

Research Article

Carbapenem resistant strains of *Pseudomonas aeruginosa* among patients in Minia university hospitals.



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Abstract

Background: *Pseudomonas aeruginosa* is a common cause of hospital-acquired infections. Carbapenems are β -lactam antibiotics with a wide-ranging antibacterial effect. Carbapenems are the most dependable last option for treating infections generated by multidrug-resistant pathogens. Carbapenem resistant *P. aeruginosa* (CRPA) isolates are increasingly observed. CRPA has emerged as a prominent global public health issue. **Aim of the work:** To detect the presence of carbapenem resistant *P. aeruginosa* in different wards of Minia University hospitals. **Methods:** From August 2022 to January 2023 carbapenem resistant *P. aeruginosa* was isolated from different clinical specimens received to the clinical microbiology unit, Minia University hospital. And the minimal inhibitory concentration of meropenem & imipenem were detected by VITEK-2. **Results:** 167 *P. aeruginosa* isolates were recovered. CRPA were 45 isolates (26.9%). Most of CRPA were isolated from patients of ICUs (55.8%) and the urine specimens were the highest specimen from which CRPA were isolated. **Conclusion:** high level of carbapenem resistance among *P. aeruginosa* in our medical setting.

Keywords: carbapenem-resistant, *Pseudomonas aeruginosa*, CRPA, nosocomial infection

Introduction

Pseudomonas aeruginosa (*P. aeruginosa*) is one of the most important and widely spread hospital-acquired pathogens, especially in ICUs.^[1] *P. aeruginosa* has the ability to retain resistance to almost all antimicrobial agents.^[2] This leads to the development of MDR *P. aeruginosa*^[3] & results in treatment complexities. In addition, MDR isolates of *P. aeruginosa* are accountable for outbreaks in hospitalized patients. MDR *P. aeruginosa* is a prevalent reason for healthcare-associated infections globally.^[4] Carbapenems are β -lactam antibiotics with a wide-ranging antibacterial effect.

Carbapenems are the most dependable last option for treating infections generated by multidrug-resistant pathogens.^[5] Nevertheless, the exponential growth of carbapenem-resistant *P. aeruginosa* poses a substantial peril to public

health & has emerged as a prominent global public health issue in the past ten years.^[6] The highest priority category is occupied by CRPA according to the 2017 WHO global priority list of pathogens.^[6] In the present research, its goal was to detect the prevalence of CRPA in different wards of Minia University hospitals.

Aim of the work

This research aimed to determine the presence of carbapenem-resistant *P. aeruginosa* in different wards of Minia University hospitals.

Subjects and Methods

Methods

Study design

A six-month research was carried out in the hospitals of Minia University between August 2022 – January 2023. Culture and other laboratory techniques were carried out at Minia University's

clinical microbiology unit & clinical pathology department, both under the faculty of medicine.

Isolation & identification *P. aeruginosa* isolates

The bacteria investigated were isolated from clinical specimens referred by physicians of different hospital wards to our clinical microbiology laboratory for diagnostic testing. Isolates of *P. aeruginosa* were obtained from diverse sources such as blood, respiratory system samples (sputum, endotracheal tube aspirates), urine (mid-stream urine and in-and-out catheters), miscellaneous sources (abscess, wound, tissue, & bodily fluids), as well as cerebrospinal fluid (CSF).

Automated VITEK-2 system (Biomérieux, Marcy-l'Étoile, France) was employed to identify & assess the antibiotic susceptibility of every isolate. The minimal inhibitory concentration of meropenem & imipenem were evaluated in accordance CLSI (Clinical and Laboratory Standards Institute) breakpoints.

Results

Throughout the research period, the clinical microbiology laboratory receive 4490 different specimen from different wards and ICUs of minia university hospitals. Out of them 167 *P. aeruginosa* isolates were recovered. CRPA were

45 isolates (26.9 percent) of all *P. aeruginosa* isolates.

