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Isolation And Identification of Bacteria from The Staff Hands of Yarmouk Teaching Hospital, Baghdad, Iraq.

Running Title: Isolation and Identification of Bacteria from The Staff Hands.

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Abstract

Healthcare professionals, hospital workers, and patients regularly touch items that contain infections or serve as sources of pathogens. The aim of this study is to isolation and identification of bacteria from the hands of health care workers. 60 samples were collected from hospital employees for analysis. Cultural, biochemical, and microscopic characteristics were used to identify organisms.102 bacterial isolates were detected, 30% had mono-microbial colonies and 70% displayed poly-microbial colonies. The percentage of *Bacillus* species and *Staphylococcus aureus* was 21.7% of the bacteria specimens, while the percentage of *Pseudomonas* species, *Streptococcus* species and Methicillin-resistant *Staphylococcus aureus* 28.3, 20 and 20 %, respectively and percentage of *Escherichia coli* and *Klebsiella* species were 16.7 and 15.0% respectively. Therefore, it is concluded that develop preventative methods as well as potential treatment options.

Keywords: Pathogenic bacteria; antibiotic resistance; MRSA; Healthcare-associated infection.

1. Introduction

A wide range of microbiological organisms are prone to colonize medical staff, hospital equipment, and the environment. The infection, which can result in morbidity and mortality, has the potential to be transmitted through direct contact with infected and/or colonized individuals as well as objects (Kamala et al., 2023). [1, 2]. Every year, at least 90,000 people in the US die from nosocomial infections, which affect almost two million patients [3, 4]. The sixth most common cause of mortality in hospitals providing critical care is nosocomial infections. The prevalence of hospital acquired infections (HAI) in undeveloped countries is neither extensively documented nor reported due to a variety of factors. [5]. A thorough analysis found that the prevalence of HAIs is 7.6% in high-income countries and 10.1% in low- and middle-income countries [6]. Bacteria have been seen to survive for varied lengths of time on a number of surfaces, includes notebooks, white coats, sticky tape,

mobile phones, elevator buttons, stethoscopes and ultrasound transducers [7, 8].

The most significant step in avoiding the transfer of infections from one patient to another and the development of illnesses linked to the healthcare industry, according to research, is maintaining adequate hand cleanliness [9]. It stops the spread of germs via oral and fecal routes as well as direct contact. It is a crucial element of strategies for infection control. Nowadays, hospitals frequently substitute hand rubbing with an alcohol-based rub-in cleaner (waterless) for hand washing.

The usage of hand rubs for routine hand hygiene has scientific support. In vitro and in vivo, it is quicker and more effective from a microbiologic viewpoint, and preliminary results indicate better compliance than hand cleaning [10**].**

One of the best strategies to stop the spread of illnesses in a hospital is currently recognized as practicing good hand hygiene [12]. There should also be ongoing training in good hand hygiene procedures. An efficient educational tool to show the posters given by the World Health Organization [13]. Additionally, continuing medical education programs are crucial for all levels of healthcare professionals [14]. Therefore, the current study was carried out in order to isolates and identifies bacteria from the thumbs of health professionals at Yarmouk Teaching Hospital.

2. Materials And Methods

2. 1. Sample collection and examination of hand impressions

On nutrient agar plates, hand-thumbs of medical staff members at Yarmouk Teaching Hospital were obtained. From October 2021 to February 2022, a total of 60 samples were collected, and these media plates were incubated at 37°C for 24 hours [15]. The next day, colonies with unique morphologies were chosen and purified on MacConkey agar and Mannitol salt agar using the streak plate method. The plates were incubated at 37°C for 24 hours.

Morphological, societal, and biochemical characteristics were used to distinguish the isolated bacterial strains. Gram staining and biochemical testing were conducted. The tests were determined to suit the results apparent from the samples and as detailed in the Clinical and Laboratory Standards Institute (CLSI, 2022) [16].

