

Evaluation of the RAPIDEC® CARBA NP test for the detection of carbapenemases in Gram-negative bacteria

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Background: The emergence and rapid dissemination of diverse carbapenemases in Russian hospitals is a major threat for the national health care system. A number of phenotypic and molecular methods have been developed for carbapenemase detection. The aim of the study was to evaluate the performance of the RAPIDEC® CARBA NP (bioMérieux, France) test on clinical isolates of Gram-negative bacteria producing main carbapenemases.

Material/methods: Non-duplicate clinical isolates of *Enterobacteriaceae*, *Acinetobacter spp.* and *Pseudomonas aeruginosa* characterized phenotypically and genetically for the presence of *bla*_{NDM}, *bla*_{KPC}, *bla*_{OXA-40-like}, *bla*_{OXA-23-like}, *bla*_{VIM}, and *bla*_{OXA-48} were included in the study. The RAPIDEC® CARBA NP assay was applied to cultures grown overnight on Mueller Hinton E agar (bioMérieux) according to the manufacturer's protocol. Reactions were read after 30 and 120 minutes of incubation. *K. pneumoniae* ST 340 harbouring *bla*_{NDM-1} gene, the presence of which was confirmed by PCR and Sanger sequencing, was used for the positive reaction's control. □

K. pneumoniae ATCC 700603 was used for the negative reaction's control.

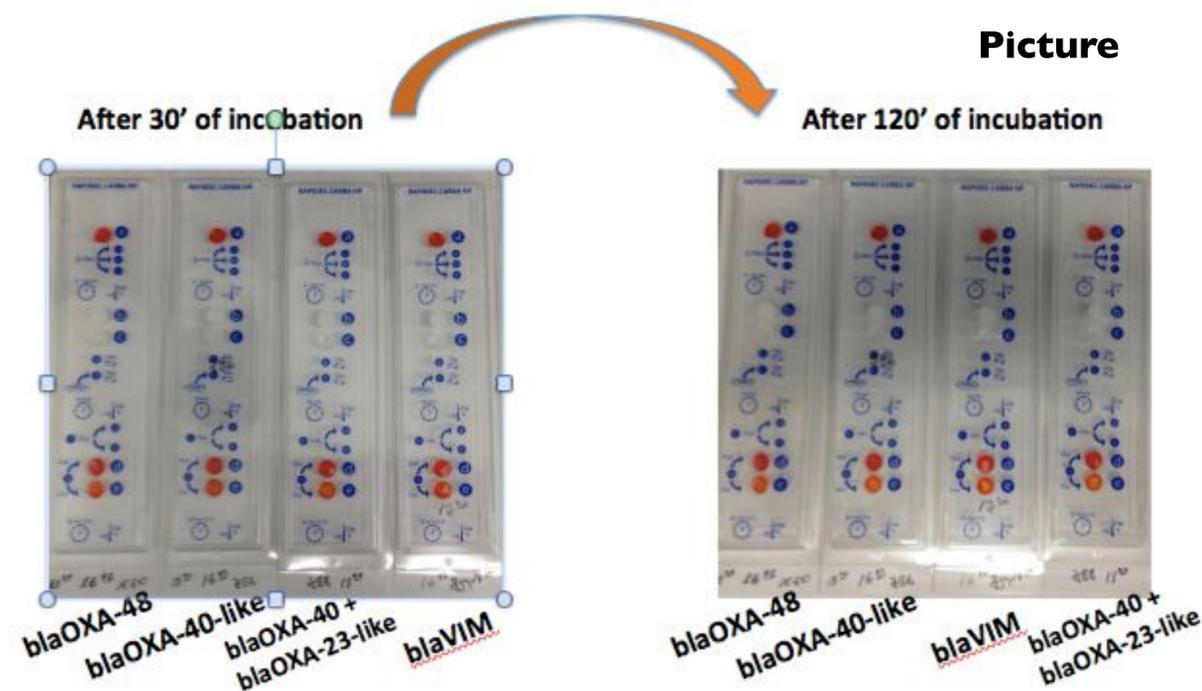
Results. The results of the RAPIDEC CARBA NP test with Quality Control strains were successful. The results of the RAPIDEC® CARBA NP test with carbapenemase-producing isolates are presented in a Table below. All of the NDM-, KPC-producing isolates and 7 of 9 VIM-producing isolates gave positive results already after 30 min of incubation. All isolates, producing OXA-type carbapenemases and 2 isolates, producing VIM-type carbapenemases, demonstrated negative results after 30 min of incubation and positive results after 120 min (see picture below). The sensitivity of the RAPIDEC® CARBA NP test after 30 min and 120 min of incubation was 65.4% and 100.0%, respectively. The specificity of the RAPIDEC® CARBA NP test after both 30 min and 120 min of incubation was 100.0%.

Table

Carbapenemases	Species (n)	MIC (mg/l) range		Results at 30'		Results at 120'	
		Meropenem	Imipenem	+ ¹	- ²	+	-
OXA-48	<i>Enterobacteriaceae</i> (11)	1-32	2-16	0	11	11	0
NDM-1	<i>Enterobacteriaceae</i> (13) <i>A. nosocomialis</i> (2)	8->64	4->64	15	0	15	0
KPC-2	<i>Enterobacteriaceae</i> (10)	8->64	4->64	10	0	10	0
VIM-type	<i>Enterobacteriaceae</i> (2) <i>P. aeruginosa</i> (7)	1-8	0.5-16	7	2	9	0
OXA-40, OXA-23	<i>A. baumannii</i> (7)	2-16	2-8	0	7	7	0
None	<i>Enterobacteriaceae</i> (29)	0.015-0.12	0.015-0.06	0	29	0	29
	<i>A. baumannii</i> (10)	0.06-0.25	0.06-0.25	0	10	0	10
	<i>P. aeruginosa</i> (8)	0.06-0.25	0.06-0.25	0	8	0	8

¹(+) - positive result, the colour changed from red to yellow, orange or red-orange

²(-) - negative result, the colour didn't change



Conclusions: RAPIDEC® CARBA NP is suitable for rapid and easy evaluation of carbapenemase activity in Gram-negative bacteria and diagnosis/screening of carbapenemase-producing patients. After the first reading at 30 minutes the sensitivity is at 65,4%. As some carbapenemase activity (OXA-type and VIM-type) might be slow the manufacturer recommends a second reading after 2 hours incubation which increase the sensitivity up to 100%; otherwise there is a risk of false-negative results with OXA-type and VIM-type carbapenemases producers.