Evaluation of mSuperCARBA™ chromogenic media for the detection of carbapenemase-producing Enterobacteriaceae

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Introduction

A previous evaluation of chromogenic media for the detection of carbapenemase-producing Enterobacteriaceae (CPE) completed within the Department of Microbiology, Leeds General Infirmary (July-Sept 2014), identified that the COLOREX™ KPC media (E&O Laboratories Ltd., UK) provided an intermediate level of sensitivity (62%) compared with other media. E&O Laboratories Ltd. have since developed COLOREX™ mSuperCARBA™, a new selective chromogenic screening medium for the detection of CPE from routine specimens. COLOREX™ mSuperCARBA™ is designed to detect a wide range of carbapenemase enzymes, including KPC, IMP, NDM, OXA-48 and VIM.

Currently within the Department of Microbiology, Leeds General Infirmary, ChromID® ESBL media (bioMérieux, UK) with a 10µg ertapenem (ERT)-containing antibiotic disc (Mast Group Ltd., UK) is used to screen rectal swabs for the presence of CPE; however, this method is not recommended by the European Committee on Antimicrobial Susceptibility Testing (EUCAST) and the laboratory is keen to introduce a recommended method of screening. In order to identify the most sensitive chromogenic media for detection of CPE an evaluation of three media types was completed.

Methods

Previously characterised control isolates (93 carbapenemase producers (IMP=6; KPC=22; OXA=22; NDM=22; VIM=21) and seven non-carbapenemase producers) supplied by the Antimicrobial Resistance and Healthcare Associated Infections (AMRHAI) Reference Unit, PHE Colindale, London were used to evaluate the following media: COLOREX™ mSuperCARBA™ (E&O Laboratories Ltd., UK), ChromID® CARBA SMART, a bi-plate containing both ChromID® Carb and ChromID® OXA-48 media (bioMérieux, UK), and ChromID® ESBL (bioMérieux, UK) with a 10µg ertapenem (ERT)-containing antibiotic disc (Mast Group Ltd., UK).

Isolates were sub-cultured from frozen storage in glycerol broth onto cysteine-lactose electrolyte-deficient (CLED) agar. A high inoculum (10^5cfu/ml) and a low inoculum (100 cfu/ml) bacterial suspension were prepared in saline for each isolate using a DensiCHEK™Plus instrument (bioMérieux, UK) and 25µL of the suspension was placed on each chromogenic agar plate type and streaked to single colonies. A Columbia blood agar plate was also inoculated for control purposes. The plates were incubated aerobically at 37°C for 18-24 hours.

A small number (n=16) of rectal swabs were also cultured using the COLOREX™ mSuperCARBA™ and ChromID® ESBL plus ERT-containing antibiotic disc media.

Results

COLOREX™ mSuperCARBA™ media had the highest sensitivity at both high and low inocula (99% and 93%, respectively). While the ChromID® CARBA SMART media had a

sensitivity of 92% at a high inoculum this decreased to 73% at a low inoculum. The ChromID® ESBL plus ERT disc method had 92% sensitivity at a high inoculum and 82% at a low inoculum (Table 1). Due to the low numbers of non-carbapenemase producers included in the panel of isolates (n=7), specificity values were not calculated.

Of the rectal swabs that were tested, 11 grew ESBL-positive and/or AmpC-positive Enterobacteriaceae on the ChromID® ESBL plus ERT disc; however, no isolates were detected on the COLOREX™ mSuperCARBA™ media. One rectal swab grew a KPC-positive *Citrobacter freundii,* which was detected by both media types and confirmed by ARMHAI and another swab grew an OXA-48-positive *K. pneumoniae* isolate on COLOREX™ mSuperCARBA™ media, which did not grow using the ChromID® ESBL plus ERT disc method. Two rectal swabs, taken from the same patient, grew *K. pneumoniae* on the COLOREX™ mSuperCARBA™ media but not the ChromID® ESBL media; the isolate was not found to be a carbapenemase producer, as confirmed by AMRHAI. One rectal swab was negative on all media types.

Table 1. Sensitivity of the three chromogenic media tested (n=99 isolates*).

Media	Inoculum	Sensitivity	95% CI
COLOREX™ mSuperCARBA™	High	99	94-99
	Low	93	86-98
ChromID® CARBA SMART'	High	92	85-97
	Low	73	63-82
ChromID® ESBL plus ERT disc	High	92	85-97
	Low	82	72-89

Key: CI: confidence interval
N.B. *One isolate was excluded from analysis as the VIM gene had been lost during storage.

Conclusions

Of the three media types evaluated, COLOREX™ mSuperCARBA™ had the highest sensitivity at both high and low inocula. Improved sensitivity of CPE detection may lead to a decrease in turnaround times for negative rectal swabs, which can be reported within 24 hours of testing. Although only a small number of rectal swabs were tested in this evaluation, an increase in specificity was suggested for COLOREX™ mSuperCARBA™ compared with ChromID® ESBL plus ERT disc, which is not unexpected given the selective purpose of each media. Increased specificity may reduce the amount of time spent investigating ESBL- or AmpC positive-Enterobacteriaceae.

Transparency declarations

COLOREX™ mSuperCARBA™ media was provided free-of-charge by E&O Laboratories Ltd., UK and Public Health England provided the funding for all other consumables and media. Neither author has received any funds or sponsorship for completing this evaluation.

Disclaimer

The views and opinions expressed in this summary are those of the authors and do not necessarily reflect the official policy or position of any agency of Public Health England.

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