Demographic Characteristics of Patients with CRPA:

Most CRPA isolated from male patients (n=23) (51.1%), while females infected with CRPA were 48.9% (n=22). Table (1)

Distribution of CRPA isolate according to clinical specimens:

Most of CRPA isolated from urine samples (n=20) (44.4%), then lower respiratory tract specimens (sputum, ETA) (17.8%, 8.9% respectively). Pus, surgical wound swab and blood equally accounts for 6.7% for each of CRPA isolates .central venous devices account for 4.4%. Vaginal swabs and burn wound swab account for the least portion 2.2% for each. Table (2). Figure (1).

Distribution of CRPA isolate according to hospital site:

Most of CRPA isolated from patients of ICUs (nephrology ICU 24.4%, ICU 11.1%, pediatric ICU 8.9%, neuro ICU 6.7%, neonatal ICU 4.4%). Followed by obst and gyna ward 11.1%, internal medicine ward 8.9% , neurosurgery ward 4.4%, General surgery ward 4.4% Pediatric ward 4.4% and the least hospital site was plastic surgery ward account for 2.2% of CRPA isolates ,table(3), figure (2).

Table (1): Frequency distribution of CRPA isolates according to gender:

Gender	Frequency	Percent (%)
Male	23	51.1
Female	22	48.9
Total	45	100.0

Table (2): Frequency distribution of CRPA according to clinical specimen:

Clinical specimen	Frequency	Percent (%)
Sputum	8	17.8
Endotracheal tube aspirate (ETA)	4	8.9
Urine	20	44.4
Surgical wound swab	3	6.7
Device	2	4.4
Burn wound swab	1	2.2
Vaginal swab	1	2.2
Blood	3	6.7
Pus	3	6.7
Total	45	100.0

