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The clonality and dissemination of carbapenem-resistant *Klebsiella pneumoniae* in a tertiary hospital in Malaysia: a retrospective analysis from 2022 to 2023

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Abstract

Objectives: Cases of nosocomial carbapenem-resistant *Klebsiella pneumoniae* (CRKP) have been increasing steadily since the 1990s. In this study, we sought to assess CRKP clonal diversity and patterns of dissemination at Hospital Canselor Tuanku Muhriz (HCTM), a tertiary university hospital located in Kuala Lumpur, Malaysia. **Methods:** From January 2022 to December 2023, all CRKP isolates from HCTM were included in the investigation. Associated patient demographic data and clinical histories were retrieved from hospital records. Antibiotic susceptibility data for the collected isolates were obtained from the HCTM diagnostic laboratory. Molecular typing was performed using

enterobacterial repetitive intergenic consensus polymerase chain reaction (ERIC-PCR) to identify genetic clusters. Based on ERIC-PCR clustering results and epidemiological investigations, selected CRKP isolates were subjected to whole-genome sequencing (WGS) to validate clonal relatedness, identify antimicrobial resistance genes, and establish phylogenomic relationships. Results: During the study period, a total of 147 CRKP isolates were recovered from various wards across HCTM. All isolates exhibited resistance to imipenem, meropenem, or ertapenem, with 124 isolates confirmed as carbapenemase producers. ERIC-PCR identified 24 genetic clusters disseminated across 23 wards within HCTM. Twelve CRKP isolates were selected for WGS based on integrated epidemiological investigation and ERIC-PCR genotyping; sequence typing revealed ST17 as the dominant circulating CRKP lineage in the intensive care unit, ward 6E, and possibly across the hospital. The carbapenemase gene bla_{NDM} was detected in all WGS-analyzed CRKP isolates. Conclusion: Integrating epidemiological investigation, phenotypic testing, molecular typing, and WGS is essential to understand resistance dynamics, map transmission, and guide hospital infection prevention strategies. © 2026, Korea Disease Control and Prevention Agency. All rights reserved.© 2026 Korea Disease Control and Prevention Agency. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Author keywords

Carbapenem; Carbapenem-resistant Enterobacteriaceae; Klebsiella pneumoniae; Molecular typing; Polymerase chain reaction; Whole genome sequencing

Indexed keywords

EMTREE drug terms

amikacin; carbapenemase; ertapenem; gentamicin; imipenem; meropenem

EMTREE medical terms

adolescent; adult; aged; antibiotic resistance; antibiotic sensitivity; Article; bacterial gene; bacterial genome; bacterial transmission; bacterium identification; bacterium isolate; carbapenem resistant Klebsiella pneumoniae; clonal variation; contact examination; controlled study; demographics; enterobacterial repetitive intergenic consensus polymerase chain reaction; epidemiological surveillance; Federal Territory of Kuala Lumpur; genotype; genotyping; human; infection rate; intensive care unit; Klebsiella pneumoniae infection; laboratory diagnosis; major clinical study; medical history; medical record; phylogenetic tree; retrospective study; tertiary care center; university hospital; ward; whole genome sequencing

Chemicals and CAS Registry Numbers

Unique identifiers assigned by the Chemical Abstracts Service (CAS) to ensure accurate identification and tracking of chemicals across scientific literature.

amikacin	37517-28-5, 39831-55-5, 110660-83-8, 1257517-67-1
ertapenem	153773-82-1, 153832-38-3, 153832-46-3
gentamicin	1392-48-9, 1403-66-3, 1405-41-0
imipenem	64221-86-9
meropenem	96036-03-2

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