Performance of CarbR GeneXpert® assay against culture and PCR for the detection of carbapenemase-producing *Enterobacteriaceae* (CPE) in rectal swabs

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Introduction

Species belonging to family *Enterobacteriaceae* colonize mainly the gut of humans and animals. They cause both community- and hospital-acquired infections. Recently, carbapenem-resistant *Enterobacteriaceae* (CRE) has emerged as a global threat around the world. These emerging pathogens cause difficult-to-treat infections with high morbidity and mortality.

Objective

This study was undertaken to evaluate the performance of CarbR GeneXpert assay (CGXA) against culture and PCR in the detection of CRE from rectal swabs.

Materials and Methods

- A total of 100 non-repetitive rectal swabs, in duplicates, were collected from patients in the high dependency units of our hospital.
- They were investigated simultaneously by culture and the CGXA.
- The culture method was by direct inoculation on a MacConkey agar plate on which a 10µg meropenem disk was placed and incubated in air at 37°C for 24 h.
- After overnight incubation, isolates identified as CRE were confirmed by PCR. CGXA was performed according to manufacturer's protocol.
- Five isolates with known metallo-β-lactamase (MBL) genes were included in the assay.

Table 1: Bio-data and characteristics of the 6 positive patients in the adult intensive care unit.

Serial #	Age	Sex	Nationality	Travel history	Previous hospitalization	Presenting complaints
1	55	M	Kuwaiti	No	Yes in KCCC	Renal cell carcinoma
2	76	M	Kuwaiti	No	Yes in MKH	Chest infection
3	NA	M	Iranian	Yes	No	Drug overdose
4	80	F	Kuwaiti	No	Yes in MKH	Infected abdominoplasty
5	26	M	Kuwaiti	No	Yes in MKH	Septic arthritis post RTA
6	NA	M	Kuwaiti	No	No	CVA

KCCC = Kuwait Center for Cancer Control; MKH = Mubarak Al-Kabeer Hospital; RTA = road traffic accident; CVA = cerebrovascular accident.

Table 2: Prevalent carbapenemase genes in the rectal swabs of the 6 positive patients.

Serial #	Nationality	Carbapenemase-positive genes		Culture
		XpertCarba-R	PCR	
1	Kuwaiti	bla_{NDM}	bla_{NDM}	*Enterobacter aerogenes*
2	Kuwaiti	bla_{NDM}	bla_{NDM}	*Klebsiella pneumoniae*
3	Kuwaiti	bla_{NDM}	bla_{NDM}	*Klebsiella pneumoniae*
4	Kuwaiti	bla_{NDM}	bla_{NDM}	*Klebsiella pneumoniae*
5	Kuwaiti	Negative	bla_{OXA-48}	*Escherichia coli*
6	Kuwaiti	bla_{NDM}	Negative	*Klebsiella pneumoniae*

Results

- General bio-data of the CRE-positive patients are given in Table 1.
- Of the 100 samples, 6 (6%) were positive for a carbapenemase gene, 5 of which were correctly detected by CGXA confirmed by PCR.
- They were 4 *Klebsiella pneumoniae* (positive for bla_{NDM}), 1 *E. coli* (bla_{OXA-48}) negative by CGXA but positive by PCR, and 1 *Enterobacter aerogenes* (bla_{NDM}). See Table 2
- The sensitivity and specificity of the CGXA, using the PCR assay as the reference test standard, were 80% and 98.9%, respectively.
- The prevalence of CRE colonization in our high-risk population by CGXA was 5%.
- All the 5 in-house positive control strains were correctly detected by CGXA.
- Non-recent travel history was significantly associated with CRE colonization (p<0.005).
- The turn-around–time from specimen to result was 1 h compared with culture and subsequent PCR of 48 h.

Conclusions

- With such performance, the CGXA can be readily incorporated into any busy routine clinical microbiology laboratory.
- The rapid detection of CRE harboring MBL genes directly from rectal swabs within 1 h should assist in optimizing decision-making on contact-precautions and early detection of outbreaks within the hospital.

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