Carbapenem Resistance Expressed by Gram-negative Bacilli Isolated from a Cohort of Libyan Patients

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Abstract

Background: Carbapenem resistance among Gram-negative bacilli has emerged as a public health concern since they raise the threat of untreatable infections. Despite reports of Carbapenemase producing Gram-negative bacilli in several countries over the world, there is a lack of data about their presence in Libya. Therefore, this study was pursued to identify the presence of carbapenemase-producing Gram-negative bacilli isolated from Libyan patients.
Methods: Bacterial species were collected from hospitals and pathology laboratories in Misrata, Libya. Growth characteristics and API 20E or API 20NE biochemical testing systems were used to identify the bacterial isolates. Screening for carbapenem resistance was performed using the disk diffusion method, and minimum inhibitory concentrations (MIC) were determined using the Sensititre Gram-negative Xtra plate format (GNX2F). All strains demonstrating resistance or intermediate susceptibility to one of the four carbapenems were subjected to carbapenemase activity detection using the RAPIDEC CARBA NP test, Modified Hodge test (MHT), carbapenem inactivation methods (CIM), Carbapenemase detection kit (D70C Set) with Temocillin (TEM)30µg from MAST group and combined meropenem-Ethylenediaminetetraacetic acid (EDTA) and/or phenylboronic acid (PBA) disks.
Results and conclusion: Of the 140, 34 (24.3%) isolates were carbapenemase-producers of which 25 (73%) were *K. pneumoniae*. These findings emphasize the crucial need for accurate screening, identification and susceptibility testing to prevent further spread of nosocomial and community acquired resistance.

