	10.1	100 (80.6–100)	22.5 (12.3–37.5)	1.29 (1.09–1.53)	0
sCRP (mg/dL)	17	8.8 ± 9.5	0.685 (0.543–0.828)	5.5	58.8 (36.0–78.4)	75.0 (59.8–85.8)	2.35 (1.21–4.59)	0.55 (0.30–1.00)

CI, confidence interval; CSFIL-6, cerebrospinal fluid interleukin 6; $_{CSF}$PMN%, percentage of polymorphonuclear cells in the cerebrospinal fluid; sIL-6, serum interleukin 6; sCRP, serum C-reactive protein.

Table 3. Interval Likelihood Ratios of Cerebrospinal Fluid Interleukin 6 for Predicting Ventriculitis and Vasospasm

Cerebrospinal Fluid Interleukin 6 (pg/mL)	iLR for Ventriculitis (95% CI)	iLR for Vasospasm (95% CI)
>3100	4.85 (2.14–11.0)	0.649 (0.284–1.48)
530–3080	0.737 (0.094–1.49)	5.06 (1.60–16.0)
<530	0	0.307 (0.078–1.21)

iLR, interval likelihood ratio; CI, confidence interval.

Lenski M et al World Neurosurg 2017; 99: 132-9

•.

•. 2021

Table 9. ROC analysis of CSF cytokine and D- lactate levels between patients with nosocomial meningitis and control

	Sensitivity (%)	Specifity (%)	PPV (%)	NPV (%)	Cut-off value	AUC	p
IL-6 (pg/mL)	79.31	87.27	76.7	88.9	>70	0.894	<0.001
IL-8 (pg/mL)	89.66	63.64	56.5	92.1	>90	0.832	<0.001
D-lactate (µmol/mL)	79.31	72.73	60.5	87.0	>0.861	0.807	<0.001
Model	79.31	22.51	85.2	89.5	>0.186	0.873	<0.001

AUC: Area under curve, PPV: Positive predictive value, NPV: Negative predictive value
Model refers to multivariate ROC analyses of the combinations of IL-6 (pg/mL) and IL-8 (pg/mL)

Table 5. Comparison of CSF examination results of patient and control groups

	Meningitis (1) (n=29)	Pleocytosis without meningitis (2) (n=38)	Patients without pleocytosis (3) *(n=54)	Overall p	Pairwise Comparison
CSF leukocyte count /mm³	160 (0-48000)	25 (10-4600)	0 (0-110)	**<0.001**	1-2 0.112 1-3 <0.001 2-3 <0.001
CSF erythrocyte count/mm³	6900 (0-230000)	1320 (0-70200)	245 (0-141000)	**0.008**	1-2 0.041 1-3 0.004 2-3 0.135
Glucose mg/dL	56 (5-133)	62.5 (17-107)	73 (38-136)	**0.001**	1-2 0.715 1-3 0.009 2-3 0.001
Protein mg/dL	141.6 (13.6-1468.4)	45.6 (4.97-189)	34.9 (6.8-392)	**<0.001**	1-2 0.002 1-3 <0.001 2-3 0.060

Descriptive statistics were given as median(minimum-maximum).

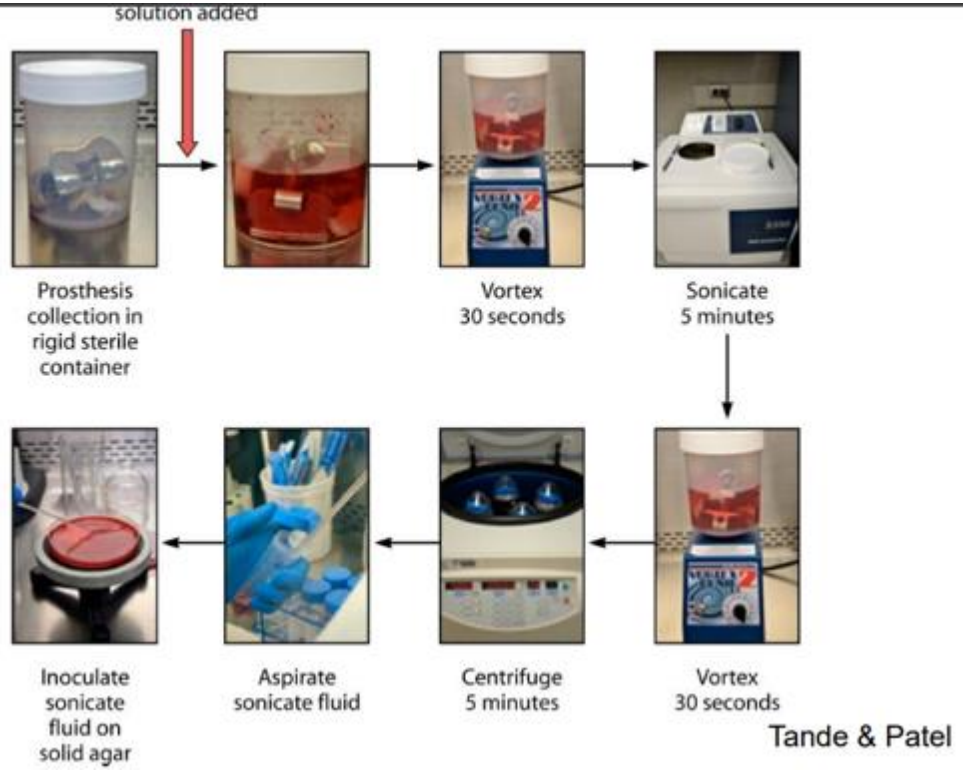
* This was secondary to the operation or caused by bloody touching.When corrected, WBC counts were not pleocytosis

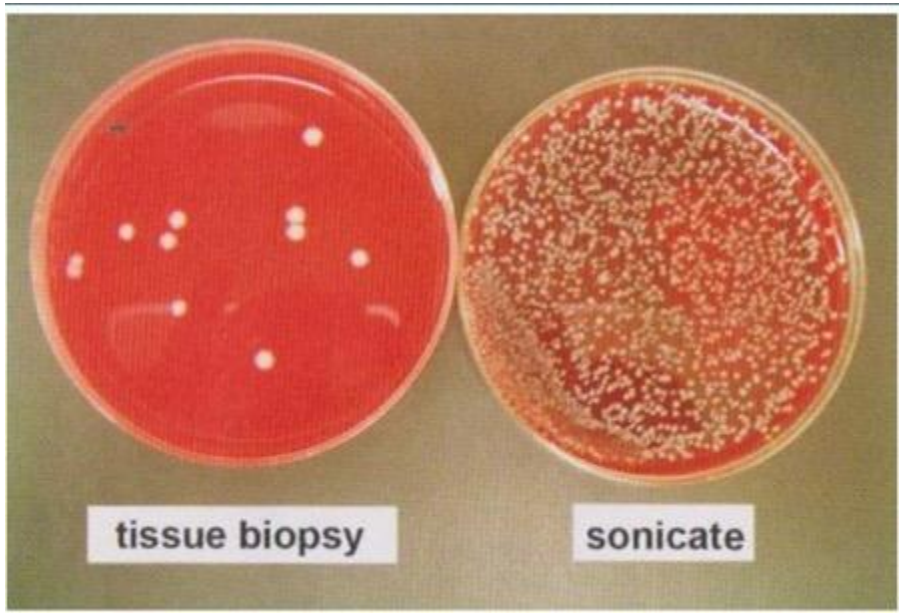
Table 8. ROC analysis of CSF cytokine and D- lactate levels between patients with nosocomial meningitis and pleocytosis patients without meningitis

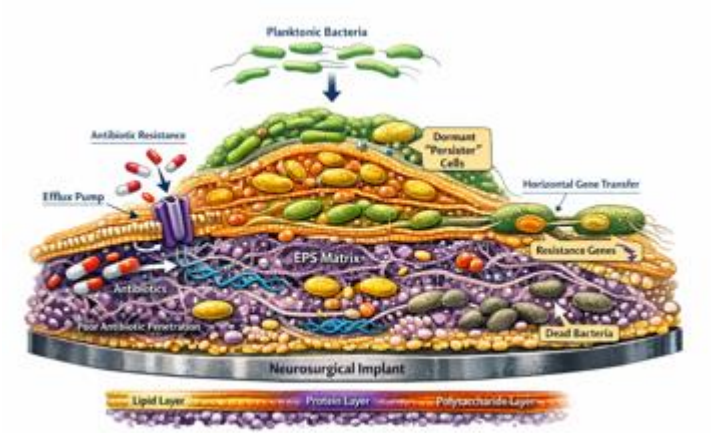
	Sensitivity (%)	Specifity (%)	PPV (%)	NPV (%)	Cut-off value	AUC	p
IL-6 (pg/mL)	55.17	94.74	88.9	73.5	>440	0.774	**<0.001**
IL-8 (pg/mL)	44.83	84.21	68.4	66.7	>1249	0.643	**0.037**
D-lactate (µmol/mL)	75.86	63.16	61.1	77.4	>1.05	0.723	**<0.001**
IL-6 & IL-8	55.17	94.74	88.9	73.5	>0.5317	0.790	**<0.001**
IL-6 & D-lactate	62.07	89.47	81.8	75.6	>0.5740	0.779	**<0.001**
IL-8& D-lactate	82.76	60.53	61.5	82.1	>0.3134	0.730	**<0.001**
IL-6 & IL-8& D-lactate	55.17	94.74	88.9	73.5	>0.60364	0.801	**<0.001**

AUC: Area under curve, PPV: Positive predictive value, NPV: Negative predictive value

Göktas S et al. Singapore M J 2021: DOI: 10.11622/smedj.2021123


solution added
Prosthesis collection in rigid sterile container
Vortex 30 seconds
Sonicate 5 minutes
Vortex 30 seconds
Centrifuge 5 minutes
Aspirate sonicate fluid
Inoculate sonicate fluid on solid agar
Tande & Patel


tissue biopsy
sonicate


Planktonic Bacteria
Antibiotic Resistance
Efflux Pump
Dormant "Persister" Cells
Horizontal Gene Transfer
Resistance Genes
EPS Matrix
Antibiotics
Poor Antibiotic Penetration
Dead Bacteria
Neurosurgical Implant
Lipid Layer
Protein Layer
Polysaccharide Layer

Şant Menenjiti

Sorular

Sorunlar

Her ateş SSS infeksiyonu mu?

Her pleositoz SSS infeksiyonu mu?

Yanıt çoğu zaman yok

Her BOS da üreme SSS enfeksiyonu mu?
Kontaminasyon?
Kolonizasyon?
Etken??

Kontaminasyon?/Kolonizasyon?/İnfeksiyon?

- Kontaminasyon
  - Sadece BOS kx ya da gram boyamada etken var
  - BOS bulguları normal
  - Klinik özellik yok
- Kolonizasyon
  - Birden fazla kx'de üreme var ve/veya gram boyama etken var
  - BOS bulguları normal
  - Klinik yok
- İnfeksiyon
  - Tek/çoklu üreme var ve/veya gram boyama etken var
  - BOS bulguları menenjit uyumlu
  - Klinik bulgu var

Tanı

Box 3
Diagnostic tests for patients with a cerebrospinal fluid shunt and suspected infection

