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Prevalence and Antibiotic Susceptibility Pattern of Staphylococcus Aureus in Clinical Specimens

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Abstract
The present study was carried out to determine the prevalence of *Staphylococcus aureus* in clinical samples and their susceptibility pattern to antibiotics. Standard microbiological and biochemical methods were used to screen 155 clinical specimens comprising of sputum, wound, urine and high vaginal swabs for *S .aureus*. Twenty eight (28) isolates was obtained from these samples. Antibiotic susceptibility results shows high percentage of sensitivity to gentamicin (89%,) azithromycin (89%), pefloxacin (79%) followed by erythromycin (68%) ciprofloxacin (61%) streptomycin (61%)and sparfloxacin (54%). A high resistance was recorded for cotrimaxazole (90%), amoxycillin (88%), ampicillin (73%), tetracycline (65%), cefuroxime and cephalexin (40%) each.
Key words: Staphylococcus aureus, antibiotic susceptibility, prevalence, resistance.

1. INTRODUCTION

Staphylococcus aureus is a facultative anaerobic Gram-positive coccal bacterium. It is the most common species of *Staphylococcus* to cause *Staph* infection. *Staphylococcus aureus* has emerged as one of the mainly important human pathogens, and has over the past numerous decades, been a leading foundation of hospital and community-acquired infections (Johnssons *et al*. 2004, Loffler *et al*.2005, Shittu & Johnson 2006). *S. aureus* may occur as a commensal on skin; it also occurs in the nose frequently (in about a third of the population) (Whitt & Salyers 2002) and the throat less commonly. The carriage of *Staphylococcus aureus* is an important source of nosocomial infection and community-acquired methicillin-resistant *S. aureus* (MRSA). Although *S. aureus* can be present on the skin of the host, a large proportion of its carriage is through the anterior nares of the nasal passages. The ability of the nasal passages to harbour *S. aureus* results from a combination of a weakened or defective host immunity and the bacteria's ability to evade host innate immunity (Quinn & Cole 2007). It was estimated that 20% of the human population are long-term carriers of *S.aureus.* This bacterium is a successful pathogen due to combination of nasal carriage and bacterial immuno-evasive strategies. One of these strategies is the production of carotenoid pigment Kluytmans *et al*.1997, Murray *et al*. 2003). *S. aureus* can cause a range of illnesses, from minor skin infections, such as pimples, impetigo, boils (furuncles), cellulitis folliculitis, carbuncles, scalded skin syndrome, and abscesses, to life-threatening diseases such as pneumonia, meningitis, osteomyelitis, endocarditis, toxic shock syndrome (TSS), bacteremia, and sepsis. Its incidence ranges from skin, soft tissue, respiratory, bone, joint, endovascular to wound infections. It is still one of the five most common causes of nosocomial infections and is often the cause of post-surgical wound infections (Whitt & Salyers 2002). It can survive on domesticated animals, such as dogs, cats, and horses, and can cause bumblefoot in chickens. It can survive for hours to weeks, or even months, on dry environmental surfaces, depending on strain (Cimolai 2008)]. It can host phages, such as Panton-Valentine leukocidin, that increase its virulence.

S. aureus infections may spread through contact with pus from an infected wound, skin-to-skin contact with an infected person by producing hyaluronidase that destroys tissues, and contact with objects such as towels, sheets, clothing, or athletic equipment used by an infected person. Various host factors, including loss of the normal skin barrier, presence of underlying diseases such as diabetes and acquired immunodeficiency syndrome, or defects in neutrophils function predispose to infection. Deeply penetrating *S. aureus* infections can be severe. Prosthetic joints put a person at particular risk for septic arthritis, and staphylococcal endocarditis (infection of the heart valves) and pneumonia (Ryan & Ray 2004).

Drug resistance in microorganisms is a predictable and perhaps inescapable response to the use of antimicrobial agent. It can arise from the selection of resistant strains among naturally susceptible species or from the ingress of new strains of naturally resistant species. The extent of use of particular agents in a given environment dictates the rate at which resistance arises among microbial populations (Kunin *et al*. 1990). *Staphylococcus aureus* is naturally susceptible to virtually every antibiotic that has ever been developed. Resistance is often acquired by horizontal transfer to genes from outside sources, although chromosomal mutation and antibiotic selection are also important (Henry & Frank 2010). Infections caused by antibiotic-resistant strains of *S. aureus*

have reached epidemic proportions globally (Grandmann *et al*. 2006). The overall burden of staphylococcal disease particularly that caused by methicillin resistant *S. aureus* strains (MRSA),is increasing in many countries, in both healthcare and community settings (Kaplan *et al.* 2005).
The pattern of antimicrobial susceptibility of *S. aureus* is a worldwide change, especially in developing countries making antimicrobial agents increasingly less effective. Thus the present study was carried out to determine the prevalence of *Staphylococcus aureus* in clinical samples and their susceptibility pattern to antibiotics.

