Colistin, Carbapenem and Cephalosporin-resistant *Klebsiella pneumoniae* reported from Misrata, Libya

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Abstract

Background: National surveillance of antimicrobial resistance has become a mandatory approach to control the spread of antimicrobial resistance and for the establishment of antibiotic treatment guidelines. In this study, clinical isolates of *K. pneumoniae* were phenotypically investigated for the presences of Colistin and beta-lactams resistance.

Methods: Clinical samples were obtained from hospitalised (n=140) and non-hospitalised patients (n= 60) in Misrata, Libya. Identification of the isolated species was achieved using VITEK 2 compact system. Screening for Carbapenem and Cephalosporin-resistance was performed using the disk diffusion method with Carbapenem (10µg) and Cephalosporin (30 µg) disks and Minimum Inhibitory Concentration (MIC) determined by VITEK 2. Colistin resistance was determined using both Sensititre Gram-negative Xtra plate format (GNX2F) and VITEK 2. Carbapenememase activity was detected using the RAPIDEC CARBA NP, Modified Hodge test, Carbapenem inactivation method, MAST Combi Carba plus kit (D73C) and Meropenem combined disk test. ESBL and AmpC production was confirmed using Sensititre ESBL confirmatory plates (ESB1F), modified double disc synergy test MDDST, MAST ESBL detection kit D67C, AmpC & ESBL detection kit D68C along with AmpC detection kit D69C.

Results and conclusion: Of the 200 clinical isolates, 85 (42.5%) were *K. pneumoniae* of which 54 (63.52%) demonstrated resistance to at least one of the Carbapenems, 16 (18.82%) were ESBL or AmpC producers and 2 (2.35%) were Carbapenem and Colistin resistant. 13 (21.25%) isolates were susceptible to all antibiotics tested except Ampicillin and Augmentin.

