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Original Research Article

The Carriage of Methicillin-Resistant *Staphylococcus aureus* amongst Pregnant Women Attending Antenatal Clinic at a Tertiary Hospital, South-South Nigeria

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Abstract: Pregnant mothers are exposed to several infections because of their reduced immunity. Infections caused by *Staphylococcus aureus* among postpartum women and babies are increasing, and a rise in methicillin-resistant *Staphylococcus aureus* may have fueled this increase. The study was designed to investigate the carriage and resistance pattern of Methicillin-resistant *Staphylococcus aureus* among pregnant women attending the ante-natal clinic at the Niger Delta University Teaching Hospital, Okolobiri. Fifty urine samples were screened for *Staphylococcus aureus* on mannitol salt agar. Positive samples were then subjected to antibiotic sensitivity testing using the disc diffusion method, and resistance to Ceftriaxone was considered methicillin resistance. Results showed that 20 (40%) of the urine samples yielded growth of *Staphylococcus aureus*, 11 (73%) were resistant to Ceftriaxone, and over 70% of the MRSA isolates were multi-drug resistant. Methicillin-resistant Staphylococcus aureus colonisation in pregnant women has dire consequences, and a surveillance system for antimicrobial resistance surveillance system is recommended.

Keywords: Antibiotic resistance, Methicillin Resistant *Staphylococcus aureus*, prevalence, pregnant women.

INTRODUCTION

The gram-positive coccoid bacterium *Staphylococcus aureus* is a common human opportunistic pathogen and colonises about 20–40% of the population. Diseases caused by *Staphylococcus aureus* range from mild skin infections, asymptomatic to soft tissue infections and even life-threatening systemic conditions (Kaplan, 2005).

Treatment of *S. aureus* infections before the 1950s involved using β-lactam antibiotics, but some strains developed resistance-producing the enzyme β-lactamase, which inactivates β-lactam. Penicillin derivatives resistant to the enzyme β-lactamase were synthesised, and one such was methicillin, but unfortunately, methicillin-resistant S. aureus (MRSA) strains were soon isolated (Stapleton *et al*., 2002; Nourollahpour *et al*., 2022).

Globally, MRSA accounts for nearly 40% of all *S. aureus* isolates and is related to more severe clinical outcomes than methicillin-sensitive *S. aureus* (MSSA). This causes extended hospital stays and increased hospital and treatment costs (Garoy *et al*., 2019).

Methicillin-resistant *Staphylococcus aureus* infections are highly challenging to treat and occasionally have serious consequences, especially for pregnant women and other immune-compromised persons. The bacteria have become a progressively significant pathogen which can result in morbidity for both mothers and their newborns (Parriott *et al*., 2013).

MRSA in pregnant women contributes to development of life-threatening skin and soft tissue infections and the risks of mother-to-child transmission. MRSA can increase birth complications for both mothers and infants among obstetrical patients. This

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study was designed to determine the carriage of MRSA among pregnant women attending an antenatal clinic at a Teaching hospital in Southern Nigeria.

MATERIALS AND METHOD

Study area and ethical clearance

The study was conducted at Niger Delta University Teaching Hospital (NDUTH) in Yenagoa Local Government Area of Bayelsa State. Yenagoa is geographically located within latitude 4°15'North, 5°23'South and longitude 5°22'West and 6°45'East. We got ethical clearance from the Ethical Committee of Niger Delta University Teaching Hospital Okolobiri, Yenagoa Local Government Area, Bayelsa State, and oral consent from each pregnant woman before participating in the study.

Sample size and population

Using Taro Yamane's method for sample size calculation, midstream urine was collected with sterile universal containers from 50 pregnant women attending the Niger Delta University, Yenago, Nigeria, antenatal clinic between February 2023 and March 2023.

Sample Analysis

The urine samples were streaked first on blood, and Mac Conkey agar and gram staining was carried out on the Staphylococcus spp isolated. The gram-positive isolates were then cultured on sterile Chromogenic MRSA Screening Agar (Mannitol salt agar. Oxoid), a selective medium to isolate *Staphylococcus aureus* and incubated for 24 hours aerobically at 37°C. The bacterial isolates were then subcultured on nutrient agar plates to obtain a pure culture. The bacterial cultures from the nutrient agar were used for antibiotic susceptibility testing.