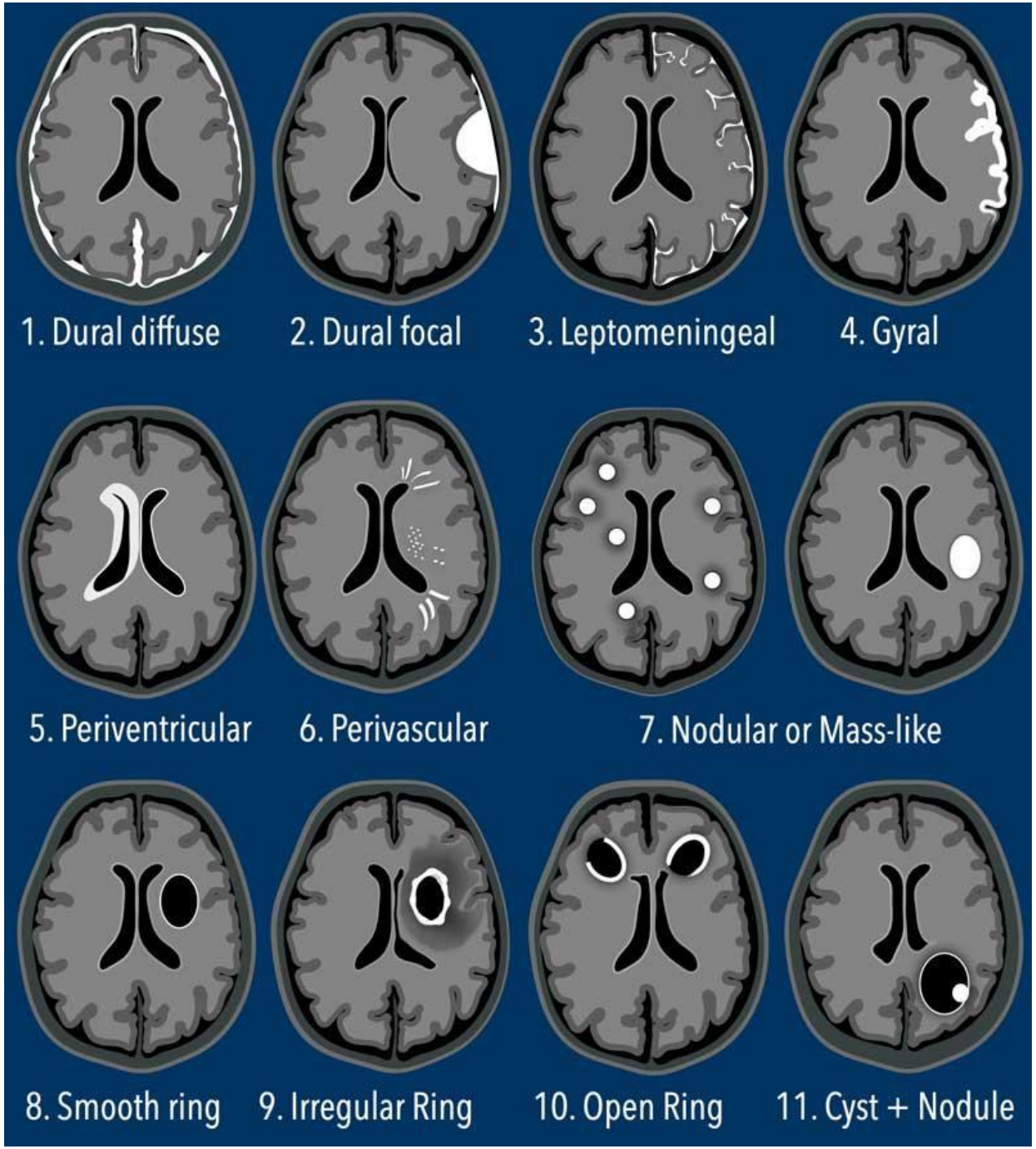
Step 1: Detect shunt malfunction

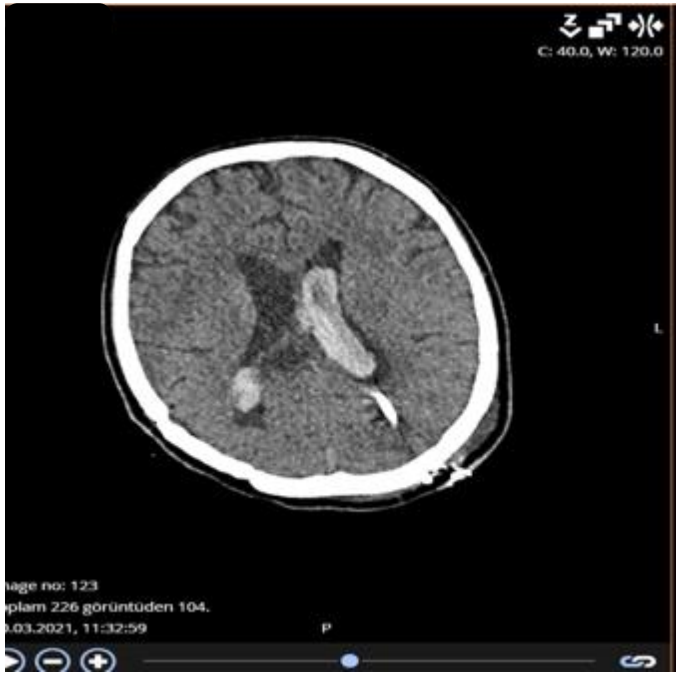
1. Shunt series (radiographs of skull, neck, chest, and abdomen) to assess for disconnection or malposition
2. Computed tomography or MRI to evaluate ventricular size or other changes that suggest elevated intracranial pressure
3. Consider abdominal ultrasound (VP shunt) looking for pseudocyst and free fluid (small amount expected)

Step 2: Detect infection

1. Shunt "tap" (at the discretion of the neurosurgeon)
   - Gram stain
   - Aerobic and anaerobic culture
   - Cell count and differential
   - Glucose, protein
2. Blood cultures (especially with VA shunt)
3. If VA shunt nephritis suspected: urinalysis, serum C3 and C4 complement

Simon D T. Infect Dis Clin N Am 2024; 38: 757-75.


1. Dural diffuse
2. Dural focal
3. Leptomeningeal
4. Gyral
5. Periventricular
6. Perivascular
7. Nodular or Mass-like
8. Smooth ring
9. Irregular Ring
10. Open Ring
11. Cyst + Nodule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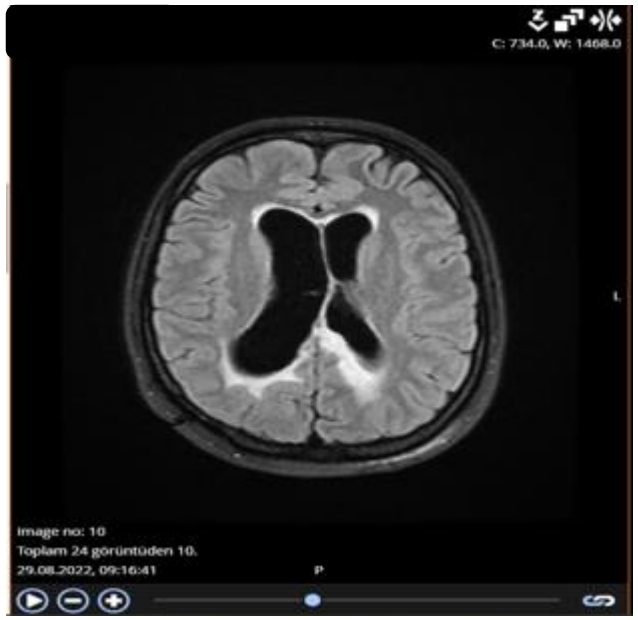
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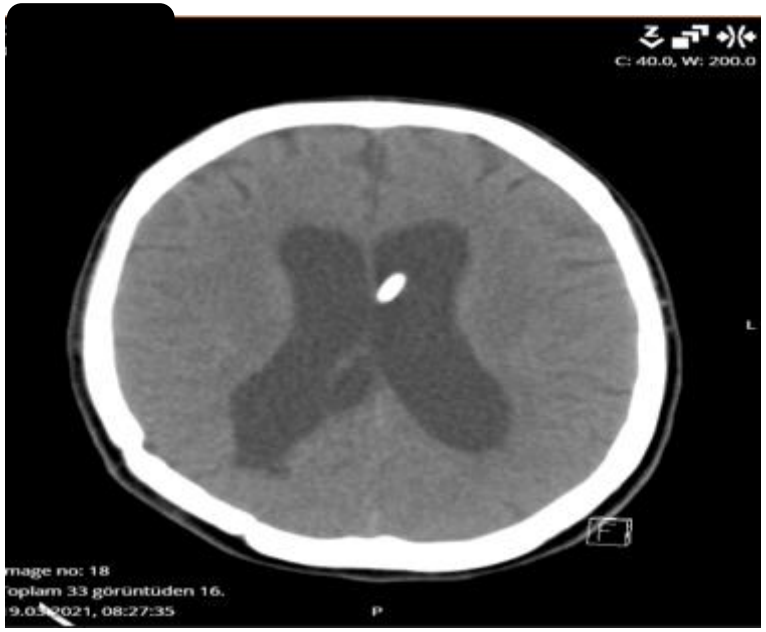
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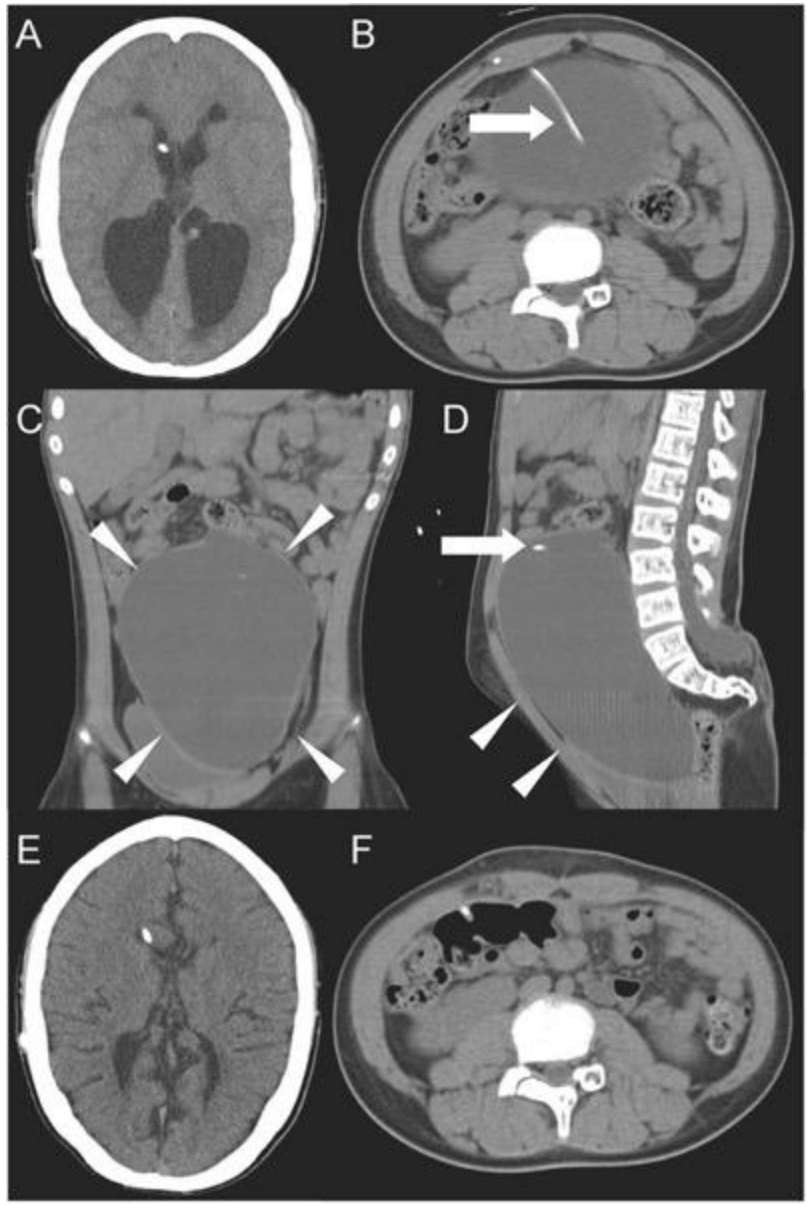
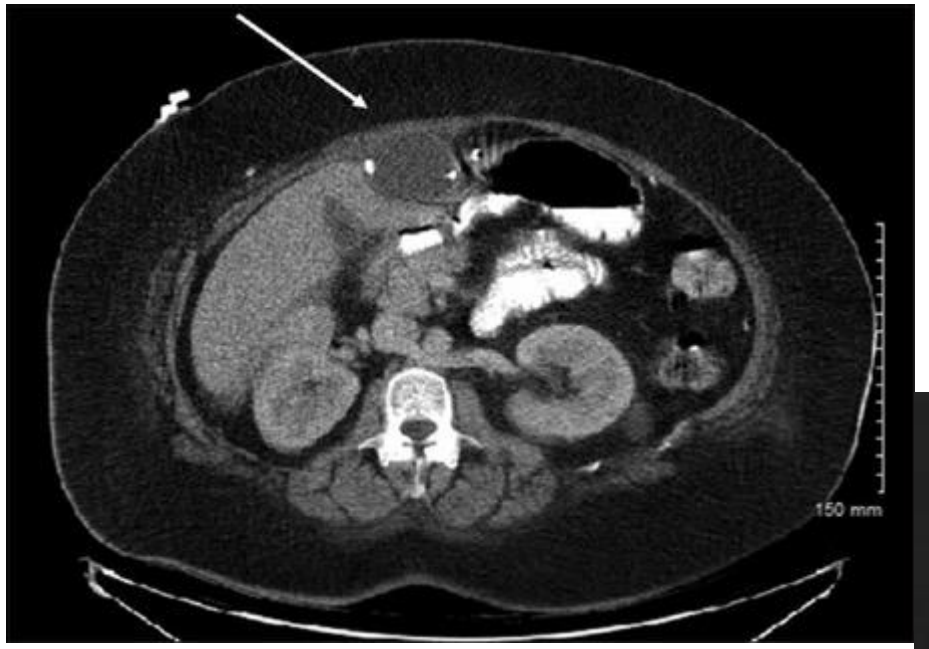
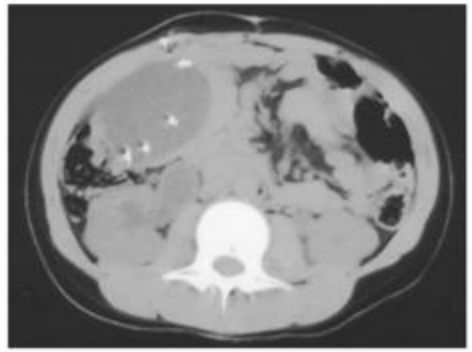






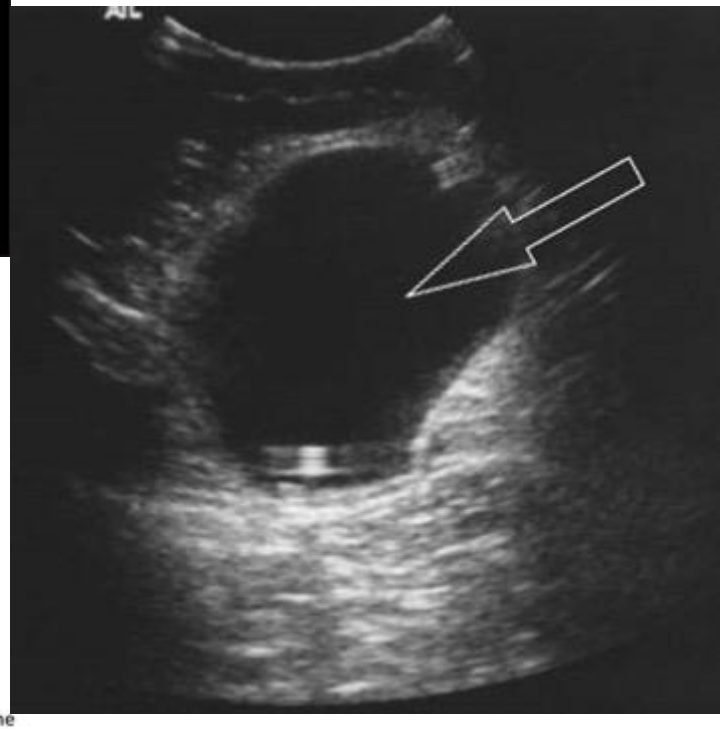
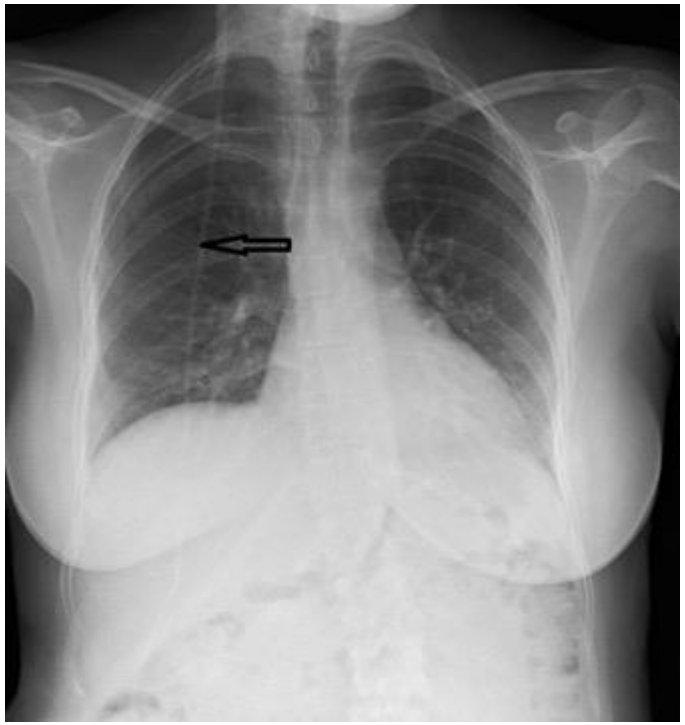
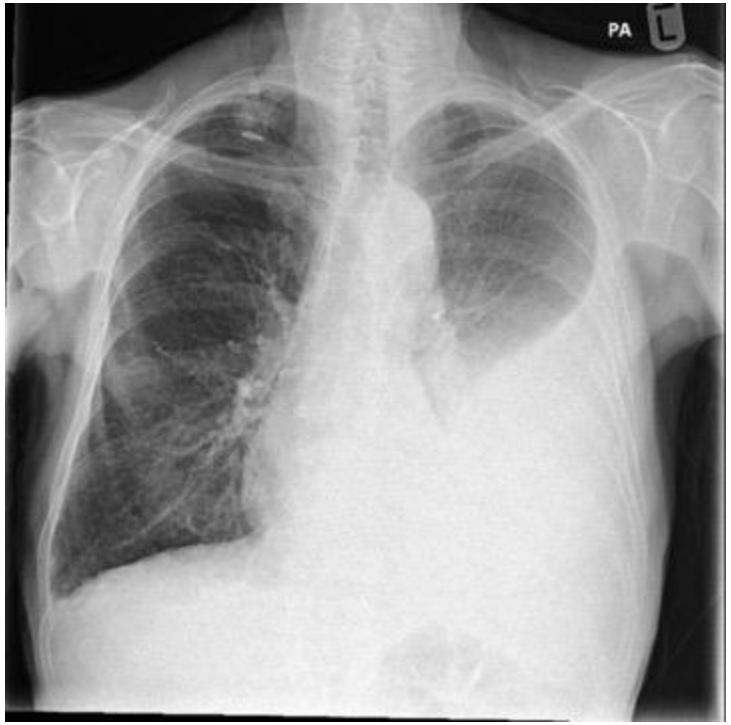