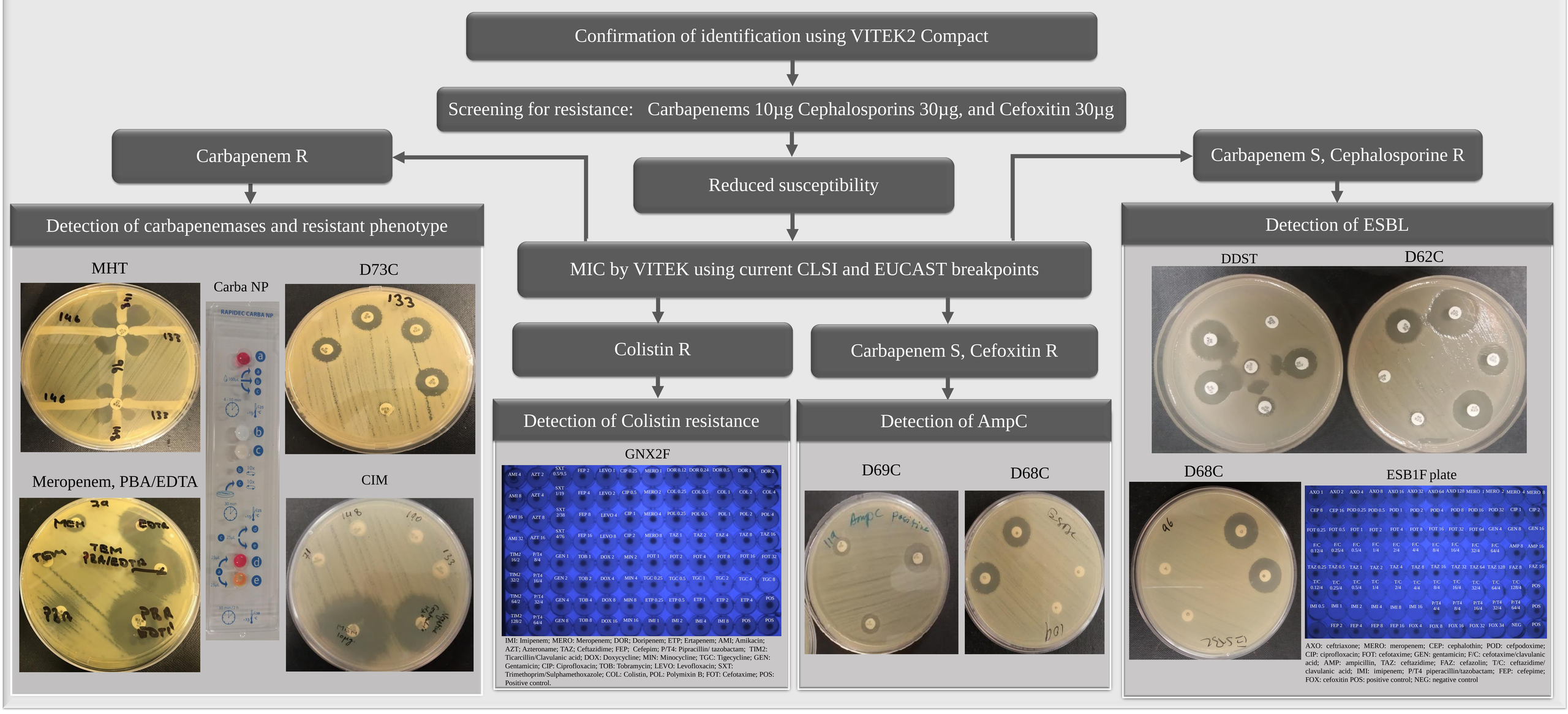
Introduction

Klebsiella pneumoniae is a significant human pathogen causing community and nosocomial infection. The use of carbapenem has increased since the spread of extended-spectrum β-lactamase (ESBL) resulting in the emergence of carbapenem resistant *K. pneumoniae* (CRKP). Due to the continued use of colistin for treatment of infections by CRKP, resistance to colistin has also been reported in several countries and become a major public health concern.

Aim of study

The aim of this study was to investigate the prevalence of carbapenem, cephalosporin and colistin resistant *K. pneumoniae* in Libyan patients from Misrata City by investigating their phenotypic characteristics and antibiograms.

Materials and Methods



Results

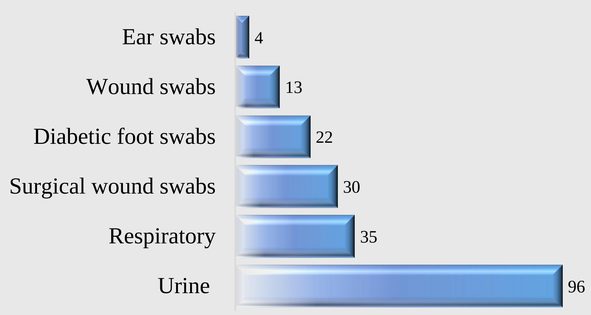


Figure 1. Specimen Source of 200 Clinical Isolates.

