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Prevalence of Acinetobacter in different clinical samples

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Abstract

From 145 samples 113 samples were diagnosed as Acinetobacter 55 isolates (83%) from burn, 32 (78%) from wounds, and 13 (92.8%), 7(46.6%), 3 (100%), 3 (50%) were from diabetic foot ulcers, tonsil, CSF and urine respectively. Biochemical tests were used for diagnosis including catalase test, oxidase test, IMVC, and TSI test) Also, identifying some isolates confirmed by using the device VITEK 2 compact, the prevalence of this bacteria was high in males at 67(59.3%) while in females at 46(40.7%). also, this bacteria was most common in patients of the age group of 50–75 years (36.1%, 64.3%,50%, 100%) in wounds, tonsils, urine, and C.S.F. swab. Data were analyzed using a chi-square test, all types of samples were non-significant (P> 0.05), (P= 1.333, 1.243, 5.571, 0.500) for burn swab, wound (bus) swab, tonsil, and urine swab respectively, so no statistically significant differences were found between the samples. The objective of this study is to evaluate the distribution of Acinetobacter isolates from various clinical samples and to correlate the distribution of Acinetobacter with sample type and patient demographic characteristics, including gender and age.

Keywords: Acinetobacter, Burn swab, Urine, C.S.F

Introduction

Acinetobacter species are classified as Gram-negative coccobacilli and are characterized as strictly aerobic, oxidase-negative organisms (1, 2). These bacteria have been identified in soil and water environments and are frequently isolated from patients experiencing diverse health complications, including but not limited to urinary tract infections, oral infections, respiratory infections, and open wounds (3, 4).

Acinetobacter bacteria are generally characterized by their low virulence potential; however, they have been observed to cause infections in immunocompromised and neutropenic patients. The majority of these infections are nosocomially transmitted and result from bacterial colonization rather than being a result of new infections. Consequently, meticulous attention must be exercised when isolating bacteria, irrespective of the presence of Acinetobacter infection has been associated with a number of risk factors, including prolonged antibiotic therapy, prolonged intensive care unit (ICU) stay, mechanical ventilation, central venous catheterization, and dialysis. These risk factors are pertinent to both colonization and actual infection (5-7).

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Although isolated cases of Acinetobacter are uncommon, most Acinetobacter infections present as outbreaks. Acinetobacter is often detected in hospitalized patients through saliva, peritoneal fluid, urinary tract specimens, respiratory secretions, and cerebrospinal fluid. This is due to the fact that Acinetobacter is a hydrophilic microorganism that tends to colonize organs that contain fluids (8, 9).

Acinetobacter bacteria are not highly virulent; however, they can acquire resistance due to the various innate mechanisms they possess (10,11).
Acinetobacter pathogenesis and virulence are influenced by a variety of technological factors. Of particular interest is the role of lipopolysaccharide (LPS) or lipopolysaccharide oligosaccharide (LOS) in the outer membranes of these bacteria (12,13). The modifications to these structures have been shown to confer antibiotic resistance and increased resistance to desiccation (14,15). Furthermore, the presence of capsules in Acinetobacter species has been demonstrated to confer protection against complement-mediated killing (16). The pellicles that Acinetobacter possesses on a surface contribute to its trembling motility, adhesion to environmental surfaces, and biofilm formation (15).

A. baumannii has been classified as an important opportunistic pathogen. It is prevalent in aquatic environments and has been isolated in high numbers from nasopharyngeal and respiratory secretions of infected individuals. The incidence of infection is high among immunocompromised individuals, especially those who have undergone prolonged hospitalization (17-19).