2. 2. Testing for antibiotic sensitivity and isolate identification

The Kirby-Bauer disc diffusion method was used to conduct the tests to determine antibiotic sensitivity [17, 18]. Bacterial suspensions from MacConkey agar and Mannitol salt agar were diluted with sterile physiological NaCl to make the standard equivalent of 1.5×10^8 colony forming units/ml with the 0.5 McFarland standard. The suspension was cultured on Mueller–Hinton agar media using a sterile cotton bud then antibiotic disks were put on the agar surface. Incubation was carried out for 16–18 hr. at 35°C [19].

Antibiotics used in this study included Ofloxacin (OFX) 5µg, Levofloxacin (LEV) 5µg, Minocycline (MH) 30µg, Gentamycin (CN) 30µg, Ciprofloxacin (CIP) 10µg, Piperacillin/Tazobactam (TZP) 36µg, Spectinomycin (SH) 25µg. Antibiotic inhibition zones formed on the Mueller–Hinton agar medium were then measured and adjusted to the standards set by Clinical and Laboratory Standards Institute [20].

3. Results

102 bacterial isolates were detected from 60 samples. Of them, 30% (18/60) had mono-microbial colonies and 70% (42/60) displayed poly-microbial colonies.

Bacillus species, and *Staphylococcus aureus* were each isolated from 21.7% of the bacterial specimens, while *Pseudomonas* species was isolated from 28.3%. Streptococcus species and Methicillin-resistant *Staphylococcus aureus* and was found in 20% of the bacterial isolates. While 16.7% of the bacterial isolates contained *Escherichia coli* and 15.0%, a *Klebsiella* species was isolated. Additions to Less than 10% of other bacteria were isolated (Table 1).

TABLE 1: BACTERIAL ISOLATES FROM HAND-SMEAR SAMPLES

BACTERIAL ISOLATES	**(N = 60)**	**%**

Pseudomonas species	17	28.3
Bacillus species	13	21.7
Staphylococcus aureus	13	21.7
Methicillin-resistant *Staphylococcus aureus*	12	20.0
Streptococcus species	12	20.0
Escherichia coli	10	16.7
Klebsiella species	9	15.0
Citrobacter species	4	6.7
Proteus mirabilis	4	6.7
Acinetobacter species	4	6.7
Micrococcus luteus	4	6.7

Gram-positive isolates were discovered in 53.7% of cases, and in 46.3%.

TABLE 2: ISOLATION TYPES DISTRIBUTION

ISOLATION TYPE	NO = (N 102)	%
Gram-positive isolates	57	58.1
Gram-negative isolates	45	44.1

18.6% of the isolates tested positive for Ciprofloxacin resistance, 12.7% for Spectinomycin and Levofloxacin resistance, 10.8% for Ofloxacin and 8.8% for Minocycline, Piperacillin, and Tazobactam resistance. Only 4.9 % of people have Gentamycin resistance (Table 3)

TABLE 3: DISTRIBUTION OF ANTIBIOTIC SUSCEPTIBILITY PATTERN.

PATTERN OF ANTIBIOTIC SENSITIVITY		ANTIBIOTIC						
		OFLOXACIN	LEVOFLOXACIN	MINOCYCLINE	GENTAMYCIN	CIPROFLOXACIN	PIPERACILLIN AND TAZOBACTAM	SPECTINOMYCIN
Resistant	**No.**	11	13	9	5	19	9	13

	%	10.8	12.7	8.8	4.9	18.6	8.8	12.7
Intermediate susceptible	**No.**	16	25	21	25	27	23	18
	%	15.7	24.5	20.6	24.5	26.5	22.5	17.6
Susceptible	**No.**	75	64	72	72	56	70	71
	%	73.5	62.7	70.6	70.6	54.9	68.6	69.6

76.7 % of methicillin-resistant *Staphylococcus aureus* were resistance for minocycline and piperacillin. as well methicillin-resistant *Staphylococcus aureus* was found to be resistant to Ofloxacin in 100% of cases as showed in (Table 4).

