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Afr. J. Biomed. Res. Vol. 27 (May 2024); 421- 424

Research Article

Isolation and Sensitivity Patterns of *Pseudomonas aeruginosa* from Nonclinical Samples

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ABSTRACT

The presence of pathogenic microorganisms in hospital environment possesses obvious clinical risk to patients with some obvious consequences. The current study was conducted to ascertain the prevalence of *Pseudomonas aeruginosa* in nonclinical samples in central Hospital, Agbor. A total of 25 *Pseudomonas aeruginosa* were isolated from a total of 110 nonclinical samples collected intermittently from Sinks traps, Mop heads, bed pans from four (4). The samples were inoculated on MacConkey and blood agar plates and incubated at 37 °C for 24 h. The isolates were identified by conventional microbiological tests. Antimicrobial susceptibility pattern was determined by modified Kirby-Bauer disk diffusion method. The overall prevalence of *Pseudomonas aeruginosa* was 23.8% with a range of 16.2% to 33.2% in the wards examined. The most contaminated area with *Pseudomonas aeruginosa was* sink traps (36.) %), floors (24.0%), mopheads (20.0%) while bedpans accounted for 20.0% of the isolate sources. the antibacterial susceptibility patterns of the *Pseudomonas aeruginosa* to ten (10) antibacterial agents used showed 84% susceptibility to pefloxacin, 76% to ofloxacin, while ceftriaxone and ciprofloxacin recorded 72% susceptibility respectively. 64% of the isolates were susceptible to gentamicin. The continued contamination of hospital wards with *Pseudomonas aeruginosa* highlights the necessity for robust infection control measures, ongoing monitoring and management of the hospital environment to minimize the risk of healthcare-associated infections.

Keywords: *Nosocomial Infection, Pseudomonas aeruginosa, antibacterial agents, cross infection, antimicrobial resistance,*

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Received: June 2023; Accepted: December 2023

DOI: https://doi.org/10.4314/ajbr.v27i.30

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INTRODUCTION

Pseudomonas aeruginosa is a ubiquitous Gram-negative bacterium belonging to the family Pseudomonadaceae that can survive in a wide range of environments. *P. aeruginosa* is common in natural environments and is an opportunistic pathogen for humans, causing a wide range of diseases such as urinary tract infections, burns, respiratory infections, and septicaemia amongst others, (Silby et al., (2011) , Fazeli et al., (2012) .

Pseudomonas aeruginosa infection has been identified as an acute problem in hospitals due to its inherent resistance to most antibiotic classes as well as its ability to acquire antibiotic resistance (Fuentefria et al., 2011). According to the US Centre For Disease, in 2017, multidrug-resistant *Pseudomonas aeruginosa* caused an estimated 32,600 infections among hospitalized patients and 2,700 estimated deaths in the United States.

Pseudomonas aeruginosa is a major microorganism to monitor antibiotic resistance in the clinical specimens. On the other hand, the spread of these bacterial by hospitals personnel, wet places are potential reservoir for resistance genes. It has long been known that hospital acquired infections are caused by microbes that are prevalent in the hospital environment. Unfortunately, this fact is mostly overlooked, and environmental studies in hospitals have received relatively little attention, with only a few reports available on environmental surveillance programs in hospitals. In view of the foregoing the current study was undertaken to determine the prevalence of *Pseudomonas aeruginosa* from nonclinical samples and determine their antibiogram patterns.

MATERIALS AND METHODS

Study Location: The study was conducted at Central Hospital Agbor between April to July 2021. Samples were collected from four wards namely Obstetrics and gynaecology, Male medical and Children wards of the Central Hospital Agbor. The wards were merged into three due to ongoing renovation of the hospital during the period of the study.

Sample collection and examination: Each of the equipment (Bed pans, Mophead) and area (Floor and sink traps) was swabbed. Appropriate samples were cultured in Blood agar, Chocolate agar and Cetrimide agar. The Chocolate agar was incubated under micro-aerophilic environment in a carbon dioxide extinction jar at 37ºC. Standard bacteriological methods were used to identify the colonies of *Pseudomonas aeruginosa* (King et al., 1954; Brown & Lowbury, 1965; Cowan & Steel, 1994; Balows, 2003).