While generally considered sensitive to most antibiotics, *A. baumannii* has demonstrated resistance to most first-line antibiotics, a development that has raised concerns about the efficacy of therapeutic options for treating infections caused by this pathogen (20). Furthermore, *A. baumannii* has been observed to form biofilms on various surfaces, including non-living materials such as glass and instruments commonly found in intensive care units, as well as on living surfaces, including epithelial cells, suggesting a versatile and adaptable biofilm formation capacity (21, 22).
This study aims to determine the extent of Acinetobacter bacterial colonization from different clinical sources and different age groups

materials and methods:

isolation of the bacteria:

One hundred and forty-five (145) samples including swabs from patients with burns, wounds, and diabetic foot ulcers, as well as tonsils, cerebrospinal fluid samples, and urine samples, were collected from patients of Mosul hospitals including Mosul Teaching Hospital, Ibn Sina Hospital, and Mosul Specialized Burns Hospital For the period beginning in August 2024 to December 2024. The samples were collected and subsequently inoculated on Acinetobacter agar; a selective medium designed for the cultivation of these bacteria. In addition, blood agar and MacConkey agar were utilized as supplementary media. All samples were then subjected to a 24-hour incubation period at a temperature of 37°C. Following this incubation, the isolated samples were meticulously examined for various physical characteristics, including size, color, pigmentation, shape, and the presence of hemolytic activity.

Collection of Specimens:

1- Wound and burn swab:

Wound and pus specimens were collected in an aseptic manner using sterile cotton swabs dipped in normal saline, as described by Levine (23,24). All wound and burn specimens were labeled and transported to the microbiology laboratory within 30 minutes by placing the swab into the sterile test tubes containing 0.5 ml of normal saline solution.

2-Urine:

Patients with suspected urinary tract infections (UTIs) who did not undergo catheterization were instructed to collect 10 ml of urine samples uncontaminated by urinary tract infection using a sterile wide-mouth vial. The same amount of urine

samples was then transferred to a sterile vial after the catheter outlet of the catheterized patients was cleaned. The collected urine sample was then transferred to the microbiology laboratory for immediate analysis, specifically for blood and MacConkey agar plates.

3- Diabetic Foot ulcer:

Samples were obtained from the deep part of the ulcer using two sterile swabs moistened with sterile glucose broth medium, and the samples were collected with a constant circular motion. Thereafter, the collected samples were transferred to the microbiology laboratory for further analysis.

4- Tonsils swab:

Samples were collected in an aseptic manner using a sterile cotton swab. The samples were then assigned a number and transported to the microbiology laboratory.

5- C.S.F swab:

CSF specimens were collected by lumbar puncture under the supervision of a physician and subsequently transferred to the Microbiology Laboratory within 30 minutes for analysis.

Identification of bacteria:

As stated in Burji's guide, the bacterial isolates were identified through the implementation of biochemical tests and Gram stains. which included (the catalase test, oxidase test, IMVC, and TSI test). The identification of some isolates was also confirmed by using the device VITEK 2 compact.

Data analysis:

The statistical analysis was conducted using SPSS 13.0 for Windows NT (SPSS Inc., Chicago, IL, USA), which facilitated the calculation of descriptive statistics for all study variables. Discrete variables were expressed as numerical values, with percentages being utilized to quantify the data. The statistical significance of the observed data was determined by performing the chi-square test, the chi-square test with Yates correction, and Fisher's exact test, as appropriate, to ensure the robustness of the statistical analysis. A p-value of less than 0.05 was considered statistically significant.

Results and Discussion:

In this study, the number of samples collected was 145 samples and (113) isolates were diagnosed as Acinetobacter, 55 isolates (83%) from burns, 32 isolates (78%) from wounds, 13 isolates (92.8%) from diabetic foot ulcers, in addition to 7 isolates (46.6%), 3 isolates (50%) and 3 isolates (100%) from tonsil swabs, urine and cerebrospinal fluid, respectively, as shown in Table (1).

Table (1) shows that 83% of isolation was from the burn which disagreed with the study of (25).

Severe burn patients demonstrate heightened vulnerability to infection due to the exposure of underlying raw tissue, the presence of protein-rich exudates, and other host defense mechanisms (26). The primary etiologies of nosocomial infections in burn units encompass bed linens, mattresses, dressing materials, and ancillary equipment utilized in patient care. Ineffective isolation of infected patients, inappropriate use of antibiotics, and other contributing factors play a pivotal role in the development of nosocomial infections (27).