Fig. 1. Computed tomography of the abdomen reveals that the distal portion of the ventriculo-peritoneal catheter (the bright white area) is encased in a collection of cerebrospinal fluid in the peritoneal space.

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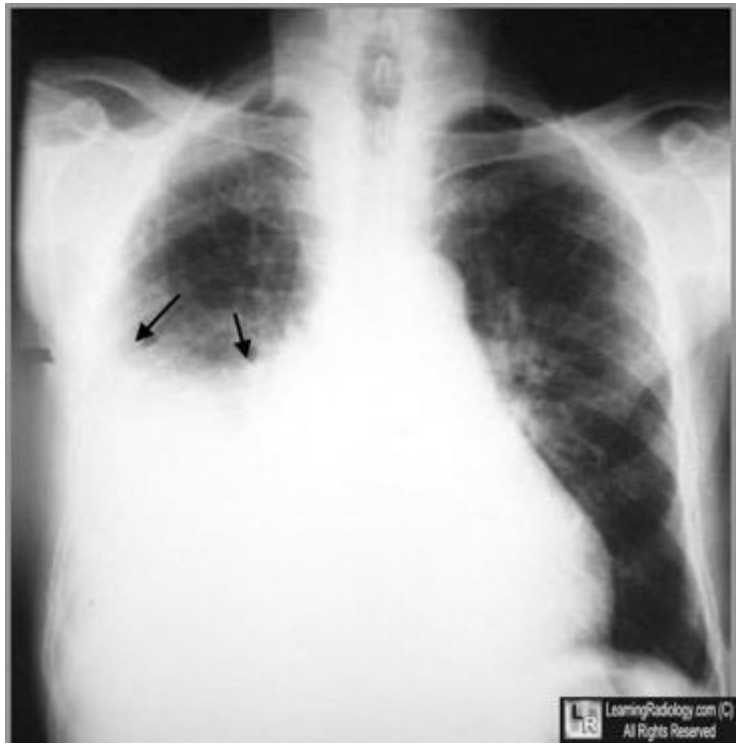
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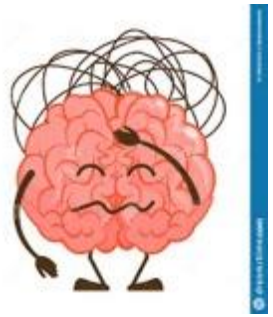
Tedavi

Şüphe durumunda

BOS/kan kültürü alınmalı
hemen tedavi başlanmalı

- Tedavi ampirik başlanır
- Genelde kombine tedavi başlanır
- En sık olası etkenler düşünülmeli
- Lokal direnç göz önünde bulundurulmalı



Randomize kontrollü çalışma yok
Olgu sunumları yada olgu serileri
Retrospektif çalışmalar

SURGICAL INFECTIONS
Volume 17, Number 4, 2016

DOI: 10.1089/sur.2015.060

Empirical Combination Antibiotic Therapy Improves the Outcome of Nosocomial Meningitis or Ventriculitis in Neuro-Critical Care Unit Patients

Zhiqi Li, Xing Wu, Jian Yu, Xuehai Wu, Zhuoying Du, Yirui

Abstract

Background: Nosocomial meningitis and ventriculitis (MEN) are ser
unit (NCCU) patients. Few data are available on the risk factors and m
these disorders caused by multi-drug-resistant (MDR) pathogens. Ou

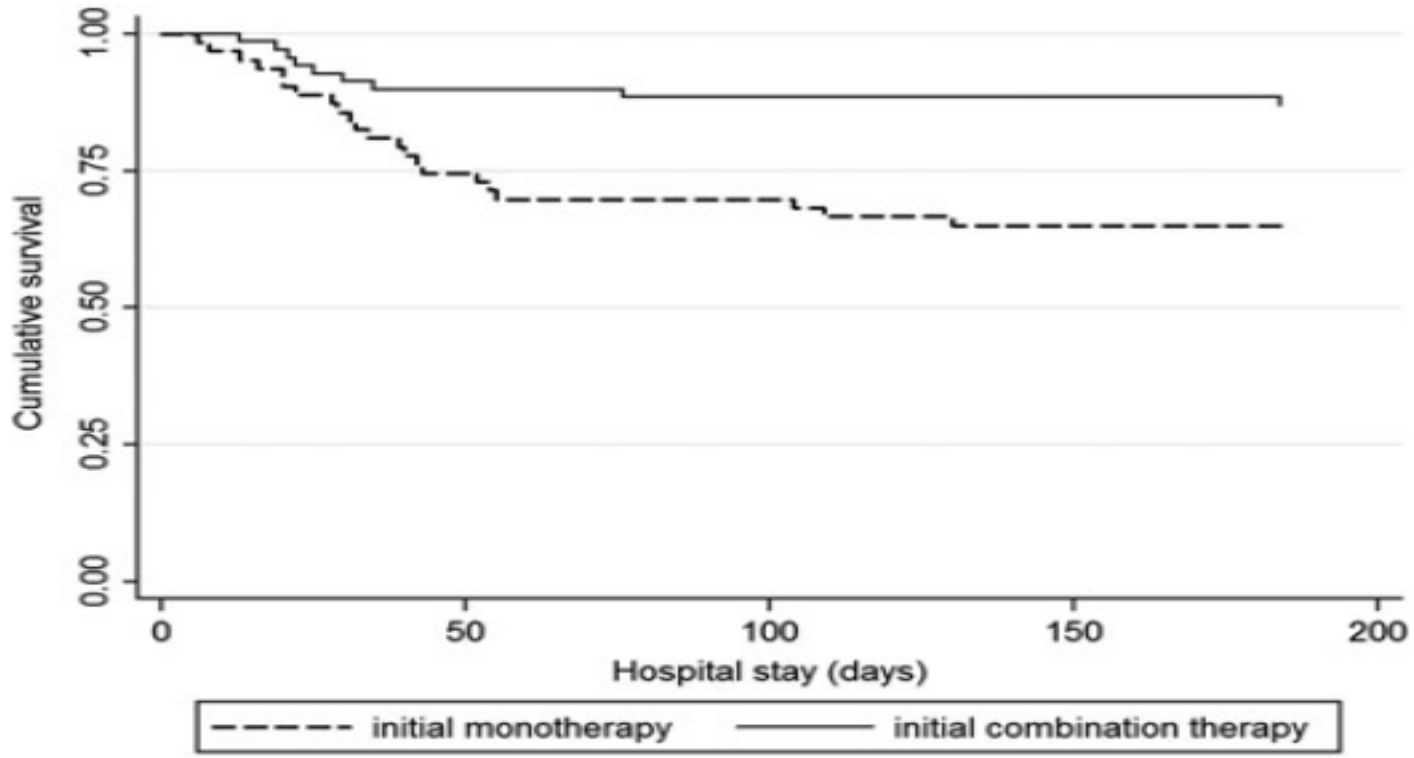
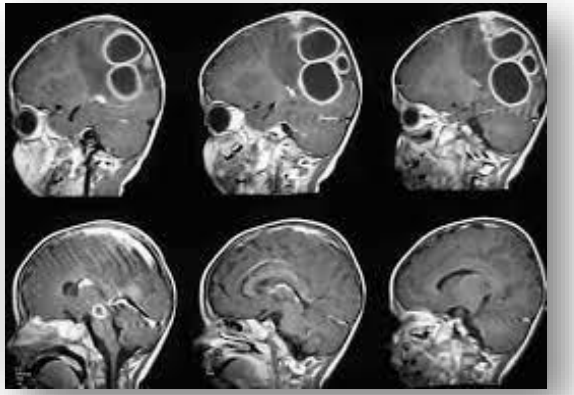


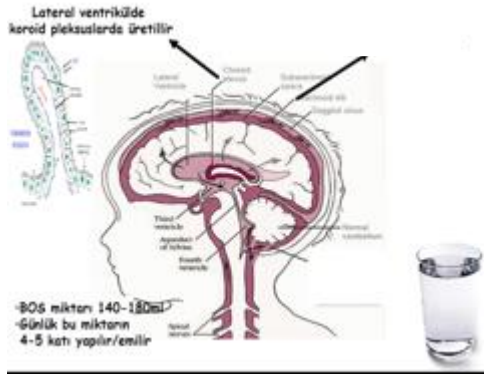
FIG. 2. Cumulative survival curves of patients receiving combined antibiotic therapy compared with patients having monotherapy in the empiric phase of treatment. (Log-rank test, $p = 0.0035$.)

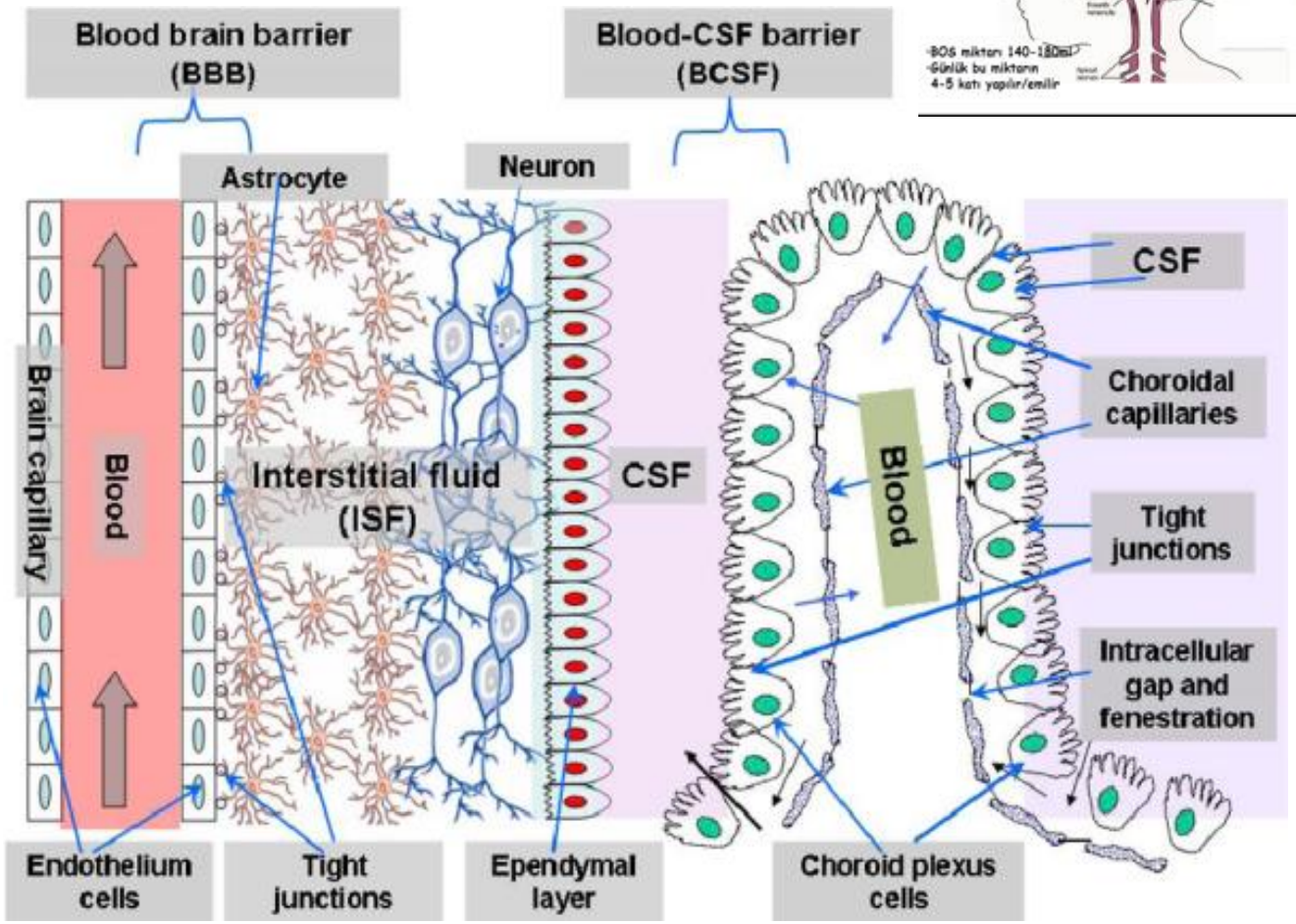
Tedavi Başarısı- Başarısızlığı

- Mikroorganizma miktarı
- Mikroorganizmanın özelliği (antibiyotik direnci, kapsül gibi virülans faktörleri)
- Yaş (antibiyotiklerin metabolizması değişir)
- Komorbid (aldığı ilaçlar antibiyotiklerin etkisini azaltır ya da arttırır)
- Menink slerde enflamasyon varsa antibiyotikler daha kolay geçer
  - Penisilin
    - Enflamasyon varlığında plazma düzeyinin %30'u BOS'a geçer
    - Enflamasyon yokluğunda ise ancak %1'i