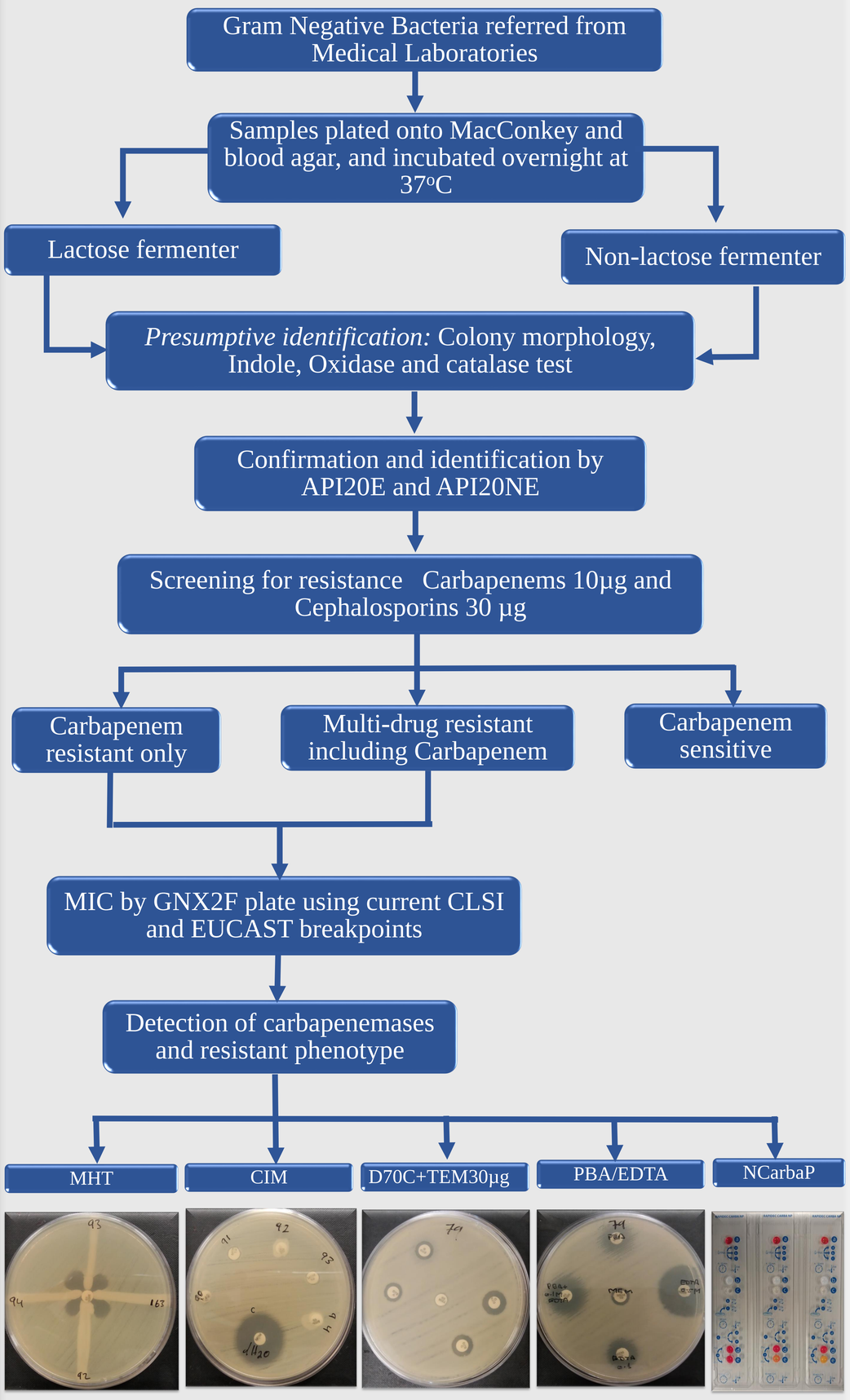
Introduction

Carbapenemases, a group of clinically significan β-lactamases capable of hydrolysing most β-lactams, including carbapenems, have emerged and spread among members of Enterobacteriaceae and other Gram-negative bacilli worldwide, leaving fewer therapeutic options and creating a public health concern. The exact occurrence of Carbapenemase-producing bacteria in healthcare settings and within the community in Libya is still uncertain.

Aim of study

The aim of this study was to obtain a better understanding of carbapenem resistant *Enterobacteriacea* (CRE) strains prevalent in Libyan patients by investigating their phenotypic characteristics and antibiograms.

Material and methods



Results

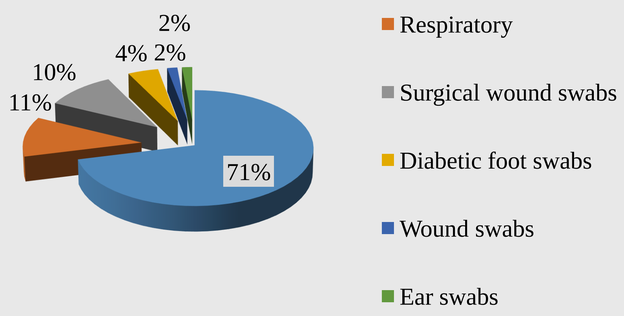


Figure 1. Specimen Source of 140 Clinical Isolates Collected from Misrata, Libya.

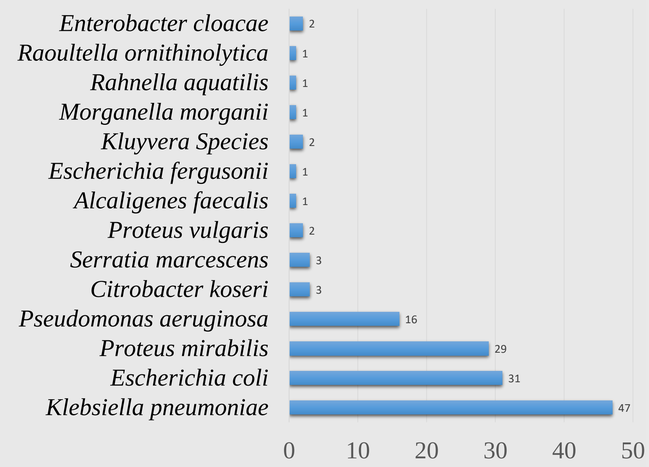


Figure 2. Bacterial species distribution of the 140 Clinical Isolates.