TABLE 4: ISOLATE RESISTANCE RATES TO THE STUDIED ANTIBIOTIC

PERCENT (%) OF THE ISOLATES BECOME RESISTANT	**ANTIBIOTIC**						
	OFLOXACIN	**LEVOFLOXACIN**	**MINOCYCLINE**	**GENTAMYCIN**	**CIPROFLOXACIN**	**PIPERACILLIN AND TAZOBACTAM**	**SPECTINOMYCIN**
***Pseudomonas* species**	0.0	16.3	25.0	53.0	22.2	25.0	0.0
***Bacillus* species**	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Staphylococcus aureus	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Methicillin-resistant Staphylococcus aureus	100.0	43.9	76.7	52.0	34.7	76.7	72.0
***Streptococcus* species**	0.0	15.5	0.0	0.0	12.3	0.0	0.0
Escherichia coli	0.0	0.0	0.0	0.0	0.0	0.0	29.7
***Klebsiella* species**	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Citrobacter species	0.0	16.4	0.0	0.0	12.3	0.0	0.0
Proteus mirabilis	0.0	0.0	0.0	0.0	0.0	0.0	0.0
***Acinetobacter* species**	0.0	15.5	0.0	0.0	20.3	0.0	0.0
Micrococcus luteus	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Conclusion

The current results emphasize the need of studying bacterial isolates from the Hospital staff tools in order to

understand the epidemiology, the level of an infection's sensitivity to antibiotics, and ultimately to create intervention/preventative tactics in addition to available therapeutic options. In order to address the evolving resistance tendencies among hospital staff utilizing a larger sample size, more study is needed in this side.

Discussion

It was discovered that patients and people working in the hospitals carry a large number of bacteria, most of it are non-pathogenic and this is due to bacterial colonization in the hospital environment. Yet in the event of an immunocompromised host, when the contamination with these bacteria may be the cause of invasive infections, they can be severe. One of the major pathogens that cause health care-associated infections (HCAI) around the world is S. aureus. [21].

Seldom, Gram negative bacteria which can be acquired by contacting diseased patients or contaminated surfaces, can occasionally be transient flora of the hands. These include *Escherichia coli*, *Klebsiella* spp, or *Acinetobacter* species.

In the current investigation, the most widely distributed strain was *Pseudomonas* species (28.3%) Followed by *Bacillus* species and *Staphylococcus aureus* which each made up 21.7% of the bacteria isolate. However, research by Singh and Singh (2016) found that *S. aureus* was mostly isolated from 95 (47.5%) healthcare professionals and that their hands contained infections. According to research from Amravati, Maharashtra, India, pupils of different age groups (between 3 and 24 years old) enrolled in different educational institutions have possible infections on their hands. There were each of *Escherichia coli* species and *Staphylococcus* species (20%), *Klebsiella* species (10%), *Citrobacter* species and *Proteus* species (7%), *Micrococcus* species (9%), *Enterobacter* species (6%), *Enterococcus* species (4%), *Salmonella* species (2%) and Pseudomonas species (3%). The researchers later showed that washing hands reduced hand infection [22].

In the current study, Ciprofloxacin resistance rates were 18.6%, Spectinomycin and Levofloxacin resistance rates were 12.7%, Minocycline and Piperacillin and tazobactam resistance rates were 8.8%, and Ofloxacin resistance rates were 10.8%. Just 4.9% of people have Gentamycin resistance. Methicillin-resistant *Staphylococcus aureus* was found on the hands of healthcare personnel in 45% of cases [23]. Cefixime is previously known to be unsuccessful in treating *Streptococcus* and *Staphylococcus* infections [24], but the worrisome development of antibiotic resistance in additional bacterial groups is concerning.

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