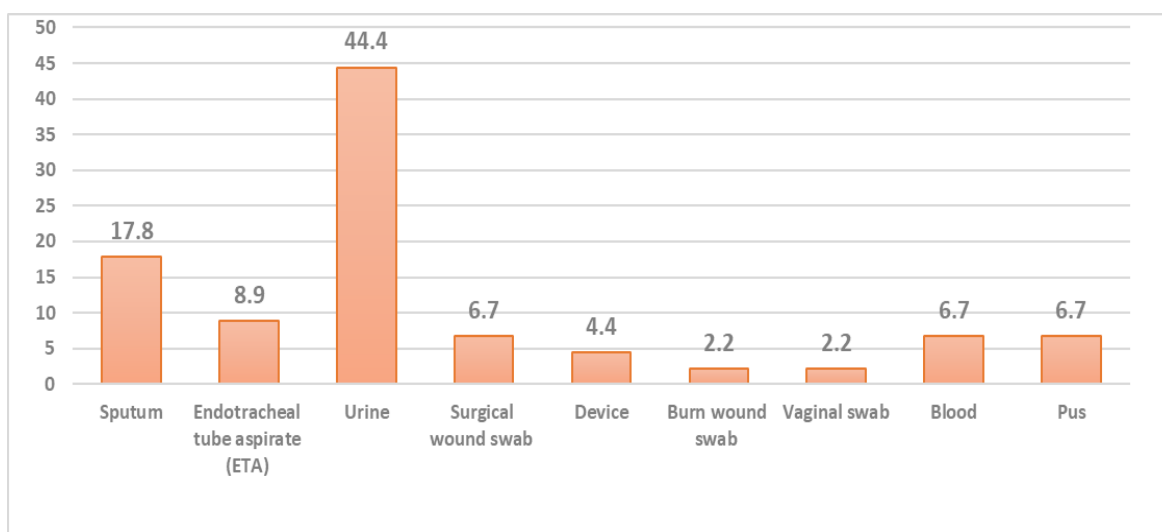


Figure (1): Distribution of CRPA according to clinical specimen

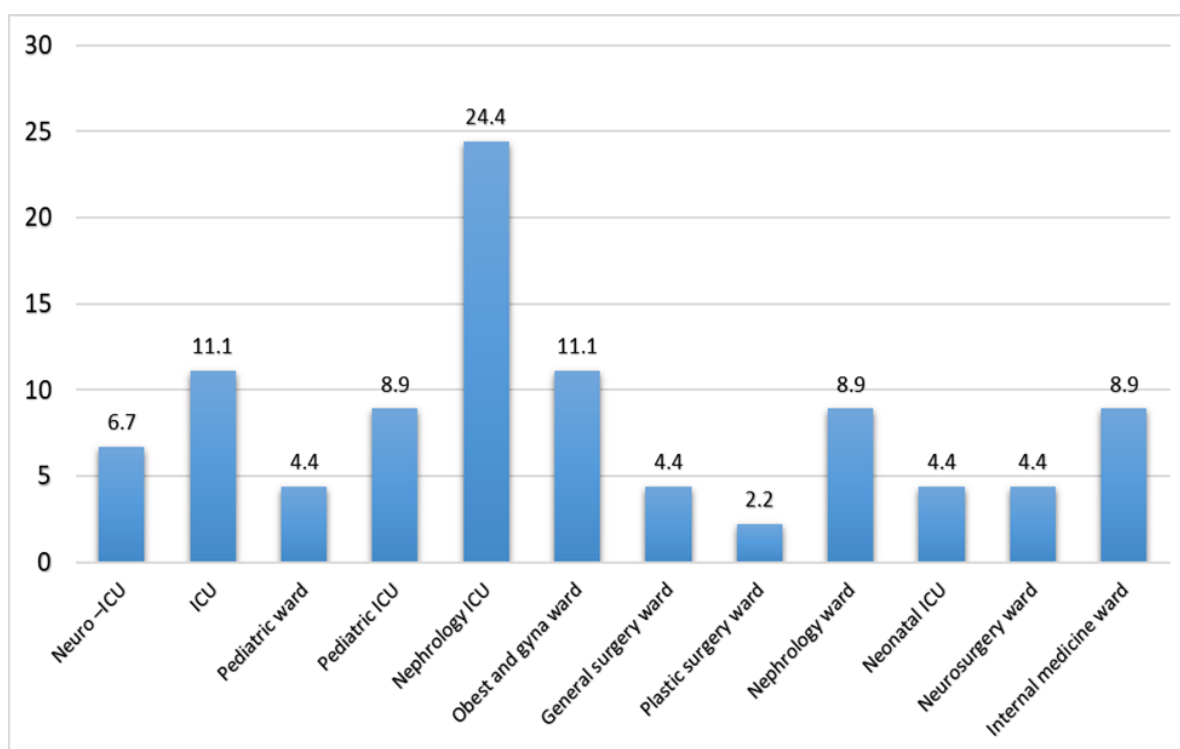


Figure (2): Distribution of CRPA according to hospital site

Discussion

P. aeruginosa strains are prevalent source of nosocomial infections globally, especially in immunocompromized patients [7]. Carbapenems are the final resort for treating several diseases caused by drug-resistant bacterial pathogens. Regrettably, there is an increasing prevalence of carbapenem-resistant *Pseudomonas aeruginosa*.

Resistance to carbapenem in *P. aeruginosa* may result via a combination of β -lactamases, carbapenemases synthesis, porin mutations, and overexpression of efflux pump systems [8]. The rise and quick dissemination of carbapenemases in *Pseudomonas* pose a huge global public health issue [9].

Our research revealed clinical isolates of *P. aeruginosa* showing resistance to carbapenem from Minia university hospital. In our study out of 167 *P. aeruginosa* isolates that recovered from admitted patients during the period from August 2022 to January 2023 45 isolates were CRPA (26.9 %) this similar to recovered with Elsayy et al., [10]. we found that CRPA isolates were more prevalent in men (51.1 percent) than in women (48.9 percent). International investigations have found that the occurrence & medication resistance of Gram-negative bacteria, as *P. aeruginosa*, are more common in men than in women [11, 12, and 13]. In this study, CRPA isolates were mostly derived from ICU patients mainly from urine specimens (44.4%) this is disagree with Hafiz, T.A who found that most of the isolate was from lower respiratory tract specimens [14]. The increase in carbapenem resistance during the past decade, particularly in poor nations, can be attributed to the inappropriate use of antimicrobial medicines. We suggest completely cleaning our hospital ICUs, adopting comprehensive antimicrobial stewardship strategies focusing on carbapenem usage, and utilizing routine infection control techniques to safeguard individuals.

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