Rapid detection of carbapenemase-producing Enterobacteriaceae directly from positive blood cultures by a new immunochromatographic assay

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Background

- Bloodstream infections caused by carbapenemase-producing Enterobacteriaceae (CPE) associated with treatment failure and increased mortality
- Detection of CPE from blood cultures (BC) by standard methods takes 20-96 hours

Objectives

- to develop and evaluate a protocol for the rapid detection of carbapenemases directly from positive BC using a new multiplex immunochromatographic test (ICT)

Methods

- blood cultures spiked with Enterobacteriaceae and incubated in a BD Bactec FX system until positive
- 170 molecularly characterized clinical isolates
  - *K. pneumoniae* (N=84), *E. coli* (N=53), *E. cloacae* (N=15), *E. aerogenes* (N=6), *C. freundii*, (N=5), other species (N=7)
  - 126 CPE
    79 OXA-48-like, 18 KPC, 29 NDM
  - 44 carbapenemase negative isolates
- blood from positive BC bottles was hemolyzed, bacteria concentrated by centrifugation and lysed
- lysate was transferred to the RESIST-3 O.K.N. ICT® (Coris BioConcept, Gembloux, Belgium), which detects OXA-48-like, KPC and NDM (Fig. 1)

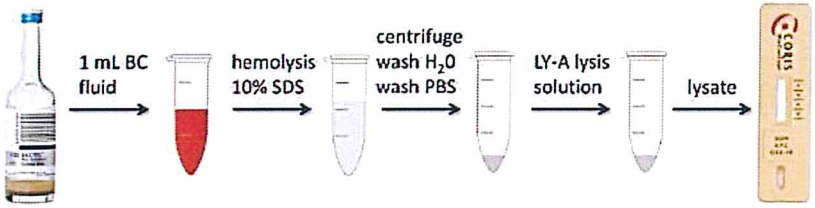

Figure 1. Workflow for the preparation of ICT directly from positive blood cultures; SDS: sodium dodecyl sulfate; PBS: phosphate buffered saline

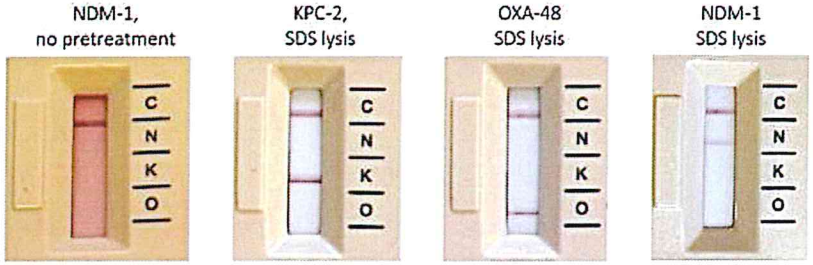

Figure 2. Result of the ICT from blood cultures

Results

- Without pretreatment, results cannot be easily determined because of red background
- After pretreatment with SDS, all carbapenemases can be easily identified (Fig. 2)
- Sensitivity and specificity 100% (Table 1)
- Easy and rapid protocol, time to result 20-30 min

Results

Carbapenemase	positive tests/ total isolates	Sensitivity	Specificity
OXA-48-like	79/79	100%	100%
OXA-48	54/54		
OXA-181	8/8		
OXA-232	7/7		
OXA-162	7/7		
others	3/3		
OXA-48-like/NDM	3/3	100%	100%
KPC	18/18	100%	100%
KPC-2	17/17		
KPC-3	1/1		
NDM	29/29	100%	100%
NDM-1	27/27		
NDM-5	1/1		
NDM-7	1/1		

Table 2. Sensitivity and specificity of the ICT from blood cultures

Conclusion

- OXA-48-like, KPC and NDM carbapenemases can be reliably detected directly from positive BC bottles with the new protocol
- more rapid than other currently available assays
- can be performed in any routine microbiology laboratory
- can help to rapidly identify patients with CPE BSI and early optimize treatment

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