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Comparison of two rapid biochemical tests and four chromogenic selective media for detection of carbapenemase-producing Gram-negative bacteria

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Background: RAPIDEC® CARBA NP (bioMérieux) and Neo-Rapid CARB test (Rosco Diagnostica) are commercially available phenotypic rapid tests for carbapenemase detection based on carbapenem hydrolysis and subsequent color change. A reliable culture-based screening should have maximum sensitivity, preserve reasonable specificity and detect low-level carbapenem resistance. We assessed the performance of two commercially available biochemical screening tests and two chromogenic selective media for detection of carbapenemase-producing *Enterobacteriaceae*, *Pseudomonas aeruginosa* and *Acinetobacter baumannii*.

Material/methods: Fifty-four well-characterized carbapenemase-producing clinical isolates were included in this study: 35 *Enterobacteriaceae* (8 KPC, 1 IMI, 8 NDM, 7 VIM, 9 OXA-48-like and 2 NDM/OXA-48-like), 10 *P. aeruginosa* (6 VIM, 3 IMP and 1 SPM) and 9 *A. baumannii* (5 OXA-23, 3 OXA-40 and 1 NDM/OXA-23). Additionally, 46 carbapenemase-negative strains were analyzed including 12 ESBL-, 17 AmpC- and 1 K1-beta-lactamase producing isolates. To ensure objective reading and interpretation, all strains were coded and tested blinded. RAPIDEC® CARBA NP (bioMérieux) was performed according to the recently updated protocol (JCM 2015,53:12) and Neo-Rapid CARB (Rosco Diagnostica) according to the manufacturer's instructions. The biplates chromID® CARBA SMART (CARB/OXA, bioMérieux), Brilliance™ CRE/ESBL (Thermo Scientific), ChromArt CRE (Biolife), and BBL™ CHROMagar™ CPE (Becton Dickinson) were streaked with 1 µl of 10⁴ CFU/ml bacterial suspensions. Carbapenemase-positive strains not growing on chromID® CARBA SMART were additionally inoculated onto chromID® ESBL (bioMérieux).

Results: The overall sensitivity of RAPIDEC® CARBA NP and Neo-Rapid CARB was 87.0% (47/54) and 72.2% (39/54), respectively. Sensitivity calculated without *A. baumannii* strains was 95.6% (43/45) for RAPIDEC® CARBA NP and 86.7% (39/45) for Neo-Rapid CARB. Specificity for both tests was 100%. The sensitivity of chromID® CARBA SMART biplate was 90.7% (49/54), but when chromID® ESBL plate was added, the sensitivity increased to 100%. Sensitivity of the CRE part of Brilliance™ biplate was 75.9% (41/54), but in combination with the ESBL part 98.1% (53/54). The quantity of bacteria recovered on each plate tested was approximately the same as the inoculum.

Conclusions: Although the analytical sensitivity of RAPIDEC® CARBA NP was better than that of Neo-Rapid CARB test, the performance with OXA-producing *A. baumannii* and OXA-48-like *Enterobacteriaceae* was limited for both tests in this blinded study. The highest sensitivity for carbapenemase screening could be achieved when an ESBL screening plate was added to chromID® CARBA SMART biplate and when Brilliance™ CRE was used in combination with Brilliance™ ESBL. Further studies are needed to determine the clinical sensitivity and specificity of the screening media using patient specimens.