Carbapenem-resistant Klebsiella pneumoniae meningitis

- 'Omics technologies for the elucidation of the molecular mechanisms related to carbapenem-resistant and extended spectrum beta-lactamase-producing Klebsiellapneumoniae
- Prevalence, Risk Factors, and Clinical Outcomes of Hypervirulent Klebsiella pneumoniae Strains among Klebsiella pneumoniae Infections: A Systematic Review and Meta-analysis
- Postoperative Meningitis Caused by Multidrug-Resistant Pathogens: A Case Report
- Antibacterial efficacy of cefoperazone/sulbactam in combination with various antimicrobials against carbapenem-resistant Klebsiella pneumoniae
- Real-World Use, Effectiveness, and Safety of Intravenous Fosfomycin: The FORTRESS Study
- Epidemiology, antimicrobial resistance profile, associated risk factors and management of carbapenem resistant Klebsiella pneumoniae in children under 5 with suspected sepsis in Ethiopia
- Clinical characteristics and mortality risk factors of premature infants with carbapenem-resistant Klebsiella pneumoniae bloodstream infection
- Impact of COVID-19 on the Prevalence and Drug Resistance of Bacteria Isolated From Bacterial Meningitis Cerebrospinal Fluid in Shandong Province: A Multicenter Retrospective Study

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Carbapenem-resistant Klebsiella pneumoniae (CRKP) meningitis is a rare but highly challenging condition to treat due to the multidrug-resistant nature of the pathogen. CRKP is resistant to most carbapenems, a class of β-lactam antibiotics often reserved for severe Gram-negative infections.

Clinical Presentation

Symptoms:

Fever

Headache

Neck stiffness

Altered mental status (confusion, drowsiness, coma)

Seizures (in severe cases)

Nausea/vomiting

Symptoms may mimic other bacterial meningitides but tend to progress rapidly.

Risk Factors

Healthcare-associated infections: Often linked to neurosurgical procedures, head trauma, ventriculoperitoneal (VP) shunts, or external ventricular drains (EVDs).

Prolonged hospital stay.

Previous carbapenem or broad-spectrum antibiotic exposure.

Immunocompromised state (e.g., diabetes, malignancies).

Diagnosis

Cerebrospinal Fluid (CSF) Analysis:

Elevated white blood cell count (pleocytosis, predominantly neutrophils).

Low glucose concentration (<40 mg/dL).

Elevated protein concentration (>45 mg/dL).

Microbiological Identification:

CSF culture: Klebsiella pneumoniae confirmed with resistance testing.

PCR: Rapid identification and resistance detection. Antibiotic Susceptibility Testing: Detection of carbapenemase enzymes (e.g., KPC, NDM, OXA-48, VIM) is critical for guiding therapy. Treatment Managing CRKP meningitis is extremely challenging due to limited antibiotic options. A multimodal approach is often required:

Antibiotics (Based on susceptibility):

Intrathecal/Intraventricular Therapy: Direct administration of antibiotics into the CSF is often necessary due to poor penetration of systemic drugs. Colistin: Often the drug of choice (5 mg/day intrathecally/intraventricularly). Tigecycline: Used off-label in some cases. Polymyxins (Colistin/Polymyxin B): Intravenous and intrathecal/intraventricular administration may be combined. High-dose Meropenem (if minimal carbapenem susceptibility remains): Combined therapy might help synergistically. Ceftazidime-Avibactam: Effective against KPC-producing strains; limited CSF penetration but promising in adjunctive therapy. Adjunctive Therapy:

Dexamethasone: To reduce inflammation and neurological sequelae. Supportive care: Monitoring and management of seizures, increased intracranial pressure, and hydrocephalus. Source Control:

Removal or replacement of infected devices (e.g., VP shunts, EVDs). Combination Therapy:

In severe cases, combining agents (e.g., colistin + tigecycline or meropenem) may enhance efficacy. Prognosis CRKP meningitis is associated with high mortality and morbidity due to its resistance and

virulence. Early diagnosis, aggressive treatment, and source control are critical for improving outcomes. Prevention Strict infection control measures: Hand hygiene, contact precautions. Proper sterilization and maintenance of neurosurgical equipment and devices. Antimicrobial stewardship programs to minimize the overuse of carbapenems.

Case reports

A 62-year-old male developed CRKP bacteremia and subsequent meningitis following the placement of an external ventricular drain for a cerebellar hematoma. Initial treatments, including meropenem, colistimethate sodium, and intrathecal amikacin, failed to eradicate the infection. Upon identifying the CRKP strain as an OXA-48 carbapenemase producer, therapy was switched to intravenous ceftazidime-avibactam (CAZ/AVI), leading to clinical improvement and sterile cerebrospinal fluid cultures. This case underscores the potential efficacy of CAZ/AVI in treating CRKP meningitis, particularly for strains harboring OXA-48 carbapenemases [1)].

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Pektezel MY, Isikay I, Gocmen R, Inkaya AC. Carbapenem-resistant Klebsiella pneumoniae meningitis and abscess treated with ceftazidime-avibactam. Enferm Infecc Microbiol Clin (Engl Ed). 2021 Apr 12:S0213-005X(21)00083-5. English, Spanish. doi: 10.1016/j.eimc.2021.03.014. Epub ahead of print. PMID: 33858707.