ST11

ST11 is a sequence type of Klebsiella pneumoniae that is part of the multi-locus sequence typing (MLST) scheme. It is globally recognized as one of the most problematic high-risk clones associated with carbapenem-resistant Klebsiella pneumoniae (CRKP) infections, particularly in healthcare settings, including neurosurgery.

Key Characteristics

Pandemic Potential:

ST11 is one of the most prevalent CRKP clones worldwide, especially in China, Southeast Asia, and Latin America. It has contributed significantly to hospital outbreaks.

Antimicrobial Resistance:

Frequently associated with the KPC (Klebsiella pneumoniae carbapenemase) enzyme, particularly KPC-2. Can also harbor other resistance genes such as NDM (New Delhi Metallo-β-lactamase) and OXA-48-like enzymes. Co-resistance to aminoglycosides, fluoroquinolones, and other antibiotic classes is common.

Hypervirulence and Resistance:

Some ST11 strains have acquired additional virulence plasmids, leading to hypervirulent CRKP (hv-CRKP). These hypervirulent strains exhibit increased capacity to cause abscesses, severe sepsis, and multi-organ damage, even in immunocompetent patients.

Mechanisms of Transmission:

ST11 spreads efficiently through clonal dissemination and the transfer of resistance plasmids. It thrives in healthcare environments, particularly in ICU and neurosurgical units, due to invasive devices and prolonged hospital stays.

ST11 in Neurosurgery

ST11 is particularly concerning in neurosurgical patients due to:

Invasive procedures (e.g., EVD, shunts, craniotomies).

Prolonged hospitalization and ICU stays, increasing exposure risk.

Infections like meningitis, ventriculitis, surgical site infections, and bacteremia, which are difficult to treat due to multidrug resistance.

Prevention and Control Strategies for ST11 CRKP:

Enhanced Infection Control:

Isolation of colonized/infected patients.

Rigorous hand hygiene and environmental disinfection.

Screening of high-risk patients upon admission to neurosurgical units.

Antimicrobial Stewardship:

Judicious use of carbapenems and other broad-spectrum antibiotics to prevent selection pressure.

Early Detection:

Implement molecular diagnostics (PCR or whole-genome sequencing) to identify ST11 and its resistance genes rapidly.

Screening for KPC, NDM, and other carbapenemases in endemic areas.

Patient Management:

Combination therapy: Use of colistin, tigecycline, ceftazidime-avibactam, or newer agents like meropenem-vaborbactam.

Intraventricular therapy for CNS infections when systemic therapy fails to achieve adequate CNS penetration.

Summary

ST11 is a critical clone of Klebsiella pneumoniae contributing to carbapenem resistance globally. Its combination of antimicrobial resistance and potential hypervirulence makes it a significant challenge in neurosurgical patients. Managing ST11 CRKP requires multidisciplinary coordination, rapid diagnosis, robust infection control, and innovative treatment strategies.

Single-center retrospective observational studies

There has been an upward trend in Carbapenem-resistant Klebsiella pneumoniae infections in China. This epidemiological trend needs to be examined to enable better disease control. Chen et al. sought to analyze the genomic characteristics, including the prevalent sequence type (ST), resistance, virulence, and evolutionary relationship, of K. pneumoniae strains isolated from patients with different types of infections in northern China to provide theoretical support for the effective prevention and control of the evolution and transmission of K. pneumoniae.

The STs were analyzed using multi-locus sequence typing (MLST). Drug susceptibility tests were used to examine the resistance of these STs to various antibiotics. A phylogenetic tree of these isolates was constructed using the National Center for Biotechnology Information genome as the reference. Antibiotic resistance genes were identified by comparing the genomic sequences against those in the Comprehensive Antibiotic Resistance Database. Virulence genes were identified using the Virulence Factor database, while the pathogenicity of the isolates was predicted using PathogenFinder.

In total, 38 clinical isolates of K. pneumoniae were identified and sequenced by high-throughput sequencing. Multidrug-resistant ST11 and hypervirulent ST23 were found to be the prevalent K. pneumoniae strains. The distribution of the ST11 strains was strongly correlated with stays in the

neurosurgery department (chi square test, P=0.02), while the ST23 strains were more frequently isolated from patients with liver abscesses and gallbladder infections. The ST23 strains were significantly more pathogenic than the other STs (Wilcox test, P<0.001). The resistance analysis showed that the rmtB genes were significantly correlated with amikacin resistance (P<2.2e-16, R2=1). The ST11 strains were also found to co-harbor the KPC-2, rmtB, and TEM-1 genes. To the best of our knowledge, this is the first study to report on the dissemination of such multidrug-resistant K. pneumoniae ST11 strains in Tianjin.

The carbapenem-resistant K. pneumoniae (CRKP) ST11 may become highly virulent K. pneumoniae (CR-hvKP) due to the acquisition of virulence plasmids. Attention should be paid to the evolutionary pressure of a caused by the overuse of antibiotics, which may trigger the further development of multidrug-resistant K. pneumoniae infections ¹⁾.

This study provides a valuable contribution to understanding carbapenem-resistant K. pneumoniae infections, particularly the roles of ST11 and ST23 strains in northern China. Despite its limitations, the genomic analysis highlights critical issues regarding antibiotic resistance, virulence, and the potential evolution of CR-hvKP. Future research incorporating larger sample sizes, clinical data, and experimental validation will further solidify these findings and support effective prevention and control strategies.

1)

Chen W, Cai Z, Liu S, Sotgiu G, Martin-Loeches I, Cao Y. A single-center retrospective study of the molecular epidemiological characteristics of different Klebsiella pneumoniae infections in northern China. J Thorac Dis. 2024 Nov 30;16(11):7739-7750. doi: 10.21037/jtd-24-1148. Epub 2024 Nov 29. PMID: 39678907; PMCID: PMC11635258.

From: https://neurosurgerywiki.com/wiki/ - **Neurosurgery Wiki**

Permanent link: https://neurosurgerywiki.com/wiki/doku.php?id=st11

Last update: 2024/12/17 07:54



3/3