Identifying carbapenem resistance mechanisms in blood culture isolates using mCIM and eCIM at National Hospital Kandy

KD Galgamuwa[1], M Kothalawala[2], HDWS Kudagammana[3], LKG Nandanie[1], IP Samaraweera[1.]

Introduction: Carbapenem resistant Enterobacterales (CRE) are a critical threat to human health. CRE identified through disc diffusion (DD) or minimum inhibitory concentration (MIC), is mediated through carbapenemase production, porin loss, efflux or hyperproduction of ESBL/Amp C coupled with porin loss. Characterisation of the resistance mechanism in CREs is not routinely done in clinical microbiology laboratories. Carbapenem Inactivation Method (CIM) is simple, cost effective and highly sensitive and specific test for detecting carbapenemases.

Objectives: To describe the pattern of carbapenemase production among carbapenem-resistant Enterobacterales and *Pseudomonas spp* from blood cultures using modified CIM (mCIM) and EDTA CIM (eCIM) and to describe the associated demographic data, and bacterial species diversity.

Method: This was a laboratory based descriptive cross-sectional study conducted over four months. Thirty-four Gram negative blood culture isolates resistant to a carbapenem antibiotic by DD or MIC was speciated using VITEK 2 or Chromogenic agar and tested with the mCIM and eCIM test. Demographic and clinical data were collected from bed head tickets. Isolates confirmed as carbapenamase negative were tested with a combination disc of antibiotics (COMBI DISC D 72C) to detect ESBL, AmpC or porin loss.

Results: In this study, isolates came from patients of whom 58.4% were male (n=21) and 41.6% (n=15) female. The median age of these patients was 58 years (5 days to 80 years). Of the 34 isolates, 24 were *Klebsiella pneumoniae* (66.6%), 6 *Escherichia coli* (16.6%), 4 *Pseudomonas aeruginosa* (11%), 1 *Stenotrophomonas spp* and 1 *Chryseobacterium* spp (both 5.5%). Of these isolates tested by the mCIM test, 6 (17.6%) were negative and 28 (82.4%) were positive for carbapenamases. Twenty-three of the 28 isolates (82%) were metallo beta lactamase (MBL) producers and 5 were serine carbapenamase producers (18%). The resistance mechanism in the 6 carbapenemase negative isolates (by mCIM test) was suspected to be ESBL/Amp C with porin loss when tested with D72C combination disc.

Conclusion: While carbapenemase production, predominantly MBL, was common, a small proportion of CRE were negative for carbapenemase production. It would be useful for laboratories to consider adding mCIM and eCIM to their testing protocols.

Keywords: *CRE, carbapenem resistance, carbapenamase vs non carbapenamase, CIM test*

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[1]*National Hospital Kandy, Sri Lanka*
[2]*National Hospital of Sri Lanka,*
[3]*Department of Microbiology, Faculty of Medicine, University of Peradeniya, Sri Lanka,*

Address for correspondence: Dr. K.D. Galgamuwa, National Hospital Kandy, Sri Lanka; Telephone: O719684356
Email: kdgalgamuwa@gmail.com *https://orcid.org/ 0000-0001-9213-2972*