Comparison of the chromID™ ESBL medium and MacConkey agar supplemented with ceftazidime (5mg/l) for the detection of extended-spectrum beta-lactamase producing *Enterobacteriaceae* from rectal swabs in hospitalized patients

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Objectives

Rapid identification of patients colonized with extended-spectrum beta-lactamase (ESBL)-producing *Enterobacteriaceae* is useful for the early detection and control of nosocomial outbreaks. The aim of this study was to evaluate the clinical diagnostic performance of the selective chromogenic medium chromID™ ESBL (bioMérieux, Marcy-l'Etoile, France), compared with our in-house medium CTAZ (MacConkey agar + ceftazidime 5 mg/l) for the detection of ESBL-producing *Enterobacteriaceae* from rectal swabs in ICU patients.

Methods

From 5/11 to 17/12/2007, ICU hospitalized patients (n=299) were screened by sampling rectal swabs (n=436) using the Eswab (Copan, Italy).

After homogenization by vortexing for 15 s, 100 µl of the Eswab were inoculated onto chromID ESBL and CTAZ. Plates were incubated at 35°C and read after 18 and 48 h.

Identification and susceptibility testing were performed by using the Vitek 2 system.

The presence of ESBL was confirmed by combined double disks according to CLSI guidelines.

Genotypic characterization was determined by PCR assays targeting bla_{TEM}, bla_{SHV} and bla_{CTX-M} genes.

Isolates harbouring bla_{TEM} and bla_{SHV} were further analyzed by sequencing to identifiy the ESBL.

A daily quality control was performed on CTAZ by using reference strains, *E. coli* ATCC 25922 (ESBL-negative) and *K. pneumoniae* ATCC 700603 (ESBL-positive), and according to CLSI guidelines for selective media.

Results

One hundred and six specimens yielded growth on at least one of the selective media (Table 1) and 330 specimens were culture negative on both media.

Of 95 *Enterobacteriaceae* strains isolated from 48 patients (16.1%), 69 ESBL-positive strains were found in 32 patients (10.7%) (Table 1).

All *Enterobacteriaceae* strains produced the expected colour colonies on chromID ESBL, except for 4 *E. coli* isolates (colourless after 18 h, pink-burgundy after 48 h).

Table 1: Distribution of bacterial isolates (n=137) recovered from rectal swabs (n=106)

Group/species	Total	No. of isolates recovered on: chromID ESBL	CTAZ	Both media
Escherichia coli	48	38	34	24
KESC group[a]:				
Klebsiella oxytoca	1	1	0	0
K. pneumoniae	10	8	10	8
Enterobacter aerogenes	6	2	6	2
E. cloacae	24	22	23	21
Citrobacter freundii	1	1	1	1
C. koseri	1	1	0	0
Hafnia alvei	1	0	1	1
PMP group[b]:				
Morganella morganii	2	0	2	0
Proteus vulgaris	1	1	0	0
Total no. of Enterobacteriaceae	95	74	77	56
Others				
Acinetobacter baumannii	5	5	0	0
Pseudomonas aeruginosa	24	16	19	11
NF-GNB	2	1	1	0
Gram + bacteria	6	5	1	0

[a] KESC: *Klebsiella-Enterobacter-Serratia-Citrobacter* group (including *H. alvei*)
[b] PMP: *Proteus-Morganella-Providencia* group

CTX-M derived enzymes (n=53) were the most frequently encountered ESBL, especially in *E. coli* and *E. cloacae.* They were significantly more frequently recovered on chromID ESBL than on CTAZ (p<0.0001) (Table 2).

TEM (n=10) and SHV (n=6) were found in *E. coli*, *K. pneumoniae* and *Enterobacter* spp. They were more frequently recovered on CTAZ than on chromID ESBL (p<0.0001).

Table 2: Distribution of ESBL-producing strains (n=69) detected by medium and ESBL class

Species (no. of isolates)	Classes of enzymzes (no. of isolates)	No. of isolates recovered on: chromID ESBL	CTAZ	Both media
E. coli (38)	TEM-40 (1)	0	1	1
	TEM-52 (6)	4	6	4
	TEM-78 (2)	0	2	0
	CTX-M 1 (18)	18	11	11
	CTX-M 2 (9)	9	6	6
	CTX-M 9 (2)	2	1	1
E. cloacae (20)	CTX-M 9 (7)	7	6	6
	SHV-12 (3)	2	3	2
	CTX-M 9/SHV-12 (10)	9	10	9
K. pneumoniae (8)	CTX-M 1 (4)	4	4	4
	CTX-M 9 (1)	1	1	1
	SHV?[a] (3)	3	3	3
E. aerogenes (1)	TEM-24	1	1	1
K. oxytoca (1)	CTX-M 9	1	0	1
C. koseri (1)	CTX-M 1	1	0	1

[a] sequencing could not determine the subtype (probable presence of different subtypes)

The diagnostic performance of media was assessed by specimens, by bacterial isolates and *Enterobacteriaceae* isolates (Table 3). No significant difference was observed.

Table 3: Performance of the selective media for detection of ESBL-positive *Enterobacteriaceae* (n=69)

Medium	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Specimens (n=436)				
chromID ESBL	89.1	91.9	61.3	98.3
CTAZ	89.1	89.2	54.4	98.3
Organisms (n=137)				
chromID ESBL	89.9	33.8	57.9	76.7
CTAZ	81.2	36.8	56.6	65.8
Enterobacteriaceae (n=95)				
chromID ESBL	89.9	53.9	83.8	66.7
CTAZ	81.2	19.2	72.7	27.8

Conclusions

1. In our ICU department, chromID ESBL and CTAZ media demonstrated equivalent overall performance for detection of rectal carriage of ESBL-producing *Enterobacteriaceae*.
2. CTX-M positive isolates, which are the predominant ESBL, were more frequently recovered on chromID ESBL.
3. The main advantages of chromID ESBL were the direct identification of most *E. coli* strains and the cost-saving due to a lower number of specimens requiring identification of non-*Enterobacteriaceae* strains eventhough the cost of chromID ESBL is 4 times more than CTAZ (including preparation workload and quality control).

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