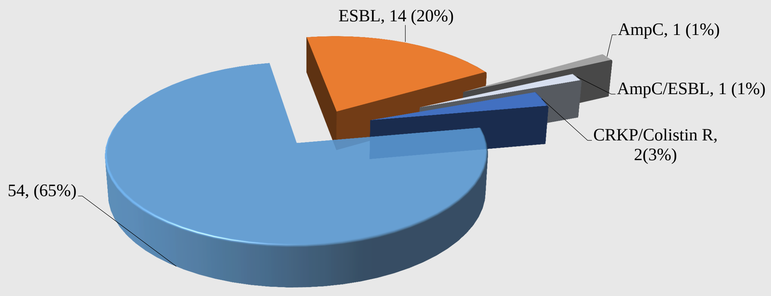


Figure 2. Distribution of Colistin and Beta-lactam resistance mechanisms

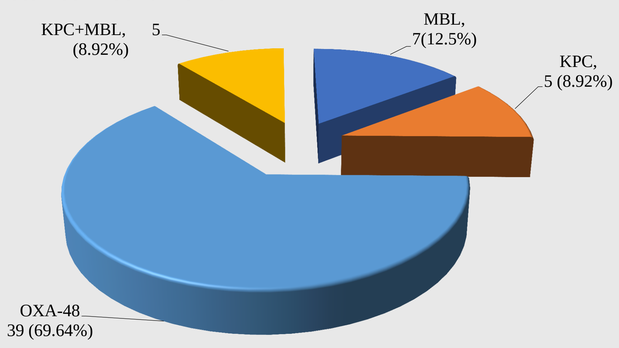


Figure 3. Distribution of various types of Carbapenemases

Table 1, Susceptibility rates of 85 *K. pneumoniae* isolates according to current CLSI and EUCAST breakpoints

Antibiotic	S n (%)	I n (%)	R n (%)
AMI	55 (64.70)	14 (6.47)	16 (18.82)
GEN	25 (29.41)	6 (7)	54 (63.52)
TOB	22 (25.88)	16 (18.82)	47(55.29)
ETP	33 (38.82)	6 (7)	46 (54.11)
MER	46 (54.11)	4 (4.70)	35 (41.17)
IMI	38 (44.70)	18 (21.17)	29 (34.11)
FEP	15 (17.64)	14 (16.47)	56 (65.88)
FOT	17 (20)	5 (5.88)	63 (74.11)
TAZ	20 (23.52)	8 (9.41)	57 (67)
FOX	27 (31.76)	2 (2.35)	56 (65.88)
CXM	13 (15.29)	0 (0)	72 (84.70)
CIP	22 (25.8)	8 (9.41)	58 (68.23)
SXT	48 (56.74)	1 (1.17)	36 (42.35)
AUG	0 (0)	0 (0)	85 (100)
AMP	0 (0)	0 (0)	85 (100)
P/T	13 (15.29)	8 (9.41)	64 (75.29)
COL**	83 (97.64)	0 (0)	2 (2.5)
TGC**	85 (100)	0 (0)	0 (0)

AMI; Amikacin, GEN: Gentamicin; TOB: Tobramycin; ETP; Ertapenem; MERO: Meropenem; IMI: Imipenem; FEP; Cefepim; FOT: Cefotaxime; TAZ; Ceftazidime; FOX: cefoxitin; CXM: cefuroxime; CIP: Ciprofloxacin; SXT: Trimethoprim/Sulphamethoxazole; AUG: augmentin; AMP: ampicillin; P/T: Piperacillin/ tazobactam; COL: Colistin ; TGC: Tigecycline. ** EUCAST breakpoints

- Coexistence of carbapenem resistance and colistin resistance was observed for the first time in Libya.
- The high rate (65.88) of carbapenem resistance was detected only in isolates obtained from in-patients, while ESBL and AmpC producers where found in both in-and out-patients.
- Among the carbapenemases detected in this study, OXA-48 was the most predominant type.
- All the isolates showed 100% susceptibility to tigecycline, and 100% resistance to ampicillin and augmentin.

Conclusion

- Establishing infection control programmes, and antibiotic therapy guidelines are urgently needed to limit the spread of these organisms.
- The result of this study calls for:
  - increased vigilance
  - accurate screening including the application of molecular techniques
  - accurate susceptibility testing
  - continuous surveillance
  - restricted use of antibiotics

Acknowledgments

We gratefully acknowledge the FIDSSA for making the conference attendance possible. We also would like to acknowledge Dr. Taher Elhobgy, Dr. Mohamed Elfagieh and the Medical Laboratory staff at Al-hekma Hospital, Misrata Central Hospital, Misrata Cancer Centre for granting us the use of their facility and helping us in collecting the clinical isolates.

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