Antibiotic Susceptibility Pattern of *Staphylococcus aureus* Isolated from Suppurative Lesions in Khwaja Yunus Ali Medical College Hospital

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ABSTRACT

Staphylococcus aureus is recognized as a major cause of persistent nosocomial and community acquired infection and has become a global health concern. The aim of the retrospective study is to establish the incidence of Staphylococcus aureus in suppurative lesions and its antibiotic sensitivity pattern to various antibiotics in this locality. Fifty-two isolates of Staphylococcus aureus were obtained from 182 different clinical specimens between January and December 2013 from the patients who admitted in the Khwaja Yunus Ali Medical College Hospital. All isolates were confirmed by standard bacteriological procedures in the Microbiology Laboratory of the hospital. Antibiotic sensitivity pattern was carried out by disc diffusion method. The highest number of pathogens were isolated from pus (37) with the overall isolation rate of 28.52%. Males (51.92%) were more infected than females (48.08%). The age group with the highest number of isolates in male and female was 16-30 years. Females between this age group were more vulnerable to the pathogen than males. Antibiotics amikacin and tobramycin were found 100% susceptible to the isolates. The overall sensitivity pattern of Staphylococcus aureus to the following antibiotics: amoxiclav, carbenicillin, gentamycin, ceftriaxone, cotrimoxaxole, imipenem, and meropenem were (92.59%), (82.35%), (94.44%), (93.75%), (80%), (87.50%), (85.71%) respectively. The least susceptible antibiotics were azithromycin, followed by cefixime, erythromycin, and amoxicillin with the sensitivity rate less 50% each.

Keywords: Staphylococcus aureus, Antibiotics, Suppurative infection, Susceptibility, Clinical isolate

1. INTRODUCTION

Staphylococcus aureus is one of the medically important gram positive cocci and thought to be causing nosocomial as well as community acquired infection [1]. It is responsible to infect new born babies, surgical patients, malnourished persons and patients with diabetes and other chronic diseases [2]. Humans are a natural reservoir of *Staphylococcus aureus*. Many studies reported that 30 to 50% of healthy adults are colonized with the pathogen whereas 10 to 20% are persistently colonized [3, 4]. According to a study, nearly 500,000 hospitalized patients in USA contract staphylococcal infections in each year [5]. The burden in developing country is much higher than that. Asia is among the regions with the highest incidence of methicillin-resistant *Staphylococcus aureus* (MRSA) in the world [6].

Staphylococcus aureus is mostly found in the nose, respiratory tract and on skin and is considered a common cause of skin infections, such as abscesses, respiratory infections such as sinusitis, and food poisoning. It is also considered as opportunistic pathogen that causes the number of infections in man and animal on the wounded skin. It is the most prevalent bacteria in the hospital that frequently cause burns and wound sepsis [7] and produce pustules, carbuncles, boils, and impetigo; sometimes it is considered as etiological agent of septicemia, osteomyelitis, bacteremia, and otitis [8]. In the tropical countries *Staphylococcus aureus* significantly causes mortality and morbidity [9]. The major colonization site of *Staphylococcus aureus* is the nostrils. The pathogens are found in the nose up to 80% of adults at one time or the other. The colonization state of *Staphylococcus aureus* is temporary in most of the persons but the colony on 20 to 40% of adults persists for months or even years [10]. Increased colonization rates have been demonstrated for subsequent infections in type I diabetes [11], intravenous drug users, individuals on hemodialysis [12], surgical patients [13], patients with the acquired immunodeficiency syndrome [14], those on ambulatory peritoneal dialysis, patients receiving routine allergy injections [15], that patients with symptomatic human immunodeficiency virus Infection [16] and patients with qualitative or quantitative defects in leukocyte function [17]. Both methicillin-sensitive and methicillin-resistant *Staphylococcus aureus* isolates are isolated from body as persistent colonizers [18].

Antibiotics are widely used to control *Staphylococcus aureus* infections in health setting. Development antibiotic resistance by *Staphylococcus aureus* is a major concern associated with hospital and community-acquired infections [19]. Improper use of antimicrobial agents, transmission of resistant bacteria from patient to patient, health workers to patient or vice versa and lack of proper judicious knowledge of using antimicrobial agents are the important factors of antimicrobial resistance [20].