Antibiotic susceptibility

The inhibition zones were measured, and the isolates were categorised as resistant, intermediate, and sensitive based on the standard interpretative chart of the BSAC Guide to Sensitivity Testing (Andrew, 2009). The antibiotics used were Gentamycin, Ofloxacin, Erythromycin, Carbapenem, Augmentin, Levofloxacin, Ciprofloxacin 30 µg, Azithromycin, Imipenem, Ceftriaxone, Ofloxacin, Cefepime. Resistant to Ceftriaxone was considered methicillin resistance.

RESULTS

Table 1: Demographic data and distribution of *Staphylococcus aureus*

Age Ranges	Number of Pregnant Women	Percentage Ranges (%)
16-20 years	5	10%
21-25 years	5	10%
26-30 years	12	24%
31-35 years	14	28%
36-40 years	11	22%
41-45 years	3	6%
TOTAL	**50**	**100%**

Staphylococcus isolation increased with age, as shown in Table 1, with the age group 31-35 having the highest frequency, followed by the 25-30 years margin but decreasing as the women aged. The age range 41-45 was just 6%, and 16-20 years was 5%. Most women between 41-45 might have stopped child rearing while those between 16-20 years are still in school.

Table 2: Distribution of pregnant women based on trimester

Trimester	Number	Percentage (%)
1st trimester	2	4%
2nd semester	12	24%
3rd trimester	36	72%
Total	**50**	**100**

From Table 2, the largest population of pregnant women was in their third trimester (72%), followed by those in the 2nd trimester.

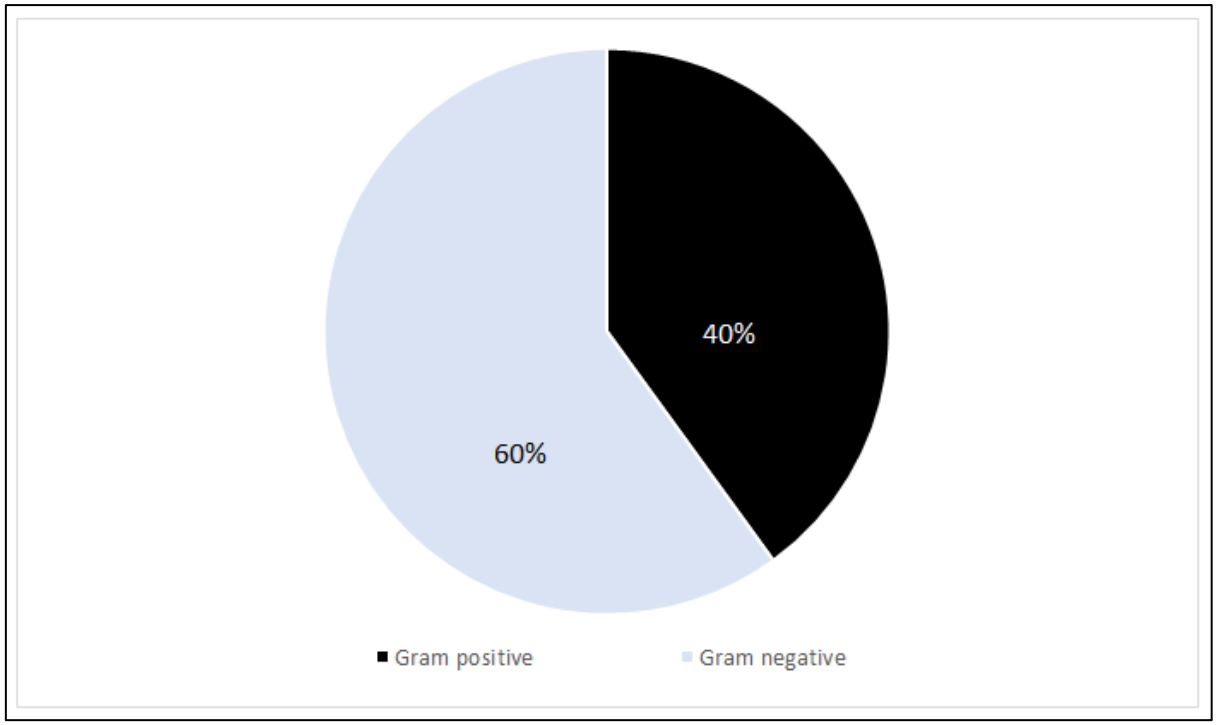

Figure 1: Gram staining reaction amongst the isolates

Thirty isolates representing 60%, were gram-negative, while 20, representing 40%, were gram-positive. Further biochemical tests were then carried out on the 20 gram-positive isolates.

