

Comparison of two rapid commercial molecular tests for detection of the most common carbapenemases: Xpert® Carba-R and eazyplex® SuperBug complete B

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INTRODUCTION

Rapid and reliable detection of carbapenemases is an imperative for clinical microbiology laboratories, but is often challenging. Xpert® Carba-R, developed for GeneXpert® platform (Cepheid, USA), detects KPC, NDM, VIM, IMP-1 and OXA-48 in gram-negative rods directly from rectal swabs. eazyplex® SuperBug complete B test (Amplex Biosystems, Germany) developed for Genie® II instrument (Optigene, UK) is based on isothermal amplification technique. It detects KPC, NDM, VIM, OXA-48, OXA-181, OXA-23 and OXA-40 directly from rectal swabs and bacterial cultures. We evaluated these two rapid commercial molecular tests on culture isolates.

MATERIALS AND METHODS

The protocol for Xpert® was adapted for testing bacterial isolates. Shortly, 100 µl of the 0.5 McF culture suspension were pipetted to the Sample Reagent vial, mixed and the whole content transferred to the Xpert® cartridge. The eazyplex® test was performed according to the manufacturer's instructions. Shortly, a fraction of the bacterial colony was picked with one microliter inoculation loop and resuspended in 500 µl of RALF buffer (resuspension and lysis buffer). The suspension was incubated at 99° C for 2 minutes enabling lysis of bacterial cells. 25 µl of suspension were pipetted in each of the 8 tubes of the test strip containing lyophilized ready-to-use mixture for isothermal amplification. 45 well characterized carbapenemase-producing clinical strains from our strain collection were tested: 38 *Enterobacteriaceae* (10 KPC, 10 NDM, 7 VIM, 8 OXA-48 "sensu stricto", 1 OXA-181, 1 OXA-48 "sensu stricto"/NDM, 1 OXA-181/NDM) and 7 *Pseudomonas* spp. (5 VIM, 1 NDM, 1 IMP). Additionally, 9 non-carbapenemase-producing strains were analyzed including ESBL and AmpC.

RESULTS

Table 1. Comparison of Xpert® Carba-R and eazyplex® SuperBug complete B on 45 carbapenemase-producing strains