Resistance to antimicrobial agents of *Staphylococcus aureus* occurs quickly and successfully due to the consequence of the acquisition and transfer antibiotic resistance plasmids, and the possession of intrinsic resistance mechanisms in bacterial populations. *Staphylococcus aureus* has ability to develop different mechanisms of resistance to antimicrobial agents that is the major global health concern for nosocomial and community acquired infection [21]. *Staphylococcus aureus* produces β-lactamase that inactivates penicillin by hydrolyzing β-lactam ring. Less than 5% population of *Staphylococcus aureus* are sensitive to penicillin. The most of the MRSA strains worldwide have resistant to multiple antibiotics including β-lactams; aminoglycosides, macrolides, lincosamides and more recently fluoroquinolones [22]. Patient infections with such resistant strains would be more severe and need long time hospitalization with unavoidable increased costs than infection with susceptible strains [23]. The goal of susceptibility test was to guide the choice of antibiotic therapy for the individual patients and investigate the incidence of antibiotic resistant *Staphylococcus aureus* strains from clinical sources in Khwaja Yunis Ali Medical College Hospital, Sirajgong, Bangladesh.

2. MATERIALS & METHODS

The research was carried out for one year between January 2013 to December 2013 in the Microbiology Laboratory Service Department of Khwaja Yunus Ali Medical College Hospital, Sirajgonj, Bangladesh. A total 182 routine clinical specimens were collected from different suppurative lesions of patients who admitted the hospital from various regions of Bangladesh. Clinical specimens such as pus, wound swabs, nipple discharge and ear swabs were used to isolate *Staphylococcus aureus* from patients. All specimens were collected from patients aseptically and the specimens were processed within 2 hours of collection by the standard microbiology technique.

Various microbiological media (sheep blood agar and mannitol salt agar) were used to identify *Staphylococcus aureus*. All media were prepared according to the manufacturer guideline and sterilized by autoclave. Cultured plates were then incubated at 35°C for 24 hours in aerobic

atmosphere. The isolation and identification of *Staphylococcus aureus* was made on the basis of morphology, Gram staining and biochemical test (catalase and coagulase) following standard procedures described by Cheesbrough [24]. Antibiotic susceptibility test of the *Staphylococcus aureus* was performed using 22 commercial antibiotics through the modified Kirby-Bauer disc diffusion technique [25]. Muller Hinton agar was used and results were interpreted according to the Clinical Laboratory Standards Institute (CLSI) Guideline [26]. The antimicrobial susceptibility testing was performed for Ampicillin (10 µg), Amoxycillin (10 µg), Amoxiclav (30 µg), Amikacin (30 µg), Azithromycin (15 µg), Cephradine (30 µg), Cefixime (05 µg), Cefuroxime (30 µg), Ceftazidime (10 µg), Ciprofloxacin (05 µg), Cloxacillin (05 µg), Gentamicin (10 µg), Ceftriaxone (30 µg), Carbenicillin (100 µg), Doxycycline (30 µg), Erythromycin (15 µg), Imipenem (10 µg), Levofloxacin (05 µg), Meropenem (10 µg), Penicillin G (10 µg), Piperacillin (100 µg), Cotrimoxazole (25 µg), and Tobramycin (10 µg).

A lawn of test organism (1ml of a 24-hour peptone broth culture) was prepared by evenly spreading 100 µl inoculums on the agar plate and *Staphylococcus aureus* ATCC 29213 was used as reference strain for the standardization of antibiotic susceptibility testing. After placing the antibiotics discs firmly and gently on the agar plates, these were left for 1 hour to allow diffusion of antibiotics into the agar medium and incubated at 37°C for 24 hours.
The antimicrobial activity was determined by the zone of inhibition; the diameter of the inhibition zones was measured in millimeter using the electronic scale. Finally, the data were recorded and analyzed at the completion of the study as per recommendations of the NCCLS [27]. For the assessment of data, intermediate readings were considered as resistant. The SPSS windows version 23.0 software was used to analyze the data.

3. RESULT & DISCUSSION:

A total of 52 *Staphylococcus aureus* were isolated from 182 specimens of suppurative lesions with the overall isolation rate of 28.52%. Highest number of pathogens were isolated from pus (37) followed by nipple discharge (6), wound swabs (5), and ear swabs (4) (Figure 1). These results are consistent with different previous findings reported in other parts of world [28].

