Post-neurosurgical meningitis treatment

see also Meningitis treatment

- Aztreonam plus ceftazidime-avibactam for post-neurosurgical meningitis due to Stenotrophomonas maltophilia
- Cerebrospinal fluid profiles of targeted metabolomics on neurotransmitters in patients with post-neurosurgical bacterial meningitis
- Treatment Options for Nosocomial Ventriculitis/Meningitis: A Case Report and Review of the Literature
- YKL-40 levels in cerebrospinal fluid serve as a diagnostic biomarker for post-neurosurgical bacterial meningitis in patients with stroke
- Risk Assessment and Recommended Approaches to Optimize Infection Control and Antibiotic Stewardship to Reduce External Ventricular Drain Infection: A Single-Center Study
- Meropenem-vaborbactam as intrathecal-sparing therapy for the treatment of carbapenem-resistant K. pneumoniae shunt-related ventriculitis: two case reports and review of the literature
- Clinical Characteristics and Predictors of Mortality of Patients with Post-Neurosurgical Meningitis-A 900-Cases Cohort Study
- Glioma grade and post-neurosurgical meningitis risk

Treatment of Post-Neurosurgical Meningitis Post-neurosurgical meningitis (PNM) is a severe complication that often results from breaches in the blood-brain barrier due to surgery, trauma, or cerebrospinal fluid (CSF) leaks. Treatment requires prompt initiation of targeted antimicrobial therapy based on suspected or identified pathogens. Here’s a general approach:

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1. Empirical Antimicrobial Therapy Empirical therapy is initiated immediately, tailored to cover common pathogens, until microbiological results (e.g., CSF cultures) are available.

- **Pathogens to Cover**:

1. Gram-positive bacteria: *Staphylococcus aureus* (including MRSA), coagulase-negative staphylococci (*e.g., S. epidermidis*), *Streptococcus pneumoniae*.
2. Gram-negative bacteria: *Pseudomonas aeruginosa*, *Klebsiella spp.*, *Escherichia coli*.

- **First-Line Empirical Therapy**:

1. **Vancomycin**: Targets Gram-positive organisms, especially MRSA and coagulase-negative staphylococci.
2. **Cefepime** or **Meropenem**: Broad-spectrum antibiotics effective against Gram-negative pathogens, including *Pseudomonas*.

Alternatively:

1. **Linezolid**: May be considered if vancomycin is contraindicated.
2. **Ceftazidime** or **Aztreonam**: Options for patients with penicillin allergy, focused on Gram-negative coverage.

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2. Pathogen-Specific Therapy Once the causative organism is identified, therapy should be narrowed to improve efficacy and reduce resistance risks.

- **Staphylococcus aureus**:

1. Methicillin-sensitive: **Nafcillin** or **Cefazolin**.
2. Methicillin-resistant (MRSA): **Vancomycin** or **Daptomycin**.

- **Coagulase-negative staphylococci**:

1. Vancomycin or **Rifampin** (added in prosthetic-related infections).

- **Gram-negative bacteria** (*e.g., Pseudomonas aeruginosa*):

1. **Cefepime**, **Meropenem**, or **Piperacillin-tazobactam**.
2. Combination therapy with **Amikacin** or **Ciprofloxacin** may be used in severe cases.

- **Polymicrobial infections**:

1. Broad-spectrum agents such as **Meropenem** or **Piperacillin-tazobactam**, with adjustments based on culture results.

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3. Route and Duration of Therapy - **Route**:

1. Begin with intravenous (IV) antibiotics to achieve rapid therapeutic CSF levels.
2. Switch to oral antibiotics if effective options are available, the patient is clinically stable, and the pathogen is susceptible.

- **Duration**:

1. Typically 10–21 days, depending on the severity of infection, causative organism, and clinical response.

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4. Adjunctive Measures - **CSF Drainage**: If a CSF leak, abscess, or hydrocephalus is present, surgical intervention (e.g., external ventricular drainage, craniotomy) is often necessary. - **Remove/Replace Infected Devices**: External or internal shunts, catheters, or prosthetics implicated in infection must be addressed.

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5. Special Considerations - **Biofilm Formation**: Infections involving implants or hardware often involve biofilm-producing pathogens, requiring prolonged treatment and sometimes rifampin for its anti-biofilm activity. - **Intrathecal Antibiotics**: Considered in refractory cases or when IV antibiotics fail to penetrate CSF adequately.

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6. Monitor and Adjust - Regular monitoring of:

1. Clinical symptoms: Fever, neurological deficits.
2. CSF parameters: Cell count, glucose, protein, culture results.
3. Drug levels (e.g., vancomycin troughs) to ensure therapeutic efficacy.

7. Prevention - Preoperative prophylaxis with cefazolin or vancomycin. - Strict aseptic techniques during surgery. - Early repair of CSF leaks.

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Example Regimen for Post-Neurosurgical Meningitis 1. **Empirical Therapy**:

1. Vancomycin + Cefepime or Meropenem.

2. **Pathogen-Specific Adjustments**:

1. Switch based on culture (e.g., MSSA: Nafcillin, Gram-negative: Cefepime).

3. **Duration**:

1. 14–21 days total, including transition to oral therapy if appropriate.

Close multidisciplinary coordination between neurosurgery, infectious disease specialists, and microbiology is crucial for optimizing outcomes.

Retrospective observational studies

Postoperative intracranial neurosurgical infections (PINI) complicate < 5% neurosurgeries. Scarce attention was dedicated to the extension and characteristics of its antimicrobial management considering their high morbidity, not negligible mortality, delayed hospital stay and increased healthcare costs.

They analyzed retrospectively (2014-2023) 162 PINI from eight Spanish tertiary teaching hospitals.

Elective clean craniotomies after tumor or vascular causes were the leading procedures. Epidural abscess (24.7%), scalp infections (19.8%), postsurgical meningitis (16.7%) and cranioplasty infections (16.7%) were the most frequent PINI. Gram negative bacteria (38.6%) and Staphylococcus spp (28.6%) were the predominant isolates. Overall 85.2% patients underwent pus drainage, mostly by craniotomy (40.3%). Interestingly 34% were already receiving antibiotics for extracranial infections before developing PINI while 16.8% did not receive pre-operative antibiotic prophylaxis. In total 77.2% patients started a combined intravenous (IV) antimicrobial therapy, of which 85.2% switched after 5 days to a second-line IV antibiotic regimen, in 41.3% cases combined, after pus culture results, for a median of 21 days. Overall 61.1% patients continued on oral antimicrobials after hospital discharge, 30.3% as a combined regimen, for a median of 42 days. Complete cure was obtained in 81.5% cases, while 11.1% relapsed, 7.4% failed to cure and 6.8% died after PINI complications. In the multivariate analysis oral antimicrobial therapy after hospital discharge ($p = 0.001$) was significantly associated with PINI cure with no effect on survival.

They conclude that an extended 6 weeks sequential IV and oral antimicrobial therapy in addition to neurosurgical correction increases PINI cure rate with no effect on survival [1)]

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Asensi V, Vázquez-Fernández C, Suárez-Díaz S, Asensi-Díaz E, Carrasco-Antón N, García-Reyne A, Panero I, Muñoz MV, Guerra JM, Arístegui J, Sepúlveda MA, García-Calvo X, Dueñas C, Biosca M, Chiminazzo V, Collazos J. Extended sequential intravenous and oral antimicrobial therapy improves cure rate in postoperative intracranial neurosurgical infections: a Spanish multicenter retrospective study. BMC Infect Dis. 2024 Nov 26;24(1):1345. doi: 10.1186/s12879-024-10204-7. PMID: 39587499.