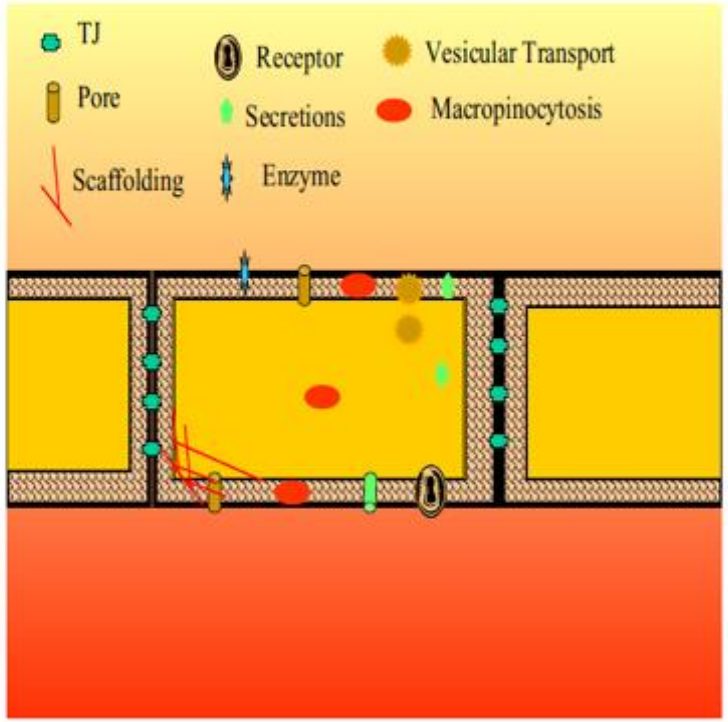


Glukoz dışında birçok madde enerji ile KBB'i geçer





BMC Neurology 2009, **9**(Suppl 1):S3

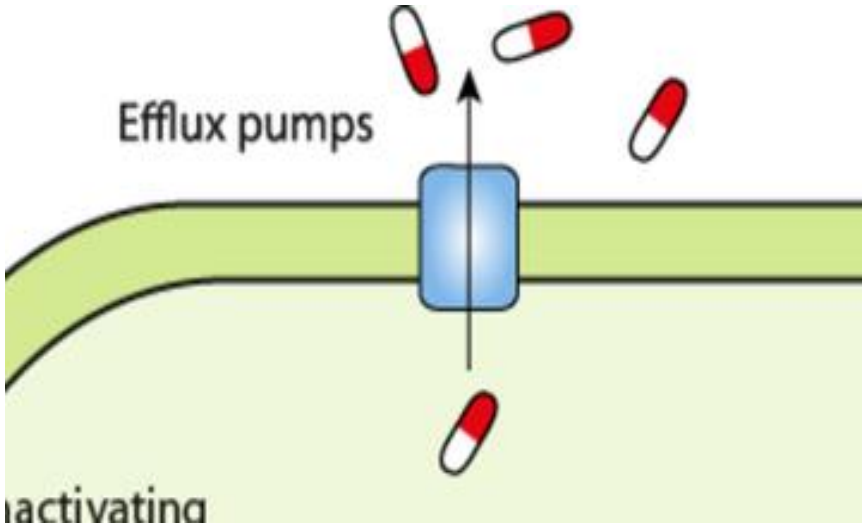


- Antibiyotiğin özelliği
  - Büyük molekül kan beyin bariyerini zor geçer ya da geçmez (Örn: Teikoplanin, kolistin)

  - Antibiyotiklerin proteine bağlanma kapasitesi
    - Ne kadar yüksekse serbest ilaç o kadar azdır
    - SSS enfeksiyonlarında BOS proteini yüksektir
    - Beta laktamlar proteine yüksek bağlanır (!!!!)

  - Hidrofilik ilaçlar KBB'ini zor geçer, lipofilik olanlar daha kolay geçer
    - Seftriakson hidrofiliktir ve ilacın BOS'a geçişi %5-10 (enflamasyonda artar)
    - Kinolonlar lipofiliktir, ilacın BOS'a geçişi %30
      - Ancak NÖROTOKSİKTİR

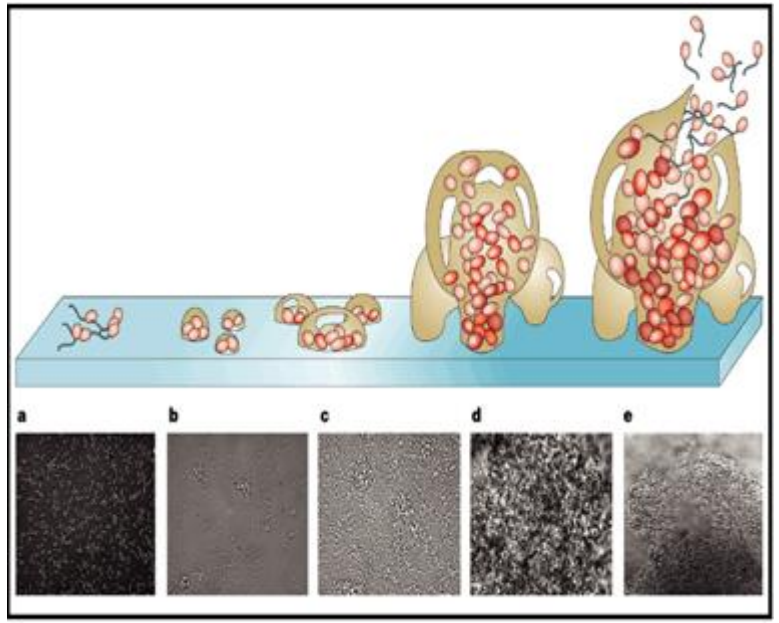
- İlaçlar BOS'a enerji bağımlı transport ile geçer
- Tekrar dolaşıma efflüx pompası ile atılır
- Enflamasyon varlığında efflüx pompası daha çok işler (antibiyotik miktarı azalır)
  - Enflamasyon ilacın geçişini kolaylaştırır
  - Ancak ilacın atılmasını da kolaylaştırır



- Metronidazol
  - Asidik ortamda çalışır ☺
  - Küçük molekül ağırılığı var ☺
  - Lipofiliktir ☺
  - Nörotoksiktir ☹
- Aminoglikozidler
  - Büyük molekül ☹
  - Hidrofilik ☹
- Kloramfenikol
  - Düşük molekül ağırlığı var☺
  - KBB kolay geçer ☺
  - Bakteriyostatikdir ☹
- Fosfomisin
  - Düşük molekül ağırılığı var ☺
  - Proteine düşük bağlanır ☺
  - Hidrofilik ☹
- Kinolonlar
  - Lipofilik ☺
  - Nörotoksikdir☹
- Rifampisin
  - Proteine fazla bağlanır aktif ilaç düşüktür ☹
  - BOS'a kolay geçer ☺
- Vankomisin
  - Büyük moleküldür ☹
  - Hidrofilikdir ☹
- Beta laktamlar
  - Hidrofilikdir ☹
  - Proteine yüksek bağlanır ☹
  - Enflamasyonda BOS'a iyi geçer ☺ (yüksek doz)
- TMP/SMZ
  - Lipofilikdir ☺
  - Düşük molekül ağırlığı var ☺
  - Toksik ☹

Biyofilm

- Antibiyotik tedavisinde başarısızlık
- Tekrarlayan iyileşmeyen enfeksiyonlar
- **Gram boyamada bakteri/kültür negatifliği**
- Ancak klinik olarak enfeksiyon bulguları
- **Antibiyotik direnci (1000 kat)**



* ESCMID guideline for the diagnosis and treatment of biofilm infections 2014

Table 1. Major characteristics of antibiotics active against staphylococcal biofilm

Antibiotics	Inhibition of biofilm formation (adhesion)	Biofilm penetration	Bactericidal activity in biofilm
Vancomycin	+	++[16,17]	+[16,17]
Linezolid	+	++[24,29]	+[24]
Daptomycin	+	+++[15]	++[21,24]
Rifampicin	+	+++[8,16,18]	++[16,30]
Moxifloxacin	+	++[31]	++[21,31]
Rifampicin + daptomycin	+	+++[2,30]	+++[28,30]
Rifampicin + vancomycin	+	++[16,18]	++[16,27,32]
Rifampicin + linezolid	+	+++[16,29]	+++[27,32]

Biyofilm penetrasyonu iyi olan antibiyotikler (Rifampisin-kombinasyonsa, daptomisin, ekinokandinler)

Cédric Jacqueline* and Jocelyne Caillon

J Antimicrob Chemother 2014; **69** Suppl 1: i37–i40
doi:10.1093/jac/dku254

Patogenez	Olası Etkenler	Tedavi
Kraniyotomi	Gram negatif basiller (*Pseudomonas aeruginosa* dahil) *S aureus* KNS (*S epidermidis*)	Vankomisin + Meropenem/ Sefepim/ Seftazidim
Ventriküler-lomber kateter	KNS (*S epidermidis*) *S aureus* Gram negatif basiller *C acnes*	
Penetran yaralanma	*S aureus* KNS Gram negatif basiller (*Pseudomonas aeruginosa* dahil)	
Kafa tabanı kırığı	*S pneumoniae* *H influenzae* AGBHS	Vankomisin + 3. kuşak sefalosporin (CRO/CTX)

Table 1. Recommended Antimicrobial Therapy in Patients With Healthcare-Associated Ventriculitis and Meningitis Based on Isolated Pathogen and In Vitro Susceptibility Testing

Microorganism	Standard Therapy	Alternative Therapies
Staphylococci[a]		
Methicillin sensitive	Nafcillin or oxacillin	Vancomycin
Methicillin resistant	Vancomycin	Daptomycin, trimethoprim-sulfamethoxazole, or linezolid
Propionibacterium acnes	Penicillin G	Third-generation cephalosporin,[b] vancomycin, daptomycin, or linezolid
Streptococcus pneumoniae		
Penicillin MIC ≤0.06 μg/mL	Penicillin G	Third-generation cephalosporin[b]
Penicillin MIC ≥0.12 μg/mL		
Cefotaxime or ceftriaxone MIC <1.0 μg/mL	Third-generation cephalosporin[b]	Cefepime or meropenem
Cefotaxime or ceftriaxone MIC ≥1.0 μg/mL	Vancomycin plus a third-generation cephalosporin[b,c]	Moxifloxacin[d]
Pseudomonas aeruginosa	Cefepime, ceftazidime, or meropenem	Aztreonam or ciprofloxacin
Haemophilus influenzae		
β-lactamase negative	Ampicillin	Third-generation cephalosporin,[b] cefepime, or a fluoroquinolone
β-lactamase positive	Third-generation cephalosporin[b]	Cefepime, aztreonam, or a fluoroquinolone
Extended spectrum β-lactamase-producing gram-negative bacilli	Meropenem	Cefepime or a fluoroquinolone
Acinetobacter baumannii	Meropenem	Colistin (usually formulated as colistimethate sodium)[e] or polymyxin B[e]
Other Enterobacteriaceae[f]	Third-generation cephalosporin[b]	Meropenem, aztreonam, trimethoprim-sulfamethoxazole, or ciprofloxacin
Candida species[g]	Lipid formulation of amphotericin B ± flucytosine	Fluconazole or voriconazole
Aspergillus species	Voriconazole	Lipid formulation of amphotericin B or posaconazole

Vankomisin MIC <1 μg/mL

Meropenem %4,7-25 İnflamasyonda %39

Kolistin %5,1-5,7??

Tunkel AR et al. CID 2017; 64: e34-e65

Table 2. Recommended Dosages of Antimicrobial Agents in Infants and Children and in Adults With Normal Renal and Hepatic Function

	Total Daily Dose (Dosing Interval in Hours)	
Antimicrobial Agent	Infants and Children	Adults
Amikacin[a]	22.5 mg/kg (8)	15 mg/kg (8)
Amphotericin B lipid complex	5 mg/kg (24)	5 mg/kg (24)
Ampicillin	300–400 mg/kg (6)	12 g (4)
Aztreonam	120 mg/kg (6–8)	6–8 g (6–8)
Cefepime	150 mg/kg (8)	6 g (8)
Cefotaxime	300 mg/kg (6–8)	8–12 g (4–6)
Ceftazidime	200 mg/kg (8)	6 g (8)
Ceftriaxone	100 mg/kg (12–24)	4 g (12)
Ciprofloxacin	30 mg/kg (8–12)	800–1200 mg (8–12)
Daptomycin	Dose not established[b]	6–10 mg/kg (24)
Fluconazole	12 mg/kg (24)	400–800 mg (24)
Gentamicin[a]	7.5 mg/kg (8)	5 mg/kg (8)
Linezolid	Age <12 years: 30 mg/kg (8)[c] Age ≥12 years: 20 mg/kg (12)[c]	1200 mg (12)
Liposomal amphotericin B	3–5 mg/kg (24)	3–5 mg/kg (24)[d]
Meropenem	120 mg/kg (8)	6 g (8)
Moxifloxacin[e]	Dose not established	400 mg (24)
Nafcillin	200 mg/kg (6)	12 g (4)
Oxacillin	200 mg/kg (6)	12 g (4)
Penicillin G	300 000 units/kg (4–6)	24 million units (4)
Posaconazole	—	800 mg (6–12)[f]
Rifampin	20 mg/kg (24)[g]	600 mg (24)
Tobramycin[a]	7.5 mg/kg (8)	5 mg/kg (8)
Trimethoprim-sulfamethoxazole[h]	10–20 mg/kg (6–12)	10–20 mg/kg (6–12)
Vancomycin[i]	60 mg/kg (6)	30–60 mg/kg (8–12)
Voriconazole	16 mg/kg (12)[j,k,l]	8 mg/kg (12)[j,k]

Tunkel AR et al. CID 2017; 64: e34-e65

!!!