- *K. pneumoniae* contributed to the vast majority of carbapenem resistant Gram -negative bacilli followed by *E. coli* and *P. mirabilis.*

- Coexistence of KPC and MBL were found in five isolates (15%), with KPC being the most frequent type of β-lactamases followed by OXA-48 and MBL.

Table 1. Carbapenem resistance of Gram-negative bacilli.

% of resistance	IMI	MER	DOR	ERT	AMI	AZT	CAZ	CPM	CTX	TZP	T-C	DOX	MIN	TIG**	GEN	CIP	TOB	LEV	SXT	CO**
K. pneumoniae (n=25)	100%	88%	76%	100%	12%	88%	88%	88%	96%	100%	100%	80%	68%	04%	84%	100%	92%	76%	88%	0%
P. aeruginosa (n= 3)	33%	0 %	100%	*	33%	33%	33%	33%	*	100%	100%	*	*	*	66.5%	66.5%	66.5%	100%	*	0%
P. mirabilis (n=2)	100%	100%	100%	100%	50%	50%	50%	50%	100%	100%	100%	*	*	*	50%	50%	50%	50%	50%	*
E. coli (n=2)	0%	50 %	50%	100 %	100%	0%	100%	100%	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%	100%	0%
Cit. koseri (n=1)	100%	100%	100%	100%	0%	0%	0%	0%	100%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%
R. aquatilis (n=1)	100%	100%	100%	100%	0%	0%	0%	0%	100%	100%	100%	100%	100%	0%	0%	0%	0%	100%	100%	0%

IMI: Imipenem; MER: Meropenem; DOR; Doripenem; ERT; Ertapenem; AMI; Amikacin; AZT; Azteroname; CAZ; Ceftazidime; CPM; Cefepim; CTX Cefotaxime; TZP: Pipracillin/ tazobactam; T-C: Ticarcillin/Clavulanic acid; DOX: Doxycycline; MIN: Minocycline; TIG: Tigecycline; GEN: Gentamicin; CIP: Ciprofloxacin; TOB: Tobramycin; LEV: Levofloxacin; SXT: Trimethoprim/Sulphamethoxazole; CO: Colistin.
* Intrinsic resistance, ** EUCAST breakpoints

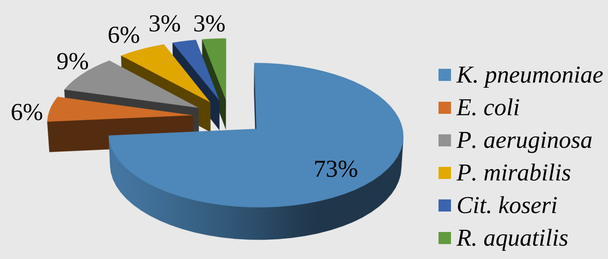


Figure 3. Distribution of 34 Carbapenem resistant Gram negative bacilli isolated.

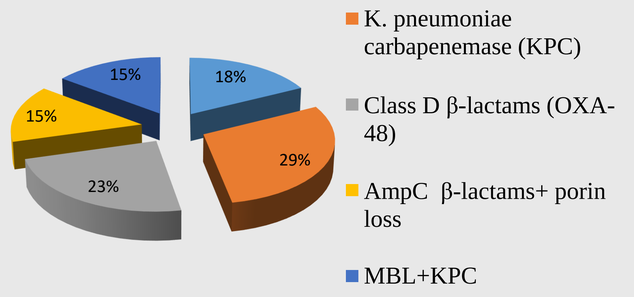


Figure 4. Distribution of various types of β-lactamases detected.

Conclusions

- The 24.3% rate of carbapenem-resistant *Enterobacteriaceae* and other Gram-negative bacilli seen in this study showed a high and worrisome trend.

- The findings of this study highlight the vital need for accurate screening and susceptibility testing to prevent further spread of nosocomial and community acquired resistance. This may be achieved through the establishment of antibiotic stewardship programmes along with firm infection control practices.

Acknowledgments

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