78% percent of the isolates from wounds were not in agreement with the findings of 28 and 29, yet they agreed with the study of 25, which found that 75% percent of its isolates were from wounds. The increase of Acinetobacter in wounds is attributable to its capacity for biofilm formation in the skin and soft tissue infections, as well as in occlusive dressings (4). The isolation of Acinetobacter bacteria from urine also aligns with the findings of another study (30), with a consistent percentage of isolation.

However, the Acinetobacter bacteria isolated from the CSF exhibited 100% agreement with the results of studies (31) and (32). The majority of Acinetobacter bacteria isolates from the CSF were attributed to external contamination. The results demonstrated that Acinetobacter bacteria in the CSF of clinical importance were frequently obtained from patients with a previous CNS infection, as well as from patients in intensive care units, or from those

who underwent neurosurgical procedures or were exposed to antibiotics. The prevalence of diabetic foot ulcers was found to be 92.8%, which was in agreement with the results of the study reported in (33).

The occurrence of diabetic foot ulcers is frequently associated with peripheral sensory neuropathy, foot deformities, and trauma, with peripheral arterial disease and infection being complicating factors that hinder the healing process. These ulcers are frequently polymicrobial, with the presence of both Gram-negative and Gram-positive organisms being observed (34,35).

The discrepancy in proportions observed when isolating Acinetobacter bacteria may be attributable to variations in the type, quantity, and timing of sample collection (36-38).

Data analysis

From 145 clinical samples, 113 isolates were diagnosed as Acinetobacter spp. The infection with Acinetobacter was high in males at 67(59.2%) while in females at 46(40.7%), this is similar to the study of (39,40), in which this bacteria was found in (males) at (67.5%) and (77.4%) respectively, but contrast with those of (42,43) The prevalence was observed to be higher among females (54.20%). This discrepancy could be attributed to the elevated rate of hospital visits observed among the female population.

In some research, the prevalence of Acinetobacter seems to be greater in males possibly due to seeking healthcare more often than females, and are more often affected by cardiovascular disease (43-45).

The isolates were most commonly found in the age group of 50–75 years (36.1%, 64.3%,50%, 100%) in wounds, Tonsils, urine, and C.S.F, followed by the age group of 30–50 years as (72.7%) in diabetic foot ulcer and age group of 10–30 years as (45.5%) in burn swab. as shown in table (2), so the infection with this bacteria is most common in patients of the older age group and this agree with study of (46-48), that their isolates of Acinetobacter were in patients of age group over 50 years. This phenomenon may be attributable to a compromised immune system and the concomitant chronic diseases that are prevalent in these age groups (49,50).

The application of the chi-square test to the data analysis demonstrated that there were no statistically significant differences between the samples of uninfected and infected patients, as illustrated in Table 3. These findings were consistent with the conclusions of the study by (51-53), which reported significant differences between the group not infected with Acinetobacter and the group infected with Acinetobacter in wound samples. However, the remaining samples did not show any statistical significance.

Table (1) Proportions of Acinetobacter bacteria isolated from different clinical sources.

n	Type of sample	Number of samples	Number of Acinetobacter isolation	Percentage of isolation ratio to total number of samples	The number and percentage depend on gender		Percentage depending on the type of samples
					M	F	
1	Burn swab	66	54	37.9	25 (46.2)	29 (53.7)	(81.8)
2	Wound swab	41	31	21.3	21 (67.7)	10 (32.2)	(75.6)
3	Tonsils swab	15	10	6.8	7 (70)	3 (30)	(66.6)
4	Urine	6	3	2	2 (66.6)	1 (33.3)	(50)
5	C.S.F	3	3	2	1 (33.3)	2 (66.6)	(100)
6	Diabetic foot Ulcer	14	12	8.2	11 (84.6)	1 (7.6)	(85.7)
Total number		145	113	77.9	67 (59.2)	46 (40.7)	(100)