Journal of Antimicrobial Chemotherapy (2007) **60**, 1097–1103
doi:10.1093/jac/dkm351
Advance Access publication 17 September 2007

JAC

Propionibacterium acnes: an under-appreciated cause of post-neurosurgical infection

M. Nisbet[1]*, S. Briggs[1], R. Ellis-Pegler[1], M. Thomas[1] and D. Holland[2]

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[2]*Department of Microbiology, LabPlus, Auckland City Hospital, Private Bag 92024, Auckland, New Zealand*

Received 17 June 2007; returned 20 July 2007; revised 15 August 2007; accepted 16 August 2007

***Background*: *Propionibacterium acnes* is increasingly recognized as a cause of post-neurosurgical infection. This review of patients with *P. acnes* neurosurgical infection was carried out in order to determine clinical characteristics and outcomes in relation to duration of antimicrobial treatment.**

***Methods*: We retrospectively reviewed the charts of consecutive patients with *P. acnes* isolated from neurosurgical specimens from 1 January 1999 to 30 June 2005. We defined *P. acnes* neurosurgical infection as isolation of *P. acnes* alone from a sterile neurosurgical site in a patient who clinically improved following treatment with an appropriate antibiotic.**

bacilli on Gram stain should not be discounted as a contaminant in neurosurgical specimens. Associated bone flaps should be removed. Intravenous benzyl penicillin ± oral penicillin VK remains effective treatment.

Kraniyotomilerde, katater ilişkili MSS infeksiyonlarında düşünülmeli
Sefalosporin/karbapenem/vankomisin yetmeyebilir
Tedavisi Penisilin IV

Table 1. Concentrations of ciprofloxacin in plasma and CSF samples from a patient with *Pseudomonas aeruginosa* meningitis.

Date, time	Hours after dose	Plasma concentration, mg/L	CSF concentration, mg/L
7 August 1999			
9:00 AM	5	1.28	0.049
10:00 AM	6	1.05	0.520
11:00 AM	7	0.78	0.913
12:00 PM	8[a]	0.67	0.922
1:00 PM	1	10.29	0.914
2:00 PM	2	3.23	
14 August 1999			
2:00 PM	2	2.98	0.955
15 August 1999			
12:00 PM	8[a]	0.47	

[a] Trough level is measured at this time.

Cerebrospinal Fluid Penetration of High Doses of Intravenous Ciprofloxacin in Meningitis

J. Lipman,[1,3] A. Allworth,[2,4] and S. C. Wallis[1]

[1]Intensive Care Facility and [2]Infectious Diseases Unit, Royal Brisbane Hospital, and Departments of [3]Anaesthesiology and Critical Care and [4]Medicine, University of Queensland, Herston, Australia

Nosocomial meningitis due to gram-negative organisms is a difficult clinical problem to manage because of both antibiotic resistance and poor penetration of many antimicrobials across the blood-brain barrier. Ciprofloxacin has potential in treating this condition when used in high doses. We investigated the plasma and cerebrospinal fluid (CSF) levels of ciprofloxacin in a patient with *Pseudomonas aeruginosa* meningitis who was treated with 400 mg of intravenous ciprofloxacin every 8 hours. Ciprofloxacin levels in plasma peaked at 10.29 mg/L without resulting in accumulation (8-hour trough levels, <1 mg/L), whereas the CSF level increased to 0.9 mg/L. This CSF level was confirmed to be similar 1 week later. After 1 week of therapy, during which there were no side effects attributable to ciprofloxacin, the organism was eradicated, and there was some clinical improvement. We recommend that 400 mg of intravenous ciprofloxacin every 8 hours be considered for treatment of difficult-to-treat gram-negative bacillary meningitis.

Beta laktam alerjisi/
MDR *P aeruginosa 'da*

Siprofloksasin 3x400 mg
Bir seçenek

Table 2. Selected results of hematologic, chemical pathological, and microbiologi yses of CSF samples from a patient with *Pseudomonas aeruginosa* meningitis.

Date	WBC count, $\times 10^6$/L	Neutrophils, %	Protein level, g/L[a]	Glucose level, mmol/L[b]	Gram stain[c]
30 May 1999	8040	88	1.398	0.7	−
4 August 1999	960	92	>3	1.1	+
5 August 1999	47	63	2.8	0.9	+
6 August 1999	150	60	4.2	1.3	+
7 August 1999	220	ND	5.48	1.2	+
14 August 1999	70	10	1.8	2.9	−

NOTE. ND, not determined; −, negative; +, positive.

[a] Normal range, 0.15–0.5 g/L.

[b] Normal range, 2.5–4.0 mmol/L.

[c] For the presence of gram-negative bacilli.

[d] For *P. aeruginosa*.

Şant İnfeksiyonu

- Tedavinin başarısı için antibiyotik tedavisi ve infekte şant/dren

En sık etken KNS (*S aureus* ve diğer gram pozitif bakteriler)
İlk seçenek Vankomisin

Linezolid (başarılı ama ilk seçenek değil)

Daptomisin BOS'a geçişi çok az (%0,8) ama başarılı bulunmuş tek kullanılmaz
(rifampisin ile kombine, 10 mg/kg)

Şant menejiti rifampisin eklenebilir (duyarlı ise)

Tunkel AR et al. CID 2017; 64: e34-e65

International Journal of Infectious Diseases

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

Central nervous system infections due to vancomycin-resistant enterococci: case series and review of the literature

Jeffrey S. Wang [a,*], Katie Muzevich [b], Michael B. Edmond [c], Gonzalo Bearman [c], Michael P. Stevens [c]

Table 1
Characteristics of patients with central nervous system (CNS) infections due to vancomycin-resistant enterococci (VRE)

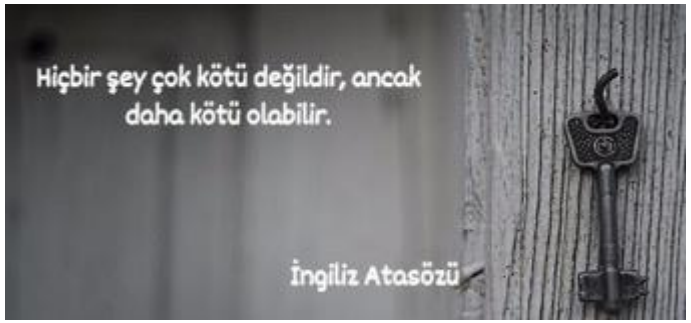
			Clinical features	Treatment	CNS device and management	Outcome
		rder s/p lacement	Fever, AMS, headache, meningeal signs, seizures	Am IV × 7 days; Cm and Rf × 14 days; Tc IT × 14 days	Brain grid removed, lumbar drain placed then removed at a later date	Clinical and microbiological cure
		ılar bleed, ions	Fever, AMS	Ch IV and Gn IV and VT; Q/D IV and Q/D VT × 28 days	Shunt removed, Ommaya placed, intraventricular lavage	Clinical and microbiological cure
		us invasive	NR	Q/D IV × 22 days	NA	Death, microbiological cure
		VPS placed	NR	Ch IV × 2 months; Q/D VT × 5 doses; Q/D IV × 10 days	Ventricular catheter removed then replaced several days later	Death, microbiological cure
		uction py and BMT	Fever, AMS, headache, seizures	Ch IV × 10 days; Q/D × 1 week	NA	Death, no microbiological cure
[19]	1998	Neonate, NR	TAPVR s/p repair, necrotizing enterocolitis	Ch × 13 days; Tc; Q/D × 13 days	NA	Clinical and microbiological cure
[20]						ical cure
						gical
						gical
						rom cure
						gical
						gical
						ure
						gical
						gical
						gical
[3]		placement			with lumboperitoneal shunt	iological

VRE'de bir çok kombinasyon var
1994-2005 arası Kloramfenikol IV+IT/IVT

2005 sonrası Linezolid ya da

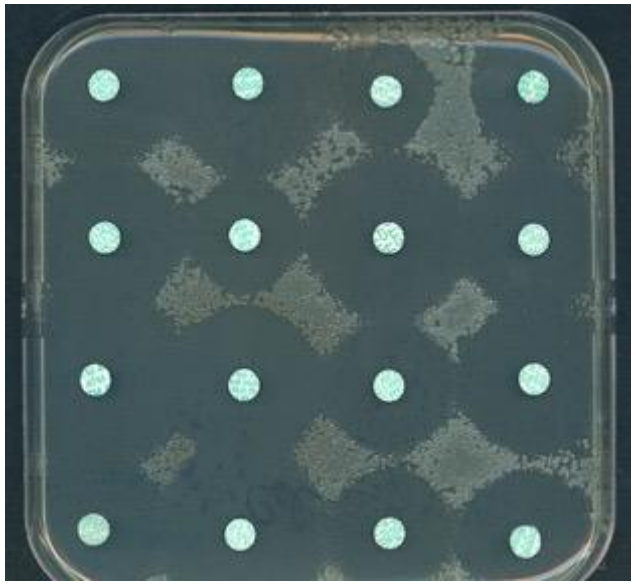
Daptomisin/Quinopristin-Dalfopristin
± Genta IT/IVT /Rifampisin NG/PO

~28 gün

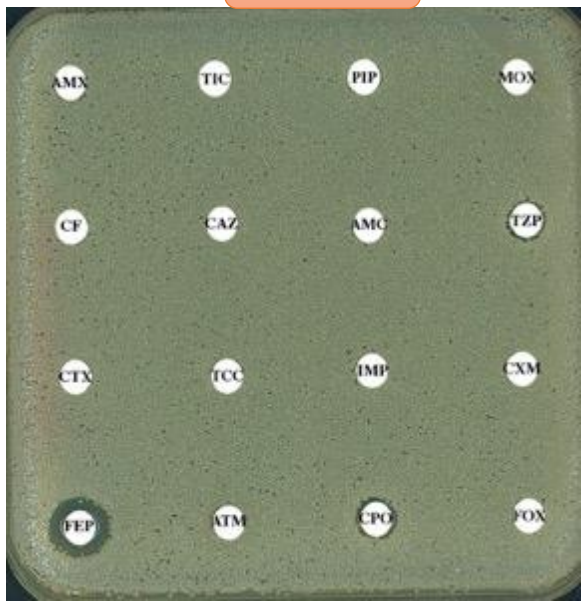


- Bitmeyen pandemi ANTİBİYOTİK DİRENCİ

2000

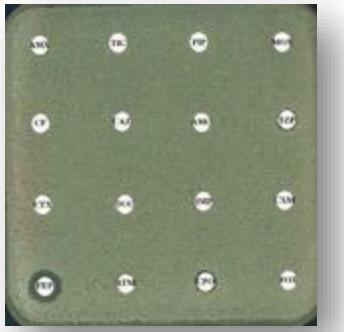


2023



İntraventriküler/İntratekal Tedavi

- Sistemik antibiyotik BOS'a geçmiyor, yeterli BOS konsantrasyonuna ulaşılamıyor
- Tedaviye rağmen üremeler devam ediyorsa uygulanır
- Lateral ventrikül ya da lomber drenajdan antibiyotik uygulanır



Kan beyin bariyeri by pass edilmiş olur

Clinical Infectious Diseases

IDSA GUIDELINE

IDSA hivma

2017 Infectious Diseases Society of America's Clinical Practice Guidelines for Healthcare-Associated Ventriculitis and Meningitis*

Allan R. Tunkel,[1] Rodrigo Hasbun,[2] Adarsh Bhimraj,[3] Karin Byers,[4] Sheldon L. Kaplan,[5] W. Michael Scheld,[6] Diederik van de Beek,[7] Thomas P. Bleck,[8] Hugh J. L. Garton,[9] and Joseph R. Zunt[10]

Serum fizyolojik ile
Eşit miktarda BOS alınarak intraventriküler antibiyotik uygulanmalı
15-60 dakika klemplemek gerek

Penisilin ve sefalosporinler nörotoksik olduğundan uygulanmaz

Antibiyotik dozu yaşa, kiloya göre değil

Ventrikül ve BOS hacmine İlaç PK'i BOS miktarına **İlaç klirensi renal ya da karaciğer fonksiyonlarına göre değil**

BOS üretimi, BOS drenajına bağlı

Table 3. Recommended Dosages of Antimicrobial Agents Administered by the Intraventricular Route

Antimicrobial Agent	Daily Intraventricular Dose
Amikacin	5–50 mg[a]
Amphotericin B deoxycholate[b]	0.01–0.5 mg in 2 mL of 5% dextrose in water
Colistin (formulated as colistimethate sodium)	10 mg
Daptomycin	2–5 mg[c]
Gentamicin	1–8 mg[d,e,f]
Polymyxin B	5 mg[g]
Quinupristin/dalfopristin	2–5 mg
Tobramycin	5–20 mg
Vancomycin	5–20 mg[e,f,h]

- BOS kültürü negatifleşinceye kadar
- <7 gün nüks fazla
- Ortalama 10 gün yeterli
- Ancak standart süre yok

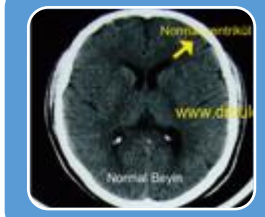
Etkin doz
24 saat sonra
BOS miktarı/MIC
>10-20 olmalı

IDSA 2017

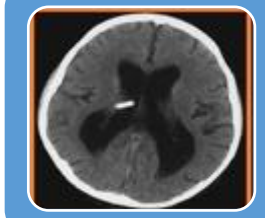
Vankomisin ve Gentamisinde BOS eksternal ventriküler drenaj miktarına göre uygulama sıklığı

<50 mL/gün ise üç günde bir
50-100 mL/gün ise iki günde bir
100-150 mL/gün ise her gün
150-200 mL/gün ise günlük vankomisin dozu 5 mg, gentamisin dozu 1 mg artırılmalı
200-250 mL/gün ise vankomisin dozu 10 mg, gentamisin dozu 2 mg artırılmalı

Slitventrikül:
Vankomisin5 mg
Gentamisin2 mg



Normal:
Vankomisin10 mg
Gentamisin3 mg

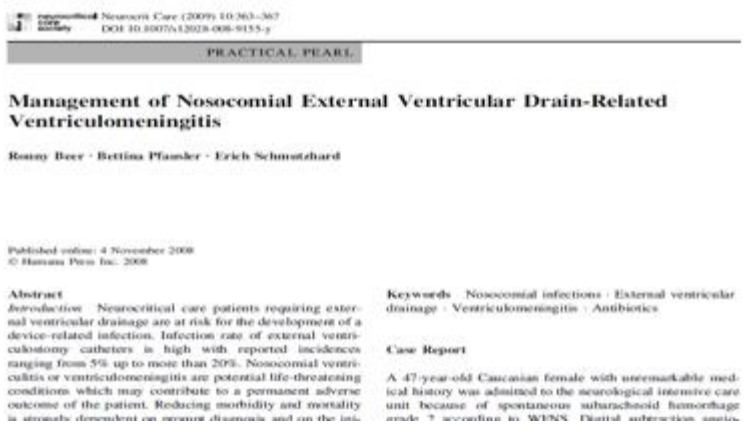


Genişlemiş:
Vankomisin15-20 mg
Gentamisin4-5 mg

Şant Menenjit Tedavisi

- Şantın mümkünse çıkarılması
- Eksternal ventriküler drenaj takılması
- SSS'e iyi geçen IV antibiyotik tedavisi
- Gerekirse intraventriküler/intratekal antibiyotik uygulanması
- Eradikasyon sağlandıktan sonra yeni şant düşünülmesi
- Rifampisin
  - Her zaman öneri yok
  - Duyarlıysa
  - Şant çekilmeyecekse denenebilir

- SBİ vetrikülit ? İle
  - BOS'da önce KNS üremiş
    - Vankomisin IV/IVT (7 gün)
  - Klinik kötüleşmiş, BOS bulguları tam düzelmemiş,
    - Meropenem de eklenmiş
  - Yine düzelme olmamış
  - Kateter çekilmiş (katater kx: KNS)
    - Vankomisin verilmiş yanıt var !!!