No.	Species	Carbapenemase Type	Xpert® Carba-R		eazyplex® SuperBug complete B		
			Ct-value	Result	Time (min:sec)	Result	
<i>Enterobacteriaceae</i>							
1	<i>K. pneumoniae</i>	KPC	19.1	positive	11:30	positive	
2	<i>K. pneumoniae</i>	KPC	18.3	positive	14:00	positive	
3	<i>K. pneumoniae</i>	KPC	17.4	positive	12:15	positive	
4	<i>K. pneumoniae</i>	KPC	19.1	positive	14:45	positive	
5	<i>K. pneumoniae</i>	KPC	19.5	positive	13:00	positive	
6	<i>K. pneumoniae</i>	KPC	20.4	positive	12:30	positive	
7	<i>K. pneumoniae</i>	KPC	19.3	positive	11:45	positive	
8	<i>K. pneumoniae</i>	KPC	19.9	positive	13:15	positive	
9	<i>K. pneumoniae</i>	KPC	17.7	positive	11:30	positive	
10	<i>K. pneumoniae</i>	KPC	17.4	positive	13:30	positive	
11	<i>E. coli</i>	VIM	18.2	positive	08:45	positive	
12	<i>E. coli</i>	VIM	19.2	positive	08:15	positive	
13	<i>E. coli</i>	VIM	18.4	positive	08:00	positive	
14	<i>K. pneumoniae</i>	VIM	15.4	positive	09:30	positive	
15	<i>K. oxytoca</i>	VIM	17.3	positive	09:30	positive	
16	<i>K. oxytoca</i>	VIM	16.0	positive	09:15	positive	
17	<i>C. freundii</i>	VIM	13.7	positive	07:45	positive	
18	<i>E. coli</i>	NDM	17.4	positive	07:00	positive	
19	<i>E. coli</i>	NDM	16.8	positive	07:15	positive	
20	<i>E. coli</i>	NDM	18.8	positive	07:30	positive	
21	<i>E. coli</i>	NDM	19.2	positive	07:00	positive	
22	<i>K. pneumoniae</i>	NDM	18.6	positive	07:00	positive	
23	<i>K. pneumoniae</i>	NDM	19.6	positive	06:30	positive	
24	<i>K. pneumoniae</i>	NDM	17.8	positive	07:00	positive	
25	<i>E. cloacae</i>	NDM	18.2	positive	06:30	positive	
26	<i>E. cloacae</i>	NDM	21.8	positive	07:45	positive	
27	<i>P. rettgeri</i>	NDM	15.1	positive	06:00	positive	
28	<i>E. coli</i>	OXA-48	19.2	positive	07:45	positive	
29	<i>K. pneumoniae</i>	OXA-48	17.9	positive	06:00	positive	
30	<i>K. pneumoniae</i>	OXA-181 (OXA-48-family)	0	negative	07:30	positive	
31	<i>K. pneumoniae</i>	OXA-48	18.2	positive	08:45	positive	
32	<i>K. pneumoniae</i>	OXA-48	17.7	positive	07:00	positive	
33	<i>K. pneumoniae</i>	OXA-48	18.9	positive	07:30	positive	
34	<i>K. pneumoniae</i>	OXA-48	17.8	positive	07:30	positive	
35	<i>K. pneumoniae</i>	OXA-48	17.2	positive	07:30	positive	
36	<i>K. pneumoniae</i>	OXA-48	18.2	positive	08:30	positive	
37	<i>C. freundii</i> -group	NDM/OXA-48	18.4/17.6	positive/positive	08:00/07:00	positive/positive	
38	<i>E. coli</i>	NDM/OXA-181 (OXA-48-family)	18.5/0	positive/negative	06:44/9:13	positive/positive	
<i>Pseudomonas</i> spp.							
39	<i>P. aeruginosa</i>	VIM	28.4	positive	08:00	positive	
40	<i>P. aeruginosa</i>	VIM	18.4	positive	08:45	positive	
41	<i>P. aeruginosa</i>	VIM	16.5	positive	08:30	positive	
42	<i>P. aeruginosa</i>	VIM	26.0	positive	09:45	positive	
43	<i>P. stutzeri</i>	VIM*	18.6	positive	11:30	positive	
44	<i>P. aeruginosa</i>	IMP*	0	negative	0	negative	
45	<i>P. aeruginosa</i>	NDM	18.9	positive	06:15	positive	

*IMP-18 confirmed by sequencing

Figure 1. eazyplex® SuperBug complete B test running on Genie® II instrument

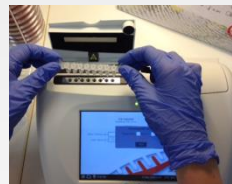


Figure 2. Xpert® Carba-R running on GeneXpert® platform



Both assays detected all KPC, VIM, NDM and OXA-48 "sensu stricto" in *Enterobacteriaceae* and all VIM- and NDM-producing *Pseudomonas* spp. Xpert® did not detect two OXA-181 (OXA-48-family) strains, which on the other hand were detected by eazyplex®. One *P. aeruginosa* IMP-18-producing strain was found negative by both assays. The hands-on time for both assays was 2-3 min. The turnaround time (TAT) for Xpert® and eazyplex® was 60 and 9-16 min, respectively. All non-carbapenemase-producing strains tested negative with both assays.

DISCUSSION / CONCLUSIONS

Both assays were very reliable for rapid detection of the carbapenemases that are covered by the assay. While Xpert® did not detect all carbapenemases of the evolving OXA-48 family (such as OXA-181) and other members of the IMP family except IMP-1, eazyplex® does not cover any IMP-carbapenemases. While the TAT of both tests is very short, results of eazyplex® were available already after 9-16 min due to the rapid isothermal amplification technology.