Table (2) The percentage of Acinetobacter depending on gender & age

Burn								
No.	Age	Number	Frequency	Percent%	Cumulative %	Mean Rank	Gender	Infected with *Acinetobacter*
1	0-10	19	19	28.8	28.8	32.95	(M 7) (F 12)	M infected (6) M non infected (1) F infected (9) F non infected (3)
2	10-30	30	30	45.5	74.2	34.80	(M 5) (F 25)	M infected (5) F infected (17) F non infected (8)
3	30-50	7	7	10.6	84.8	35.43	(M 5) (F 2)	M infected (5) F infected (2)
4	50-75	10	10	15.2	100.0	29.30	(M 9) (F 1)	M infected (9) F infected (1)
Wound								
No.	Age	Number	Frequency	Percent%	Cumulative %	Mean Rank	Gender	Infected with *Acinetobacter*
1	0-10	5	5	13.9	13.9	17.60	(M 5)	M infected (4) M non infected (1)
2	10-30	7	7	19.4	33.3	16.57	(M 5) (F 2)	M infected(4) M non infected (1) F infected (2)
3	30-50	11	11	30.6	63.9	20.55	(M 9) (F 3)	M infected (7) M non infected (2) F infected (1) F non infected (2)
4	50-75	16	13	36.1	100.0	18.15	(M 8) (F 8)	M infected (6) M non infected (2) F infected (7) F non infected (1)
Tonsil's								
No.	Age	Number	Frequency	Percent%	Cumulative %	Mean Rank	Gender	Infected with *Acinetobacter*
1	0-10	1	1	7.1	7.1	11.00	(M 1)	M non infected (1)
2	10-30	1	1	7.1	33.3	4.00	(F 1)	F infected (1)
3	30-50	11	3	21.4	35.7	11.00	(F 3)	F non infected (3)
4	50-75	9	9	64.3	100	6.33	(M 7) (F 3)	M infected (6) M non infected (1) F infected (2) F non infected (1)
Urine								
No.	Age	Number	Frequency	Percent%	Cumulative %	Mean Rank	Gender	Infected with *Acinetobacter*
1	10-30	1	1	16.7	16.7	1.50	(F 1)	F infected (1)
2	30-50	2	2	33.3	50.0	2.25	(M 1))F 1)	M infected (1) F non infected (1)
3	50-75	3	3	50.0	100	---	(M 2) (F 1)	M infected (1) M non infected (1) F non infected (1)
CSF								
No.	Age	Number	Frequency	Percent%	Cumulative %	Mean Rank	Gender	Infected with *Acinetobacter*
3	50-75	3	3	100	100	---	(M 1) (F 2)	M infected (1) F infected (2)
Diabetic Foot ulcers								
No.	Age	Number	Frequency	Percent%	Cumulative %	Mean Rank	Gender	Infected with *Acinetobacter*
1	30-50	4	8	72.7	72.7	6.88	(M 4)	M infected (3) M non infected (1)
2	50-75	7	3	27.3	100.0	5.50	(M 8) (F 1)	M infected (8) F infected (1)

Table (3) data analysis using chi-square test

Frequency of infection					Chi-Square
Type of Samples		Frequency	Percent%	Cumulative %	
Burn	Infect	51	77.3	77.3	1.333
	Non-infect	15	22.7	100.0	
	Total	66	100.0		
Pus	Infect	27	75.0	75.0	1.243
	Non-infect	9	25.0	100.0	
	Total	36	100.0		
Tonsil's	Infect	7	50.0	50.0	5.571
	Non-infect	7	50.0	100.0	
	Total	14	100.0		
Urine	Infect	3	50.0	50.0	0.500
	Non-infect	3	50.0	100.0	
	Total	6	100.0		
CSF	Infect	3	100.0	100.0	---
	Total	3	100.0		
Foot ulcers	Infect	10	90.9	90.9	---
	Non-infect	1	9.1	100.0	
	Total	11	100.0		

Conclusion:

The present study found a higher prevalence of Acinetobacter bacteria among males. Moreover, a higher proportion of Acinetobacter isolates was observed in older age groups. However, statistical analysis revealed no significant differences between different samples. Therefore, implementation of continuous surveillance and integration of infection prevention and control programs is essential to avoid the spread of these pathogens within healthcare facilities.

Ethical Statement:

Consent was taken from the administrator of the hospitals from which the samples were taken, in addition to the consent of the patients lying in these hospitals, who expressed their willingness to participate in this study.

Conflict of interest: NIL

Funding: NIL

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