Neurocrit Care (2009) 10:363–367
DOI 10.1007/s12028-008-9135-y

PRACTICAL PEARL

Management of Nosocomial External Ventricular Drain-Related Ventriculomeningitis

Ronny Beer · Bettina Pfausler · Erich Schmutzhard

Published online: 4 November 2008

Abstract
Introduction Neurocritical care patients requiring external ventricular drainage are at risk for the development of a device-related infection. Infection rate of external ventriculostomy catheters is high with reported incidences ranging from 5% up to more than 20%. Nosocomial ventriculitis or ventriculomeningitis are potential life-threatening conditions which may contribute to a permanent adverse outcome of the patient. Reducing morbidity and mortality

Keywords Nosocomial infections · External ventricular drainage · Ventriculomeningitis · Antibiotics

Case Report

A 47-year-old Caucasian female with unremarkable medical history was admitted to the neurological intensive care unit because of spontaneous subarachnoid hemorrhage

Şant İnfeksiyonlarında 3 Ana Yaklaşım

- 1. Şant kısmi?/tam çıkartılır, tedavi tamamlanıncaya kadar EVDS ile takip edilir, üreme olmaz ise şant takılır

- 2.Şant menenjiti erken dönem ve KNS, *C acnes* ise şant yerinde bırakılabilir (olguya göre) tedavi süresi çok net değil

- 3.Erken dönemde ise tedavisi yapılır, şant çekilir ve hemen şant takılır ????? (KNS, *C acnes*)

Conen A et al. CID 2008; 47: 73-82


ERKEKLER
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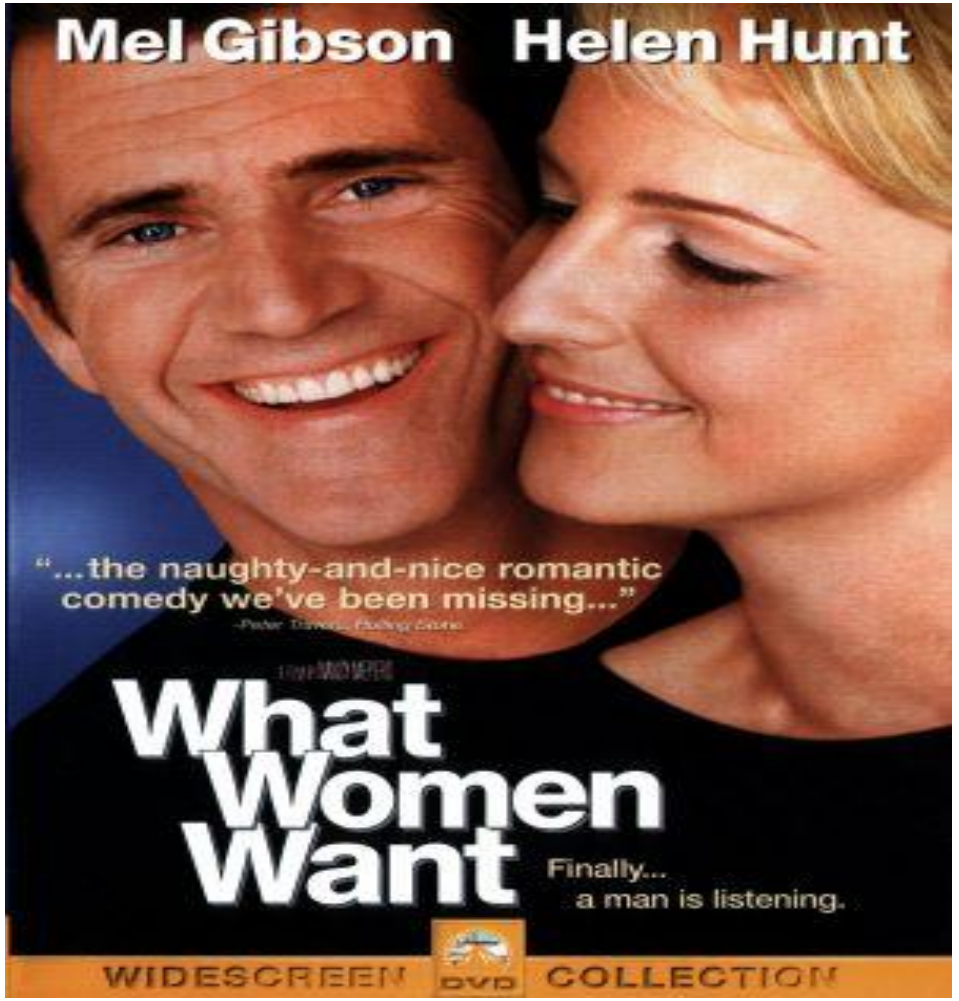
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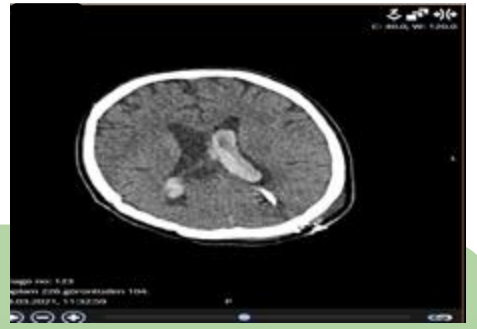
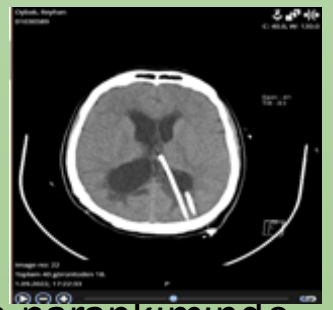
J Neurol (2008) 255:1617–1624
DOI 10.1007/s00415-008-0059-8

REVIEW

R. Beer
P. Lackner
B. Pfausler
E. Schmutzhard

Nosocomial ventriculitis and meningitis in neurocritical care patients





an appropriate and
sis of this disease
to propose an algo-
rapid diagnosis and

frequently impaired either by the
presence of systemic inflammation
due to the primary disease or be-
cause the hemorrhagic CSF itself

EVDS-şant değişimi

Kanama?
Yanlış yerleştirme
Yeni enfeksiyon??
ventrikülit
????
Eski şant çekilirken ucunun yapışıklıktan beyin parankiminde kalması
Drenaj tıkanması
Aşırı drenaj
Herniyasyon

Tedavi başarısı için
EVDS/şant değişimi

Şant çekilmeden Tedavi Mümkün mü?

- Kanıt düzeyi yüksek değil ancak uzman görüşü

- Örnek VP şantı var
  - BOS bulguları normal (biyokimya ve hücre)
  - BOS basıncı yüksek değil
  - Tıkanıklık yok
  - Üreyen bakteri KNS ya da *C acnes*

Antibiyotik tedavisi ile başarı %93 olabilir

Ancak moleküler ve kültür negatif olmalı tedavi sonrası antibiyotiksiz izlenmeli

Tedavi süresi??? (10-14 gün ancak kişiye göre değişir) Rifampisin duyarlı ise tedavi rejiminde olmalı

Conen A et al. CID 2008; 47: 73-82

Found 1 result for 7340429

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Acta Neurochir (Wien). 1981;59(3-4):157-66. doi: 10.1007/BF01406345.

The management of cerebrospinal fluid shunt infections: a clinical experience

H E James, J W Walsh, H D Wilson, J D Connor

PMID: 7340429 DOI: 10.1007/BF01406345

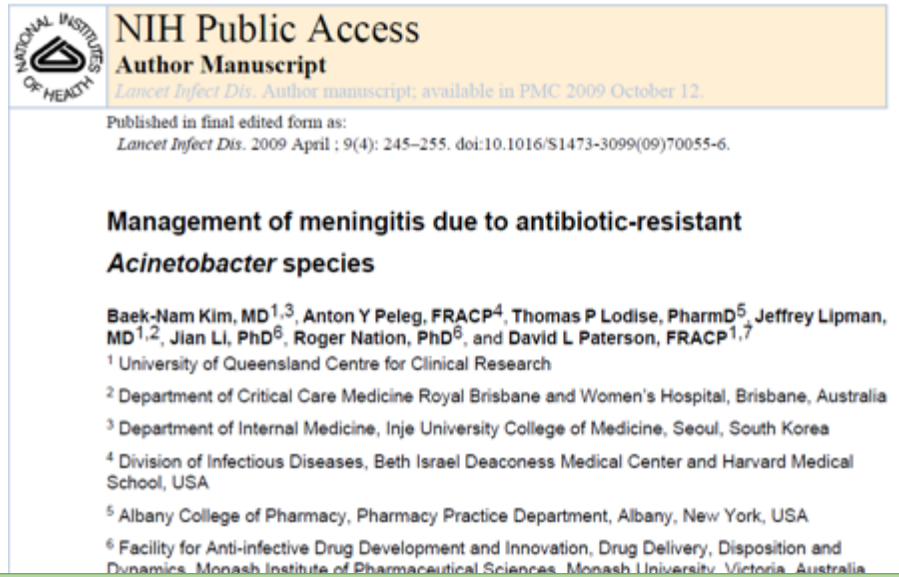
Abstract

Fifty patients with infected cerebrospinal fluid shunts were treated by one of three forms of treatment: a) Twenty-two patients had shunt removal, systemic antibiotic treatment, and either external ventricular drainage or intermittent ventricular taps for decompression and antibiotic administration. b) Seventeen patients had removal and immediate replacement of the shunt with intrashunt and systemic antibiotics. c) Eleven patients received intrashunt and systemic antibiotics without shunt removal. In the first group, antibiotics were given for a period of one week; in the second and third groups, intravenous antibiotics were administered for a minimum period of three weeks, and intraventricular antibiotics twice daily for two weeks. In all patients ventricular CSF was obtained and cultured 48 hours after cessation of antibiotic therapy, and cultures were repeated within four months after completion of therapy. Twenty-one of 22 patients in the first group as well as 11 of 13 of the second group, were successfully treated. In the third group only four of the 11 patients responded to treatment.

İnfekte şantın çıkarılması+EVDS+uygun antibiyotik başarı %95

İnfekte şantın çıkarılması+ yeni şantın hemen takılması+uygun antibiyotik = başarı %65

Sadece uygun antibiyotik = başarı %35



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Lancet Infect Dis. Author manuscript; available in PMC 2009 October 12.

Published in final edited form as:

Lancet Infect Dis. 2009 April ; 9(4): 245–255. doi:10.1016/S1473-3099(09)70055-6.

Management of meningitis due to antibiotic-resistant *Acinetobacter* species

Baek-Nam Kim, MD[1,3], Anton Y Peleg, FRACP[4], Thomas P Lodise, PharmD[5], Jeffrey Lipman, MD[1,2], Jian Li, PhD[6], Roger Nation, PhD[6], and David L Paterson, FRACP[1,7]

[1] University of Queensland Centre for Clinical Research

[2] Department of Critical Care Medicine Royal Brisbane and Women's Hospital, Brisbane, Australia

[3] Department of Internal Medicine, Inje University College of Medicine, Seoul, South Korea

[4] Division of Infectious Diseases, Beth Israel Deaconess Medical Center and Harvard Medical School, USA

[5] Albany College of Pharmacy, Pharmacy Practice Department, Albany, New York, USA

[6] Facility for Anti-infective Drug Development and Innovation, Drug Delivery, Disposition and Dynamics, Monash Institute of Pharmaceutical Sciences, Monash University, Victoria, Australia

IV +Intraventriküler antib+şantı çıkarma+EVDS başarı %90

IV +Intraventriküler antib+şantı çıkarma başarı %75

IV +Intraventriküler antib başarı %40

James HE et al. Acta Neurochir 1981; 59: 3-4

Tedavi Süresi

- Etkene
- BOS bulgularının düzelme süresine
- Şantın çekilip çekilmemesine
- Klinik ve/veya radyolojik düzelmeye bağlıdır
- Netlik yok
- **Bireyselleştirilmelidir**

Tedavi süresi;

- <10 gün %28,5
- 11-20 gün %23,3
- ≥21 gün %27,7

Tedavi Süresi?