All 20 gram-positive isolates were catalase-positive, 15 were coagulase-positive, and five were coagulase-negative, as shown in Table 3.

Table 3: Catalase and Coagulase reaction of the gram-positive isolates

Reaction	Catalase	Coagulase
Positive	20 (100%)	15 (75%)
Negative	-	5(25%)
Total	**20 (100%)**	**20 (100%)**

Table 4: Resistance pattern of MRSA isolated from the pregnant women

Antibiotic	Resistant	Intermediate	Sensitive
Gentamycin	(7) 47%	2 (13%)	6 (40%)
Cefotaxime	15 (100%)	-	-
Carbapenem	13 (87%)	2 (13%)	-
Augmentin	14 (93%)	1 (7%)	-
Levofloxacin	13 (86%)	1 (7%)	1 (7%)
Ciprofloxacin	10 (66%)	4 (27%)	1 (7%)
Azithromycin	9 (60%)	2 (13%)	4 (27%)
Imipenem	15 (100)	-	-
Ceftriaxone	11 (73%)	4 (27%)	-
Ofloxacin	-	-	15 (100%)
Erythromycin	12 (80%)	1 (7%)	2 (13%)
Cefeime	15 (100%)	-	-

Results showed that 11 (73%) of the 15 Staphylococcal isolates screened were methicillin-resistant (Ceftriaxone), while 4 (7%) were intermediate. The resistant pattern of the isolates to other antibiotics is shown in Table 4. Results showed that over 70% of the MRSA isolates were multi-drug resistant, and carriage based on trimester was highest in the third trimester (Table 5).

Table 5: MRSA carriage based on trimester

Trimester	% MRSA
1ST trimester	3 (20%_
2nd trimester	2 (13%)
3rd trimester	10 (67%)

DISCUSSION

Methicillin-resistant-staphylococcus aureus is a global problem, and a meta-analysis showed that 3.23% of pregnant women were positive for MRSA at any particular time. It is a challenging problem, especially for developing countries with the extra burden of infectious diseases (Nourollahpour *et al*., 2022).

Pregnant mothers are exposed to several infections because of their reduced immunity (Lin *et al*., 2018), and Infections caused by *Staphylococcus aureus* among postpartum women and babies are increasing. A rise in methicillin-resistant *Staphylococcus aureus* may have fueled this increase (Top *et al*., 2012). Colonisation with *Staphylococcus aureus* and MRSA, specifically, has been linked with an increased risk of infections (Nourollahpour *et al*., 2022).

The colonisation of pregnant women in this study was highest in women in their third trimester (67%). This differs from another study where colonisation was 67% in the second trimester (Ayogu *et al*., 2017). This is a cause for alarm because studies have shown that babies born to women colonised with *Staphylococcus aureus* were more likely to infect the newborn (Jimenez-Truque *et al*., 2012).

The carriage of MRSA by pregnant and postpartum women leads to different outcomes, such as menstrual toxic shock syndrome, breast abscesses, mastitis, postoperative infections, pyomyositis—perineal abscesses, necrotising pneumonia in antenatal (Gray *et al*., 2010).

The prevalence of MRSA infection in Nigeria is rising, although with variations in the different parts of the country. A previous study in 2009 showed the prevalence of MRSA was 18.3%, which increased to 42.3% in 2013 (Abubakar and Sulaiman 2018). This study showed a high prevalence of MRSA (73%), similar to what was observed by Udobi *et al*., 2017 and Ayogu *et al*., 2017 but higher than the rates presented by Okiki *et al*., 2020 in the South East of Nigeria.

The increase could be attributed to the excessive use of antibiotics that is readily available over the counter. Patients can purchase these antibiotics indiscriminately without a prescription from the pharmacy, and sometimes, prescriptions are transferred between friends.

Also, the results showed that over 70% of the MRSA isolates were multi-drug resistant to other classes of antibiotics, which is alarming because it narrows therapeutic choices for the patient.

CONCLUSION

This study revealed a high prevalence of MRSA among pregnant women in the South-South of Nigeria and suggested a likely representation of the state of other pregnant women in the rural communities. Regular screening through the gestation period and prompt treatment of cases are recommended to avert possible maternal and foetal complications due to this organism. Also, public enlightenment on the effect of the abuse and misuse of antibiotics is recommended.

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