

NIVB Meeting 2022

30th November – 2nd December, 2022

Kutná Hora, Czech Republic

The first annual meeting of the National Institute
of Virology and Bacteriology (NIVB)

Organizers:

Institute of Organic Chemistry
and Biochemistry of the CAS

Masaryk University

Charles University

University of Chemistry
and Technology Prague

Palacký University Olomouc

Institute of Molecular Genetics
of the CAS

Institute of Microbiology of the CAS

Biology Centre CAS

Book of abstracts

edited by

Šárka Šímová



National Institute
of Virology and Bacteriology

The project National Institute of Virology and Bacteriology
(Programme EXCELES, ID Project No. LX22NPO5103) – Funded
by the European Union – Next Generation EU.



Funded by
the European Union
NextGenerationEU



MINISTRY OF EDUCATION,
YOUTH AND SPORTS



CZECH
RECOVERY
PLAN

L-24

PREFERRED β -LACTONE SYNTHESIS CAN EXPLAIN HIGH RATE OF FALSE-NEGATIVE RESULTS IN THE DETECTION OF OXA-48-LIKE CARBAPENEMASES**VENDULA STUDENTOVA^{a,b}, VENDULA SUDOVA^{a,c}, IBRAHIM BITAR^{a,b}, VERONIKA PASKOVA^{a,b}, JIRI MORAVEC^a, PETR POMPACH^d, MICHAEL VOLNY^d, PETR NOVAK^d, JAROSLAV HRABAK^{a,b,*}**^a Biomedical Center, Faculty of Medicine in Pilsen, Charles University, alej Svobody 76, 323 00 Pilsen, Czech Republic,^b Department of Microbiology, Faculty of Medicine in Pilsen, Charles University, alej Svobody 80, 323 00 Pilsen, Czech Republic,^c Department of Clinical Biochemistry and Haematology, Faculty of Medicine in Pilsen, Charles University, alej Svobody 80, 323 00 Pilsen, Czech Republic^d Institute of Microbiology of the Czech Academy of Sciences, BIOCEV, Prumyslova 595, 252 50 Vestec, Czech Republic
Jaroslav.Hrabak@lfp.cuni.cz

The resistance to carbapenems is usually mediated by enzymes hydrolyzing β -lactam ring. Recently, an alternative way of the modification of the antibiotic, a β -lactone formation by OXA-48-like enzymes, in some carbapenems was identified. We focused our study on a deep analysis of OXA-48-like-producing *Enterobacterales*, especially strains showing poor hydrolytic activity. In this study, we characterized 74 isolates of *Enterobacterales* resistant to carbapenems were used. Carbapenemase activity was determined by matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF MS), liquid chromatography/mass spectrometry (LC-MS), and Carba-NP test. As meropenem-derived β -lactone possesses the same molecular weight as native meropenem (MW 383.46 g/mol), β -lactonization cannot be directly detected by MALDI-TOF MS. In the spectra, however, the peaks of $m/z=340.5$ and 362.5 representing decarboxylated β -lactone and its sodium adduct were detected in 25 out of 40 OXA-48-like producers. In the rest 15 isolates, decarboxylated hydrolytic product ($m/z=358.5$) and its sodium adduct ($m/z=380.5$) have been detected. The peak of $m/z=362.5$ was detected in 3 strains co-producing OXA-48-like and NDM-1 carbapenemases. The respective signal was identified in no strain producing class A or class B carbapenemase alone showing its specificity for OXA-48-like carbapenemases. Using LC-MS, we were able to identify meropenem-derived β -lactone directly according to the different retention time. All strains with a predominant β -lactone production showed negative results of Carba NP test. In this study, we have demonstrated that the strains producing OXA-48-like carbapenemases showing false-negative results using Carba NP test and MALDI-TOF MS preferentially produced meropenem-derived β -lactone. We also identified β -lactone-specific peak in MALDI-TOF MS spectra and demonstrated the ability of LC-MS to detect meropenem-derived β -lactone.

Acknowledgement

This work was supported by the research project grant NV19-05-00541 provided by Czech Health Research Council, by the project Nr. CZ.02.1.01/0.0/0.0/16_019/0000787 "Fighting Infectious Diseases" provided by the Ministry of Education Youth and Sports of the Czech Republic and by the project National Institute of Virology and Bacteriology (Programme EXCELES, ID Project No. LX22NPO5103) – Funded by the European Union – Next Generation EU.