Anaerop bakteri
Kültür genelde negatif

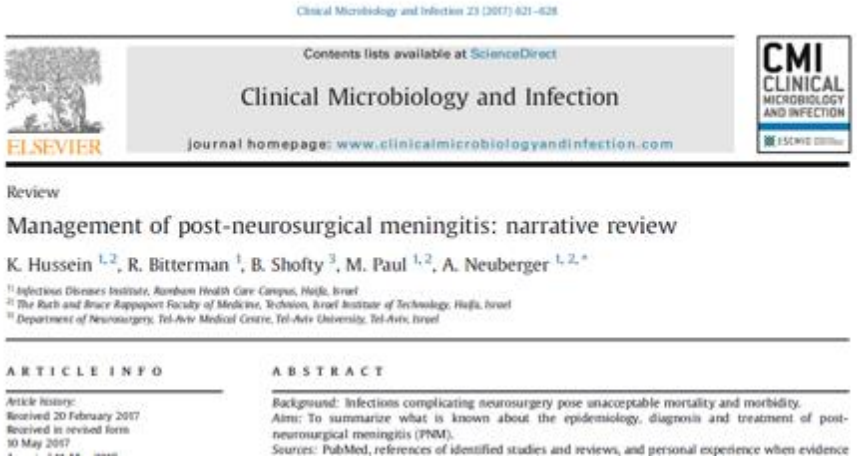
- KNS ve *C acnes*
  - Klinik düzelme ve BOS bulguları düzelme varsa
    - ~10 gün
  - Düzelme hemen olmazsa
    - 10-14 gün
- *S aureus* ve Gram negatif üremelerde
  - Klinik ve BOS bulguları düzelmişse
    - 10-14 gün
  - Bazı klinisyenler özellikle gram negatifler için 21 gün (rekürrens sık)

Katater ilişkili menenjitlerde ~ 18 gün
(4-91 gün)

Tekrarlayan kültürlerde üreme varsa son üremeden sonra 10-14 gün

Tunkel AR et al. CID 2017; 64: e34-e65

Yeni Şant Ne zaman



Clinical Microbiology and Infection 23 (2017) 621–628

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journal homepage: www.clinicalmicrobiologyandinfection.com

Review

Management of post-neurosurgical meningitis: narrative review

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ARTICLE INFO

Article history:
Received 20 February 2017
Received in revised form
30 May 2017

ABSTRACT

Background: Infections complicating neurosurgery pose unacceptable mortality and morbidity.
Aims: To summarize what is known about the epidemiology, diagnosis and treatment of post-neurosurgical meningitis (PNM).
Sources: PubMed, references of identified studies and reviews, and personal experience when evidence

- Kontrol BOS kültürleri ile takip ama sık değil!!
  - Her manipülasyon infeksiyon riski taşır

Günlük BOS kx önerisi yok
48-72 saat aralarla BOS incelemesi olabilir

Netlik yok

Tedavisiz bekleme
önerilmez

Hussein K et al CMI 2017; 23: 621-8

Tunkel AR et al. CID 2017; 64: e34-e65

Yeni şant ne zaman takılacak

Etken	Kültür	BOS bulguları	
S epidermidis *C acnes*	Tek kültür pozitif	Normal	3 gün tedavi sonrası kültür negatif ise yeni şant
			7 gün tedavi sonrası kültür negatif ise yeni şant
			10 gün veya BOS kültürü negatifleşene kadar tedavi
Diğer etkenler (*S aureus*, Gram negatif basiller)	Tek ya da birden fazla kültür pozitif	Normal veya anormal	10-14 gün tedavi ve en az 10 günlük kültür negatifliği varsa yeni şant

16S rRNA araştırılmalı
Kontrol kültürler negatif olmalı
Kateter farklı lokalizasyonlarda biyofilm yanlış negatiflik???

EVDS kaldıkça yeni infeksiyon riski

Tunkel AR et al. CID 2017; 64: e34-e65

BURSA ULUDAĞ ÜNİVERSİTESİ HASTANESİ CERRAHİ EL YIKAMA TALİMATI	Doküman Kodu	AH.TL.06
	İlk Yayın Tarihi	01.09.2025
	Revizyon Tarihi	-
	Revizyon No	00
	Sayfa	1/1

1. **Amaç:**
   Bu talimatın amacı, cerrahi uygulama öncesinde, ön kollardan, ellerden ve tırnaklardan geçici mikroorganizmaları ve artık maddeleri arındırarak, derideki kalıcı mikroorganizma sayısını ve hastada enfeksiyon oluşma riskini azaltmaktır.

2. **Kapsam:**
   Bu talimat BUÜ-HASTANESİ bünyesinde ameliyathanedeki tüm cerrahi uygulamalardan önce yapılan el yıkama faaliyetini kapsar.

3. **Kısaltmalar:**
   HBYS: Hastane Bilgi Yönetim Sistemi

4. **Tanımlar:**

5. **Sorumlular:**
   Ameliyathanede görev yapan hekim/hemşire/sağlık memurları /ameliyathane tekniker bu talimatın uygulanmasından sorumludur.

6. **Faaliyet Akışı:**
   - 6.1. El yıkama işlemi öncesinde favoriler de dahil olmak üzere tüm saçlar bone ile ağız ve burun maske ile tamamen kapatılır. Yüz koruyucu maske/gözlük takılır. Parmaklarda ve bileklerdeki takılar, küpeler çıkartılır. Tırnaklar kısa ve olmalıdır.
   - 6.2. Musluk, fotoselli veya diz yardımıyla açılır.
   - 6.3. Cerrahi yıkama alanlarında Eller parmak ucundan, dirseğe doğru ıslatılır.
   - 6.4. Disposable fırça poşetinden çıkartılır 3-5 ml antiseptik solüsyon alınır.
   - 6.5. Eller ve ön kollar 1 dk boyunca, friksiyonel hareketlerle, dirseğin 3-5 cm üstüne kadar yıkanır.
   - 6.6. Eller, dirseklerden yukarıda olacak şekilde tutularak durulama işlemi yapılır.
   - 6.7. Suyun altında, kollara ileri- geri dönüş yaptırılmaz.
   - 6.8. Tırnaklar, fırça ile 30'ar sn (30 fırça darbesi) fırçalanır.
   - 6.9. Eller durulandıktan sonra yeniden antiseptik solüsyon alınarak, parmak uçlarından (özellikle baş parmaktan) başlayarak parmak araları, ellerin ön ve arka yüzleri dahil kollar, dirseğin 3-5 cm üstüne kadar dairesel hareketlerle yıkanır. Bu işlem her iki kol için toplam üç dakika olmalıdır. Günün ilk yıkanması için bu süre 5 dakikadır.
   - 6.10. İki kol birbirine değdirilmeden parmak uçlarından dirseğe doğru durulanır.
   - 6.11. Eller yukarıda dirsekler aşağıda olacak şekilde nonsteril yüzeylere dokunmadan ameliyat odasına girilir.

World Health Organization | Patient Safety
A World Alliance for Safer Health Care

WHO Guidelines on Hand Hygiene in Health Care

First Global Patient Safety Challenge
Clean Care is Safer Care

Surgical Handrubbing Technique

- Handwash with soap and water on arrival to OR, after having donned theatre clothing (cap/hat/bonnet and mask).
- Use an alcohol-based handrub (ABHR) product for surgical hand preparation, by carefully following the technique illustrated in Images 1 to 17, before every surgical procedure.
- If any residual talc or biological fluids are present when gloves are removed following the operation, handwash with soap and water.

1 Put approximately 5ml (3 doses) of ABHR in the palm of your left hand, using the elbow of your other arm to operate the dispenser.

2 Dip the fingertips of your right hand in the handrub to decontaminate under the nails (5 seconds).

3 4 5 6 7

Images 3-7: Smear the handrub on the right forearm up to the elbow. Ensure that the whole skin area is covered by using circular movements around the forearm until the handrub has fully evaporated (10-15 seconds).

8 9 10 11 12

Images 8-10: Now repeat steps 1-7 for the left hand and forearm.

11 Put approximately 5ml (3 doses) of ABHR in the palm of your left hand as illustrated, to rub both hands at the same time up to the wrists, following all steps in images 12-17 (20-30 seconds).

12 Cover the whole surface of the hands up to the wrist with ABHR, rubbing palm against palm with a rotating movement.

13 Rub the back of the left hand, including the wrist, moving the right palm back and forth, and vice-versa.

14 Rub palm against palm back and forth with fingers interlinked.

15 Rub the back of the fingers by holding them in the palm of the other hand with a sideways back and forth movement.

16 Rub the thumb of the left hand by rotating it in the clasped palm of the right hand and vice versa.

17 When the hands are dry, sterile surgical clothing and gloves can be donned.

Repeat this sequence (average 60 sec) the number of times that adds up to the total duration recommended by the ABHR manufacturer's instructions. This could be two or even three times.

World Health Organization

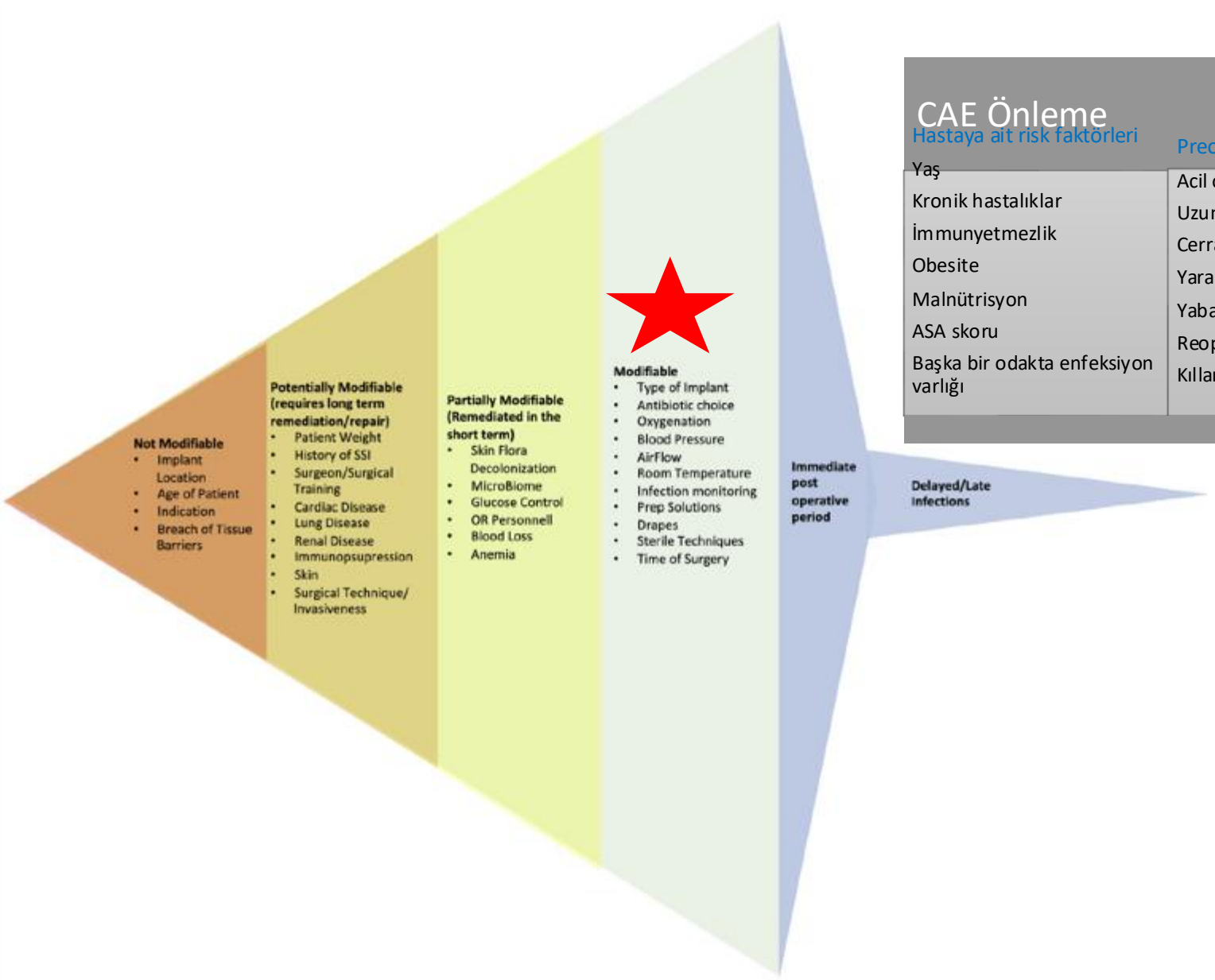

Figure 1. Risk factors for neural implant infections. Unless a patient is harboring an infection before surgery, inoculation at the time of surgery accounts for most neural implant infections. Remediating potentially or partially modifiable risk factors may act to reduce the likelihood of a clinical infection but the emphasis should still be on the events in the operating room. SSI, surgical site infection.

CAE Önleme

Hastaya ait risk faktörleri	PreoperatifRisk Faktörleri	İntraoperatifRisk Faktörleri	Postoperatifrisk Faktörleri
Yaş	Acil operasyon	Operasyonun uzaması	Drenlerin 3 günden fazla sürmesi
Kronik hastalıklar	Uzun yatış	Operasyon bölgesinde enfeksiyon varlığı	Postoperatifinvazifgirişimler
İmmunyetmezlik	Cerrahiprofilaksi	Kan transfüzyonu	
Obesite	Yara sınıfı	Fazla sıvıreplasmanı	
Malnütrisyon	Yabancı cisim varlığı	Hipoksi	
ASA skoru	Reoperasyon	Hipotermi	
Başka bir odakta enfeksiyon varlığı	Kılların tıraş edilmesi		

Korunma

- Cerrahi asepsi, antisepsi
- Nazal *S aureus* dekolonizasyonu
- Klorheksidinli duş alma
- Uygun cerrahi el hijyeni
- Ameliyathane odası trafiğinin engellenmeli
- Oda (+) basınçlı olmalı
- Uygun cerrahi profilaksi (antibiyotik)
- Minimal doku hasarı
  - Ekartörlerin sık gevşetilmesi, yer değiştirilmesi
- Kanama kontrolü
- Operasyon süresinin mümkünse kısa tutulması
- Deneyimli cerrahi ekip

Postoperatif yara bakımı *******
Erken infeksiyon tanısı

CAİ demetlerinin uyulması

Çözülmemiş daha çok veriye ihtiyaç olan bilgiler
Lokal antibiyotik
Antibiyotik emdirilmiş şant

JNS PEDIATRICS CLINICAL ARTICLE

Utilization trends in cerebrospinal fluid shunt infection prevention techniques in the United States from 2007 to 2015

Stacey Podkovik, DO,[1] Chuan Zhou, PhD,[2,6] Susan E. Coffin, MD, MPH,[3] Matthew Hall, PhD,[4] Jason S. Hauptman, MD, PhD,[5] Matthew P. Kronman, MD, MSCE,[6] Francesco T. Mangano, DO,[7] Ian F. Pollack, MD,[8] Sabrina Sedano, BS,[9] Joshua K. Schaffzin, MD, PhD,[10] Emily Thorell, MD,[11] Benjamin C. Warf, MD,[12] Kathryn B. Whitlock, MS,[9] and Tamara D. Simon, MD, MSPH[9,13]

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6 merkez
<18 yaş
Hidrosefali için şant takılma

Standart preop IV sefazolin
2007-2009 İtratekal antibiyotik
2012-2013 antibiyotik emdirilmiş kateter

En az antibiyotik emdirilmiş kateter ile infeksiyon

Podkovik et al. J Neurosurg Pediatr January 5, 2024

Şant Meninjiti-Koruma

27 çalışma incelenmiş
Heterojen grup
Randomize kontrollü çalışma+gözlemsel çalışma
≈50 gün antibiyotik salınımı var

Primer sonlanım= infeksiyon
Sekonder sonlanım= şant başarısızlığı
Şant başarısızlığının en önemli nedeni obstrüksiyon, kanama ve adezyon

REVIEW

OPEN

Antibiotic-Impregnated Ventriculoperitoneal Shunts Decrease Bacterial Shunt Infection: A Systematic Review and Meta-Analysis

Janka Kovács, MD, Vanda Máté, MD, Mahmoud Obeidat, MD, Rita Nagy, MD, PhD, Gergely Agócs, PharmD, PhD, Szilvia Kiss-Dala, PharmD, Péter Hegyi, MD, PhD, DSc, Renáta Kiss-Miki, MD, Andrea Párniczky, MD, PhD, Katalin E. Müller, MD, PhD, Miklós Garami, MD, MSc, PhD

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Received, November 17, 2023; **Accepted,** March 29, 2024; **Published Online,** May 29, 2024.