2. MATERIALS AND METHODS

2.1 Study Population

A total of one hundred and two (102) clinical specimens comprising of wound swabs, nasal swabs, vaginal swabs and urine were collected from patients attending Lagos University Teaching Hospital (LUTH), Lagos State University Teaching Hospital (LASUTH), and Lagos State University Health Centre. The specimens were collected as described by Cheesebrough (2000) and transported to the laboratory within an hour of collection for processing.

2.2 Isolation of *Staphylococcus aureus*

The samples were inoculated on mannitol salt agar (Oxoid) and plates were incubated at 37^0C for 24 h. Colonies formed were later sub-cultured on blood agar twice for purification. The Purified colonies were maintained on nutrient agar slant at 4^0C.
Identification of Isolates.
Bacterial isolates were identified on the basis of their colonial morphology, cellular morphology and biochemical characteristics following the scheme Barrow & Feltham, (1995)

2.3 Antibiotic Sensitivity Test

The agar diffusion method Bauer, *et al.* (1966) was employed for antimicrobial susceptibility testing. Overnight cultures of each isolates were adjusted to 0.5, McFarlannd turbidity standard. A sterile cotton swab was dipped into the standardized suspension, drained and used for inoculating 20mL of Mueller-Hinton agar in a 100mm disposable plate (Sterilin, UK). The inoculated plates were air –dried, and antibiotic discs (Oxoid, UK) were placed on the agar using flamed forceps and were gently pressed down to ensure contact. After proper diffusion of the antibiotics into the agar, the plates were now incubated at 37^0C for 18 h and the zones of inhibition were measured and compared with a zone-interpretation chart. The antimicrobial discs used include pefloxacin (10µg), ciprofloxacin (20µg), sparfloxacin (20µg), gentamicin (10µg), ampicillin (10µg). erythromycin(10µg) azithromycin (15µg), amoxicillin(25µg), cefuroxime (30µg), cephalexin (30µg), cotrimoxazole (30µg), tetracycline(15µg)

3. RESULTS

A total number of 155 clinical specimens were screened for the presence of *Staphylococcus aureus*, of all the cultured samples, only twenty eight (28) showed the presence of these bacteria. The frequency of isolation from the various samples examined is shown in Table 1.
High vaginal swab recorded highest isolation of the *Staphylococcus aureus*.
The results of antimicrobial susceptibility pattern of the isolates are illustrated in Table 11.
High percentage of sensitivity were obtained for gentamicin (89%,) azithromycin (89%), pefloxacin (79%) followed by erythromycin (68%), ciprofloxacin (61%), streptomycin (61%) and sparfloxacin (54%). A high resistance was recorded for cotrimaxazole (90%), amoxycillin (88%), ampicillin (73%), tetracycline (65%), cefuroxime and cephalexin (40%) each.

4. DISCUSSION

The isolation of Staphylococci from the clinical specimens is as a result of the widespread nature of this organism as earlier reported (Murray *et al*. 2003).
The high isolation rate in genital samples (71.4%) might be attributed to the fact that the anatomy of females exposes them to easy contamination as this pathogen is endogenous colonizing the vagina vault of healthy women (Warner & Onderdonk 2004). This result is similar to the findings of Nkwenlag *et al*., (Nkwelang *et al*. 2009) in which 51% of the genital samples analyzed were positive for *Staphylococcus aureus.*
S. aureus is a relatively infrequent urinary tract isolate in the general population. In a multicenter, community-based study conducted in Great Britain, *S. aureus* accounted for only 0.5% of isolates (Barrett *et al*. 1999). A similar laboratory-based study conducted in France found that *S. aureus* accounted for only 1.3% of isolates from urine specimens submitted from the community (Goldstein 2000)
The results obtained in this study are in accordance with these findings which recorded only 5% of isolates from the urine samples analysed. Prior studies suggest that isolation of *S. aureus* from the urine is often secondary to staphylococcal bacteremia originating at another site (e.g., in cases of endocarditis) (Musher & McKenzie 1997).

