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Antibiotic susceptibility patterns of Staphylococcus aureus isolated from pregnant women with urinary tract infections

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ABSTRACT

Introduction: Pregnancy-related urinary tract infections (UTIs) are prevalent in pregnant women, and these infections vary from lower to upper UTIs. Staphylococcus aureus is a gram-positive, cocci grape-shaped, naturally occurring bacterium that can cause infections, which are increasingly seen among pregnant ladies. Adverse effects of UTI treatment in both pregnant mother and the embryo represent the biggest challenge.

Methods: We analyzed 189 urine samples collected from pregnant women who had UTIs. These samples were used to isolate and identify S. aureus. The disc diffusion method was used to test the action of antibiotics against these bacteria.

Results: The number and percent of S. aureus isolates were equal to 27 and 14.286%, respectively. The susceptibility pattern of antibiotics against these bacteria showed 100% activity for nitrofurantoin, amikacin, and imipenem, 96.296% for chloramphenicol and vancomycin, and no activity (0%) for erythromycin and ceftazidime.

Keywords: *antibiotics; pregnant women; Staphylococcus aureus; urinary tract infection.*

INTRODUCTION

The infections of urinary tract are more prevalent in pregnant women due to increased sexual activity, as well as transmission of pathogenic bacteria from the digestive tract to the urinary tract through the closing and opening of the anus and urethra. Compared to men, women are extra disposed to urinary tract infections (UTIs),1,2 due to shorter urethra, lack of prostate discharge, pregnancy, and based on the grade of fecal flora contamination of the urinary tract.3 UTIs during pregnancy range from lower UTI (acute cystitis) to the upper UTI (acute pyelonephritis).4 Urethral tract infections are a common health issue during pregnancy.5 Asymptomatic bacteriuria is found in around 20–40% of pregnant women, and this must be detected and treated.6,7 In hospitalized patients, UTIs are the most prevalent infection besides the second largest bacteremia.8 There are several factors which cause an increase in UTIs. A weak socioeconomic status is represented as the main risk factor,9 while other factors include, high parity, age, history of repeated UTIs, poor personal hygiene, anatomic or abnormal functions of the urinary tract, elevated sexual activities, and diabetes mellitus.10 Staphylococcus aureus is gram-positive bacterium, with cocci cells and appear in grape shape. These bacteria can cause nosocomial infections that can lead to bacteremia.11 Infections due to S. aureus are found increasingly in pregnant women.12 These bacteria have been discovered to invade the vaginal tracts of roughly 4–22% of pregnant women.13,14 The most prevalent bacterial variety that causes infections in individuals without any typical risk factors is methicillin-resistant S. aureus (MRSA).15,16 The rectovaginal colonization of MRSA has been found to increase from 0.5 to 10%.13,14 Treatment for UTIs is essential for a woman to have a healthy pregnancy and childbirth, which is a goal of the Safe Motherhood Initiative.

MATERIAL AND METHODS

Samples

This study was conducted at a specialized hospital in Babylon Province, Iraq, from January 2019 to 2020. Urine samples of 189 pregnant women were collected in 10 ml sterile containers, which were used for the isolation and identification of S. aureus and to study their antibiotic susceptibility pattern of these bacteria.

Identification of Staphylococcus aureus

Urine samples of pregnant women collected in 10 ml sterile containers were sent to the hospital lab for detection of S. aureus through biochemical tests (Table 1).

TABLE 1. Biochemical identification of Staphylococcus aureus.

Bacterial species	Biochemical test
Staphylococcus aureus	Api Staph
	Catalase Positive Urease Negative

Detection of antibiotics susceptibility against Staphylococcus aureus

The analysis of antibiotic activity pattern against S. aureus, isolated from the urine samples of pregnant women with UTIs, was carried out on Mueller–Hinton agar medium by using 14 types of antibiotics. S. aureus was incubated with the antibiotic types on the agar plate for 24 h, and the size of the inhibition zones which were formed were measured using a special tool.

RESULTS

Urine samples of 189 pregnant women with UTIs were collected, and these samples were used for the isolation and identification of S. aureus, and for testing the susceptibility of drug against these bacteria. Table 2 shows the demographic characteristics of the pregnant women with UTIs. Married women in the age category of 40–44 were more mores susceptible to UTIs. Most of these women were symptomatic and had a history of the infection.

The total number of urine samples was 189, and the number and percentage of S. aureus isolated from these samples were 27 and 14.285%, respectively (Table 3). The antibiotics nitrofurantoin, amikacin, and imipenem had an activity percent equal to 100%, and chloramphenicol and vancomycin had an activity percent of 96.296%, while erythromycin and ceftazidime had no activity against the bacteria (Table 4).

TABLE 2. Prevalence of urinary tract infections (UTIs) and demographic characteristic of the study population (N = 189).