Neurosurgery 95:1263–1273, 2024

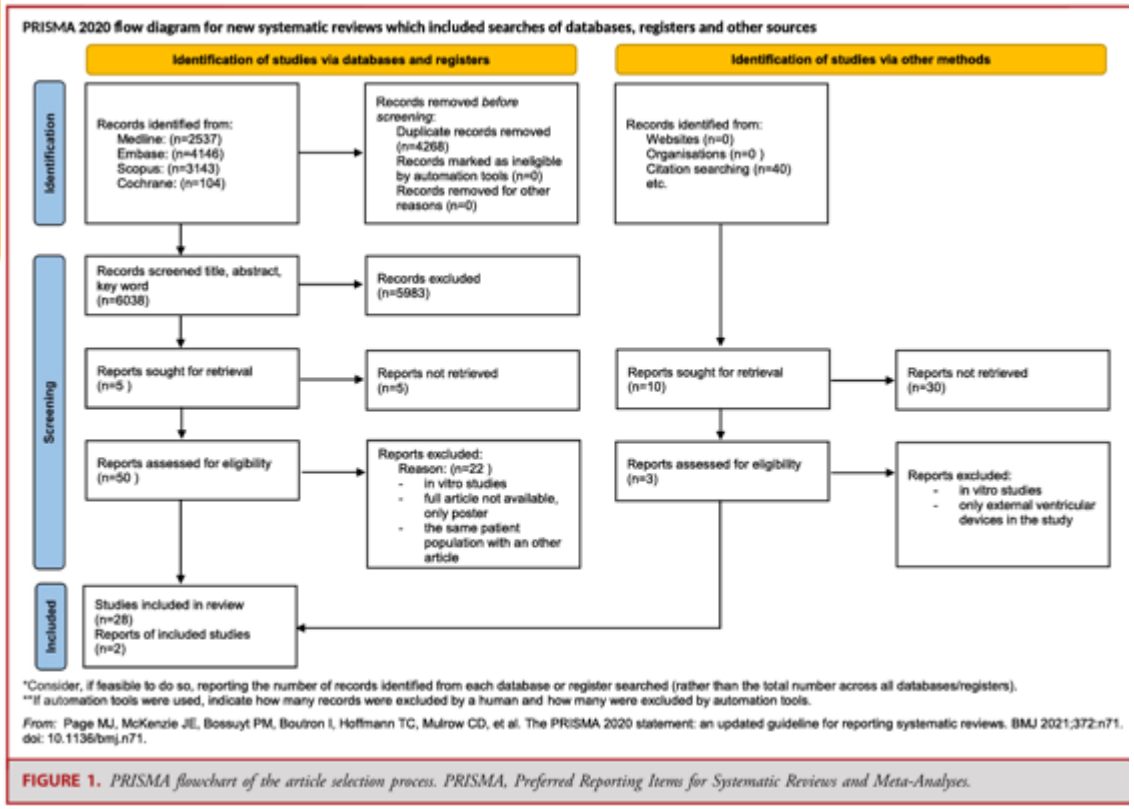

FIGURE 1. *PRISMA flowchart of the article selection process. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.*

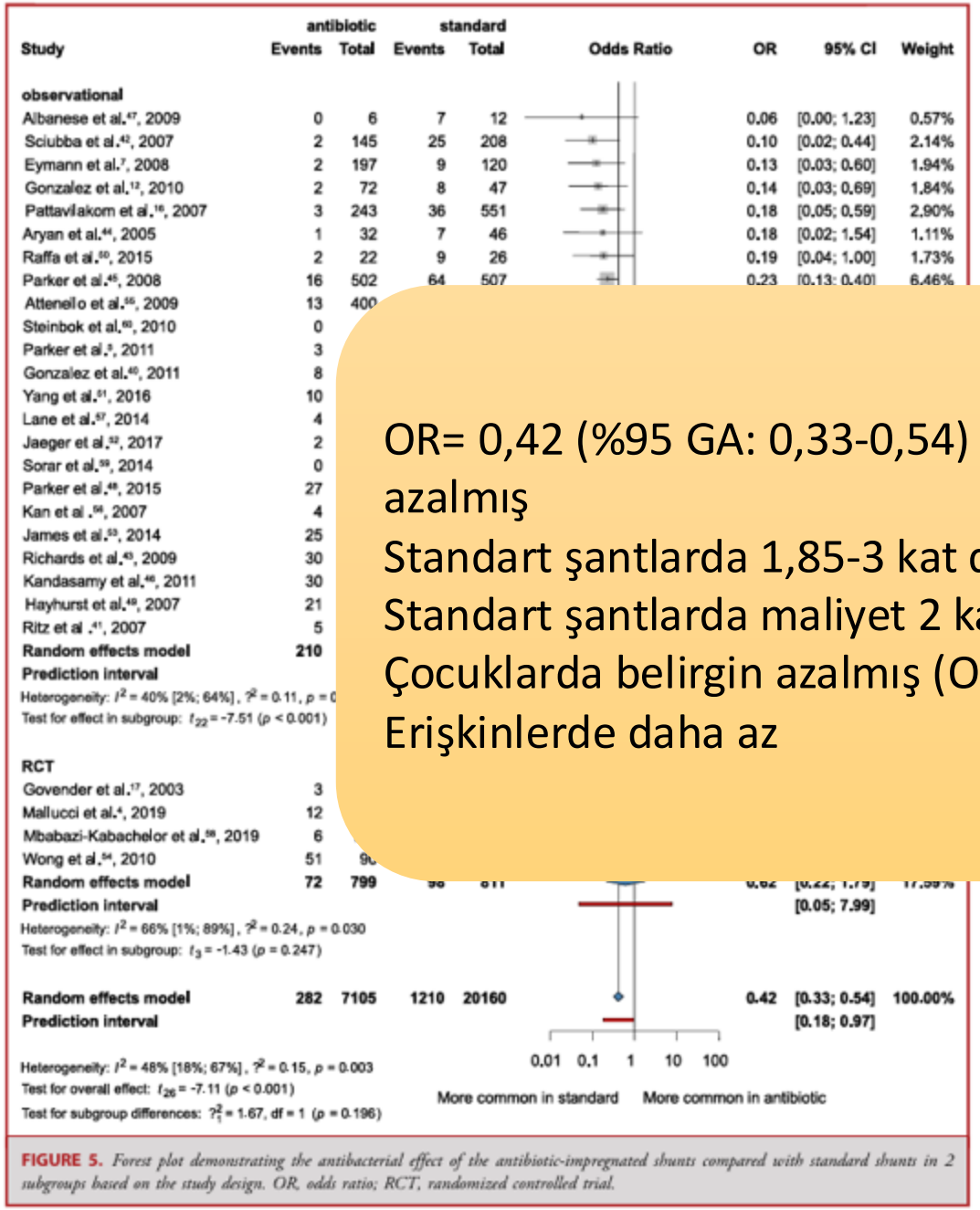

FIGURE 5. *Forest plot demonstrating the antibacterial effect of the antibiotic-impregnated shunts compared with standard shunts in 2 subgroups based on the study design. OR, odds ratio; RCT, randomized controlled trial.*

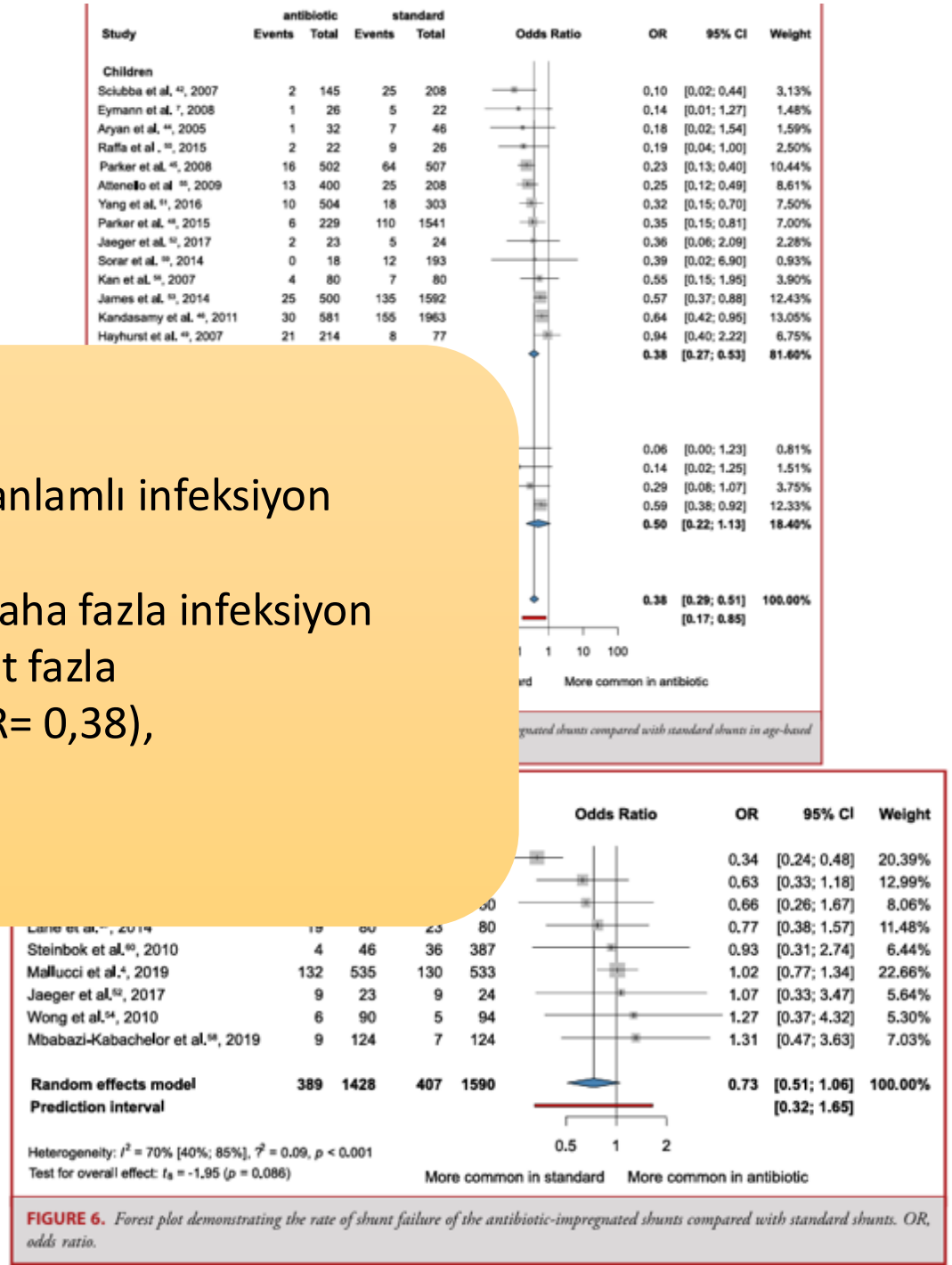

FIGURE 6. *Forest plot demonstrating the rate of shunt failure of the antibiotic-impregnated shunts compared with standard shunts. OR, odds ratio.*

OR= 0,42 (%95 GA: 0,33-0,54) anlamlı infeksiyon azalmış

Standart şantlarda 1,85-3 kat daha fazla infeksiyon

Standart şantlarda maliyet 2 kat fazla

Çocuklarda belirgin azalmış (OR= 0,38),

Erişkinlerde daha az

- Antibiyotikli şantlar infeksiyon oranını azaltır

- Ancak cerrahi asepsi ve infeksiyon kontrolünün yerini hiçbir şey alamaz

On the Report of the First Successful Surgical Treatment of Brain Abscess in the Ottoman Empire by Dr. Cemil Topuzlu in 1891

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Received, February 6, 2007

IN 1891, DR. Cemil Topuzlu operated on a brain abscess that originated as a complication of a depression fracture of the cranial inner table. The patient presented with Jacksonian seizures on his left side after a sharp trauma resulting in a 15-cm-long scalp laceration and underlying linear cranial fracture in the right parietal bone. Dr. Topuzlu

FIGURE 1. *Dr. Cemil Topuzlu, also known as "Cemil Pascha."*

FIGURE 3. *Dr. Topuzlu's operative note, written in French for his presentation to the 8th Surgery Congress in Lyon in 1894.*

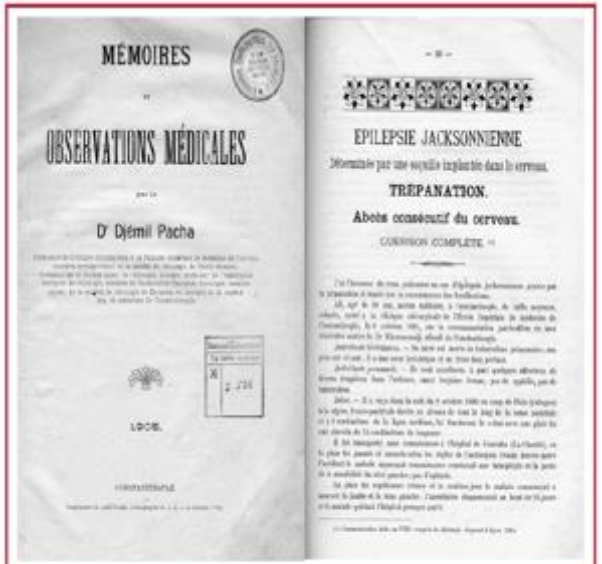

FIGURE 4. *Title page of Dr. Topuzlu's report published in* Memories et Observations Medicales *in 1905.*

FIGURE 2. *Dr. Cemil Topuzlu (first row, sixth from left) seen at the operation theater in Haydarpada Numune Hospital in the early 1900s.*

Teşekkürler