Evaluation of rapid biochemical test Beta-Carba for detection of carbapenemase-producing Gram-negative bacteria

Vladimira Hinic*1, Josiane Reist1, Adrian Egli1

1University Hospital of Basel; Clinical Microbiology

Background: β-Carba test (Bio-Rad) is a commercially available phenotypic rapid test for the detection of carbapenemase-producing Enterobacteriaceae. The principle of this test is based on the change of color of a chromogenic substrate in the presence of carbapenemase enzyme activity. In this study, we assessed its performance on carbapenemase-producing Enterobacteriaceae, Pseudomonas aeruginosa and Acinetobacter baumannii.

Material/methods: Fifty three well-characterized carbapenemase-producing clinical isolates were included in this study: 35 Enterobacteriaceae (8 KPC, 8 NDM, 7 VIM, 10 OXA-48-like and 2 NDM/OXA-48-like), 9 P. aeruginosa (6 VIM, 2 IMP and 1 SPM) and 9 A. baumannii (5 OXA-23, 3 OXA-40 and 1 NDM/OXA-23). Additionally, 50 carbapenemase-negative strains were analyzed including 9 ESBL- and 12 AmpC-producing isolates. To ensure objective reading and interpretation, all strains were coded and tested blinded. β-Carba test was performed according to the instructions of the manufacturer. Apart from interpretation after 30 minutes, we evaluated the test at two additional timepoints: 1 hour and 1.5 hours.

Results: The overall sensitivity and specificity of β-Carba test read after 30 min was 98.1% (52/53) and 90.0% (45/50), respectively. The calculated sensitivity in the 1h reading increased to 100% (53/53) and specificity decreased to 86.0% (43/50). After 1.5 hours the sensitivity was 100% (53/53), while the specificity further dropped to 82.0% (41/50). Interestingly, the carbapenemase-negative strains showing false positive results were almost exclusively P. aeruginosa (8 P. aeruginosa and 1 Proteus mirabilis ESBL-producer). The calculated sensitivity and specificity of the assay without P. aeruginosa were following: 30 min 97.7% (43/44) and 96.9% (32/33); 1h 100% (44/44), 96.9% (32/33); and 1.5h 100% (44/44), 96.9% (32/33).

Conclusions: The sensitivity of the β-Carba test estimated after 30 min of incubation (as recommended by the manufacturer) was 97.1%, but when evaluated after 1 hour, the sensitivity increased to 100%. Low specificity of the test (false positive readings) is found almost exclusively in P. aeruginosa, which can probably be explained by strong pigment production of these strains. In
conclusion, β-Carba is a rapid and reliable test for detection of carbapenemases in Enterobacteriaceae, A. baumannii and P. aeruginosa.