Antibiotic susceptibility Antimicrobial susceptibility testing on isolates was done the following antibiotics CN, OFX performed by using Kirby Bauer disc diffusion methods as recommended by CLSI (Bauer et al., 1966; Clinical and Laboratory Standards Institute, 2019).

RESULTS

A total of 110 nonclinical samples were examined (Table 1). The overall prevalence of *Pseudomonas aeruginosa* was 23.8% with a range of 16.2% to 33.2% in the wards examined. The most contaminated area with *Pseudomonas aeruginosa was* sink traps (36.)%), floors (24.0%), mopheads (20.0%) while bedpans accounted for 20.0% of the isolate sources.

Table 2 shows the antibacterial susceptibility patterns of the *Pseudomonas aeruginosa* to antibacterial agents using disc diffusion techniques. Ten (10) different agents were used. The organism had 84% susceptibility to pefloxacin, 76% to ofloxacin, while ceftriaxone and ciprofloxacin recorded 72% susceptibility respectively. 64% of the isolates were susceptible to gentamicin.

Table 1.
Pseudomonas aeruginosa Contamination in sampling site

Sampling sites	Ward												Total		
	Male Medical			Female Medical			O & G			Children's Ward					
Bed pans	10	1	10.0	12	2	17.7	15	1	6.7	5	1	20.0	42	5	20.0
Floor	5	2	40.0	6	1	17.7	6	2	33.3	4	1	25.0	21	6	24.0
Mophead	3	1	33.3	8	1	12.5	10	1	10.0	5	2	40.0	26	5	20.0
Sink traps	7	3	42.9	4	2	33.3	6	2	33.3	4	2	50.0	21	9	36.0
Total	**25**	**7**	**28**	**32**	**6**	**18.8**	**37**	**6**	**16.2**	**18**	**6**	**33.2**	**110**	**25**	**22.7**

Table 2
Sensitivity patterns of *Pseudomonas aeruginosa* to antibiotics

S/N	OFX	PEF	CIP	CN	CAZ	AMP	TE	ERY	CHL	SXT
1.	+	+	+	R	R	R	R	R	R	R
2.	+	+	+	+	R	R	R	R	R	R
3.	+	+	R	+	R	R	R	R	R	R
4.	R	+	+	+	+	R	R	R	R	R
5.	R	R	R	R	+	R	R	R	R	R
6.	+	+	+	+	+	R	R	R	R	R
7.	+	+	+	+	R	R	R	R	R	R
8.	R	+	+	R	+	R	R	R	R	R
9.	+	R	+	+	+	R	R	R	R	R
10.	+	+	R	+	+	R	R	R	R	R
11.	+	+	R	+	+	R	R	R	R	R
12.	+	+	R	+	R	R	R	R	R	R
13.	+	+	+	R	+	R	R	R	R	R
14.	+	+	+	+	+	R	R	R	R	R
15.	+	+	+	R	+	R	R	R	R	R
16.	R	R	+	+	R	R	R	R	R	R
17.	+	+	+	R	+	R	R	R	R	R
18.	+	+	+	+	R	R	R	R	R	R
19.	+	+	+	+	+	R	R	R	R	R
20.	R	+	R	+	+	R	R	R	R	R
21.	+	+	R	R	+	R	R	R	R	R
22.	+	R	+	+	+	R	R	R	R	R
23.	R	+	R	R	+	R	R	R	R	R
24.	+	+	+	+	+	R	R	R	R	R
25.	+	+	+	R	+	R	R	R	R	R

KEY:OFX=Ofloxacin, PEF=Pefloxacin, CIP=Ciprofloxacin CAZ= Ceftriaxone, CN=Gentamycin, AMP= Ampicillin , TE=Tetracycline