Isolation of *S. aureus* from urine samples in the absence of bacteremia is therefore often considered to represent colonization.

S.aureus has been found to be a frequent cause of wound sepsis (Emmerson 1994).This was seen from the result obtained .Though only (7 %) was isolated from the samples, but this could be due to the number analysed. A study by Ndip *et al*., Ndip *et al* 1997) at Ilorin, Nigeria reported wound infections of 38% as the highest frequency of *S. aureus* isolates

In specific patient populations, however, *S. aureus* can be an important primary urinary pathogen. For example, MRSA urinary tract infection occurs in both an endemic and epidemic fashion among patients undergoing urologic surgical procedures (Bentley *et al*. 2001, Araki *et al*. 2002).

The most effective chemotherapeutic agents observed against *Staphylococcus aureus* in this study were Gentamicin (89%), Azithromycin (89%), Pefloxacin (79%).The isolates are also sensitive to Erythromycin (68%) Ciprofloxacin (61%), Streptomycin (61%), and Sparfloxacin (54%).These results shows that staphylococcal infection could be treated with gentamicin, Azithromycin, Pefloxacin, Ciprofloxacin, Streptomycin and sparfloxacin. This results is in agreement with the findings of (Uba & Umar 2002, Uwaezuoke & Aririatu 2004)

Lesser activity were recorded for ampicillin, amoxicillin, cotrimoxazole, tetracycline, cefuroxime and cephalexin. The resistance to ampicillin and tetracycline drugs commonly available over the counter in Nigeria and very often used without any prescription is due to misuse or abuse of these antibiotics which is a common phenomenon in developing countries (Olasupo *et al*. 2003).

For a long time, penicillins have been a main stay for the management of a variety of Staphylococcal infections. But the organism has gradually acquired resistance towards them. This is observed in this study where only 7%, 11% of the *Staphylococcus aureus* were sensitive towards ampicillin and amoxicillin only.

The ability of the of *Staphylococcus aureus* to resist these antibiotics is as result of their ability to produce a plasmid encoded β-lactamase that hydrolyses the β-lactam ring of this class of antibiotic which is essential for its antimicrobial activity. The isolates were found to show 32% sensitivity to tetracycline which is in accordance with the result of Oyagade & Oguntoyinbo (1997) and Iroegbu *et al* 1997), who also found a 32% and 30.9% sensitivity to tetracycline.

Co-trimoxazole recorded the lowest sensitivity of 7% .This is in contrast to the result of Shammim *et al*. (2003) that recorded 23.6% sensitivity of their isolates to co-trimoxazole .

The high percentage of sensitivity observed to some of the drugs especially gentamicin which is a broad spectrum and inexpensive antibiotic shows that its usage has not been abused like others antibiotics observed in this study.

The evolution of increasingly antimicrobial-resistant bacterial species stems from a multitude of factors that includes the widespread and sometimes inappropriate use of antimicrobials, the extensive use of these agents as growth enhancers in animal feed, and, with the increase in regional and international travel, the relative ease with which antimicrobial-resistant bacteria cross geographic barriers (Barrett *et al*. 1968, Cohen 1992, Tomasz 1994, Swartz 1997, Perveen *et al*. 2013)

It can be concluded from this study that there is need for regular surveillance on the choice of antibiotic that *Staphylococcus aureus* is susceptible to as this will go a long way in guiding the physician on the management of this notorious organism.

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Table 1: Frequency of *Staphylococcus aureus* from different clinical specimens

Specimen	Number examined	Number isolated
High vagina	80	20(25%)
Wound	7	2(28.57%)
Sputum	8	3(37.5%)
Urine	60	3

Table 2: Antimicrobial susceptibility pattern of the isolates

Antibiotics	Sensitive	Resistance
1. Pefloxacin	22 (79%)	6 (21%)
2. Ciprofloxacin	17 (61%)	11 (39 %)
3. Sparfloxacin	15 (54 %)	13 (46%)
4. Gentamicin	25 (89%)	3 (11%)
5. Ampicillin	2 (7%)	26 (93%)
6. Erythromycin	19 (68%)	9 (32%)
7. Azithromycin	25 (89%)	3 (11%)
8. Amoxycillin	3 (11%)	25 (89%)
9. Cefuroxime	12 (43%)	16 (57%)
10. Cephalexin	11 (39%)	17 (61%)
11. Co-trimoxazole	2 (7%)	26(93%)
12. Tetracycline	9 (32%)	19 (68%)
13. Streptomycin	17 (61%)	11 (39%)

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