No.	Age category	Negative N(%)	Positive N(%)
1.	20–24	45(27.777)	3(11.111)
2.	25–29	32(19.753)	5(18.518)
3.	30–24	38(23.456)	4(14.814)
4.	35–39	26(16.049)	6(22.222)
5.	40–44	21(12.963)	9(33.333)
	Marital status		
1.	Married	60(37.037)	19(70.370)
2.	Unmarried	102(62.963)	8(29.629)
	UTI symptoms		
1.	Symptomatic	15(9.259)	21(77.777)
2.	Asymptomatic	147(90.740)	6(22.222)
	History of UTI		
1.	Yes	21(12.963)	17(62.963)
2.	No	141(87.037)	10(37.037)
1.	Total	162(85.714)	27(14.285)

TABLE 3. Number and percent of Staphylococcus aureus samples.

No.	Samples	N(%)
1.	Positive	27(14.285)
2.	Negative	162(85.714)
3.	Total	189(99.999)

TABLE 4. Antibiotic activity against Staphylococcus aureus.

Staphylococcus aureus		
No.	Antibiotic	N(%)
1	Chloramphenicol	26(96.296)
2	Vancomycin	26(96.296)
3	Tetracycline	22(81.481)
4	Gentamycin	18(66.666)
5	Nitrofurantoin	27(100)
6	Penicillin	5(18.518)
7	Amikacin	27(100)
8	Clindamycin	11(40.740)
9	Ciprofloxacin	14(51.851)
10	Imipenem	27(100)
11	Oxacillin	25(92.592)
12	Cefoxitin	24(88.888)
13	Erythromycin	0(0)
14	Ceftazidime	0(0)

DISCUSSION

In this study, 14.285% of the pregnant women who participated reported positive results to UTIs. The study by Gessese et al. found 18.7% to be infected, while the study by Alemu et al. reported 10.4% positive cases.1 The percentage of S. aureus isolates was equal to 14.285% in the current study, while the study by Alemu et al. detected 10% bacterial presence in isolates of pregnant women.1 The study by Gessese et al. demonstrated 14.3% S. aureus in pregnant women.17 Mousa and Hussein in there study found that these bacteria were related to UTIs in pregnant women.18 Several studies have demonstrated the increase in S. aureus infections among pregnant women.19–20 Our study revealed that women in the age category of 40–44 were mostly infected (33.33%), while those under the 20–24 years category were less infected (11.111%). Our findings were not in agreement with that of Gessese et al. who reported the infection rates at 9.3, 8, and 1.3% for the age categories 15–24, 25–34, and 35–44, respectively.

17 Our study also showed that married women were more susceptible to UTIs, and most of these women showed symptoms and had a history of the infection. Women who had a history of UTI were at greater risk of the infection than those who did not. These findings were verified by a research undertaken in Pakistan.21 The presence of strains resistant to antimicrobials and the failure of drugs to destroy the bacteria contribute to recurrent infections (relapse), the major reasons for the spread of the disease among pregnant women with a history of UTI.22 The study results are subject to variations due to the differences in the methodology adopted, environmental conditions, and populations under study such as food habits, standard of personal hygiene, and food habits.23 This study showed 100% activity for nitrofurantoin, amikacin, and imipenem, 96.29% for chloramphenicol and vancomycin, and no activity for erythromycin and ceftazidime against S. aureus. Other antibiotics showed varied activity percentages.

The study by Gessese et al. revealed high resistance levels of S. aureus against ampicillin (75%) and ceftriaxone (63%), respectively, and low resistance levels against norfloxacin, ciprofloxacin, and amoxicillin–clavulanic acid,17 and these findings were in agreement with that of the previous studies conducted in Ethiopia,1,24–26 Ghana,27 Nigeria,28 and Tanzania.29,30 The study by Alemu et al. found that the antimicrobial sensitivity patterns of S. aureus against ampicillin, amoxicillin, ceftriaxone, chloramphenicol, ciprofloxacin, gentamicin, norfloxacin, co-trimoxazole, tetracycline, and amoxicillin + clavulanic acid antibiotics were equal to 25, 50, 100, 50, 75, 100, 50, 50, 25, and 100% respectively.1 The antimicrobial resistance in the urinary tract, it is known that pathogens are increasing worldwide, especially for commonly used antibiotics.31 Patterns are also important. Antibiotic resistance can change over short periods of time in different pathogenic organisms depending on their location, isolation, and environmental factors.32 There is significant variability in the pattern of antibiotic sensitivity against these pathogenic bacteria, and this may be related to the antibiotic manufacturer purchasing without an appropriate prescription, or a prescription without laboratory guidance, misuse, and indiscriminate use, and area of study, type of bacteria, and methods of resistance.33

CONCLUSIONS

Urinary tract infections are prevalent in the pregnant women, and these infections vary from lower to upper UTIs. There has been an increase in these types of infections due to S. aureus in pregnant women. The susceptibility pattern of antibiotics showed that Nitrofurantoin, Amikacin, and Imipenem had full higher activity, Chloramphenicol and Vancomycin had a moderate-higher activity, and Erythromycin and Ceftazidime had no activity against this bacteria.

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CONFLICT OF INTEREST

The authors declare that there are no potential conflicts of interest with respect to research, authorship, and/or publication of this article.

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