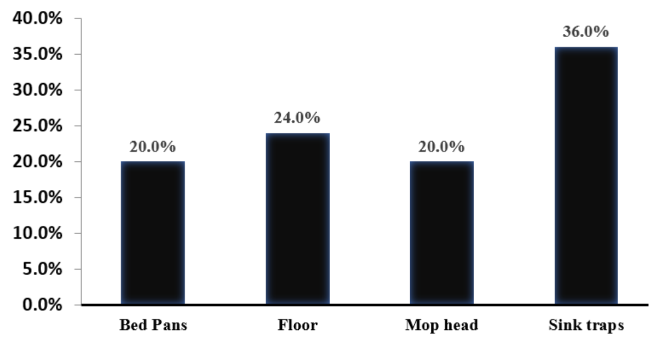

Figure.1
Cluster bar chart showing percentage isolate of *Pseudomonas aeruginosa* from non-Clinical samples

DISCUSSION

Infections due to *Pseudomonas aeruginosa* strains can be life threatening and is now an emerging public health treat due to a wide range of mechanisms for adaptation, survival, and development of resistance (Moradali et al., 2017).

In this study, Obstetrics and gynaecology ward recorded the highest prevalence amongst the ward's samples. This finding indicates that hospital wards act as reservoir of *Pseudomonas aeruginosa*. The impact of an obstetrical ward being contaminated with *Pseudomonas aeruginosa* can have serious consequences for patient health and well-being especially the posed to such a high-risk group of such as expectant mothers and new-borns.

Hospital sinks and drains can support long-term persistence of multidrug- resistant Gram-negative organisms, including *Pseudomonas aeruginosa* (Lalancette et al., 2017). Sink traps accounted for the highest number of isolated recorded.

The floor samples ranked second in the prevalence. It has been suggested act as a temporary carrier of dislodged organism from other sources such as bed sheets during bed making, wound dressings or other procedures (Rezvani Ghomi et al., 2019).

Water is considered a significant source of infection, especially in healthcare institutions where patients are more susceptible to infection (Ferranti et al., 2014; Suleyman et al., 2018). The prevalence of *Pseudomonas aeruginosa* in mop heads could be attributed to the fact that mop heads when left wet after use, provides an ideal environment for microbes to multiply . The high prevalence of this organism in mop heads and floor despite the use of disinfectants is in consistent with previous reports from studies conducted in India by Davane et al., 2014 . Isolation of *Pseudomonas aeruginosa* from bed pans is an indication of the presence of the organism in GIT and other body fluids which may predispose female to urinary tract infection if not properly used (Bekele et al., 2015).

Environmental contamination plays a role in the transmission of microorganisms that can cause infections (van Seventer & Hochberg, 2017). *Pseudomonas aeruginosa* transmission occurs through direct contact, aspiration and inhalation of water and water aerosols, and indirect transfer from moist environmental surfaces via contaminated hands(Sehulster et al., 2003; Davane, 2014).

Pseudomonas aeruginosa strains has a wide range of mechanisms for adaptation, survival, and resistance to multiple classes of antibiotics ; hence infections caused by P. aeruginosa strains can be life-threatening (Dey et al., 2019). *Pseudomonas aeruginosa* has demonstrated the ability to develop resistance to a wide range of antimicrobial agents through intrinsic or acquired mechanisms, often resulting in high levels of resistance to multiple classes of antibiotics. This has been attributed to its selective ability to prevent various antibiotic molecules from penetrating its outer membrane or to extrude them if they enter the cell (European Centre for Disease Prevention and Control, 2019; Spagnolo et al., 2021). *Pseudomonas aeruginosa* resistance to antibacterial agents and disinfectants (mops, brushes). It colonizes liquid antiseptics such as quaternary ammonium compounds (particularly cetrimide and benzalkonium), eye medications, infusion fluids, soap solutions.(Pang et al., 2019). *Pseudomonas aeruginosa* displays resistance to a variety of antibiotics, including aminoglycosides, quinolones, and β-lactams (Hancock & Speert, 2000).

In conclusion, the continued contamination of hospital wards with *Pseudomonas aeruginosa* highlights the necessity for robust infection control measures, and ongoing monitoring and management of the hospital environment to minimize the risk of healthcare-associated infections.

Acknowledgement
Our debt of gratitude to the patients the management of Central Hospital who graciously approved the study to be ccarried out at the facility.

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