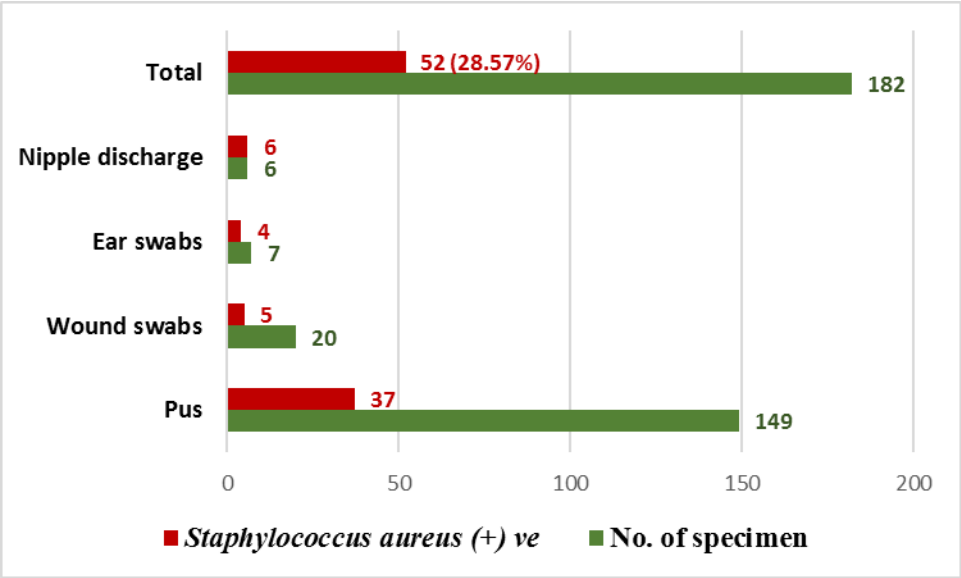

Figure 1: Distribution *Staphylococcus aureus* in clinical specimens of suppurative infections.

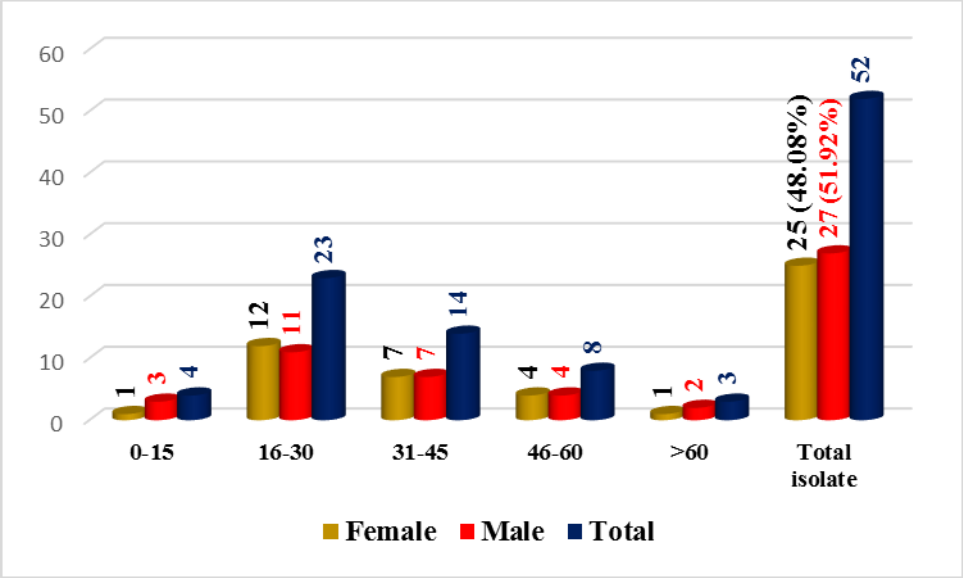

Figure 2: Distribution of *S aureus* isolates in relation to age and sex.

Figure 2 shows that the prevalence of the pathogen was higher in males (51.92%) than in females (48.08%). Patients aged between 16 to 30 years were more vulnerable group *Staphylococcus aureus* associated suppurative infections. Higher number of females (12) were found to be infected with the pathogen in age group 16-30 years than males (11) whereas males were higher in age ranges 0-15 years (3 males as compared to 1 female) and over 60 years (2 males against 1 female). The equal number of pathogen isolated from male and female between the ages 31-60 years. These patterns were consistent with the finding of another study conducted in Uganda [29].

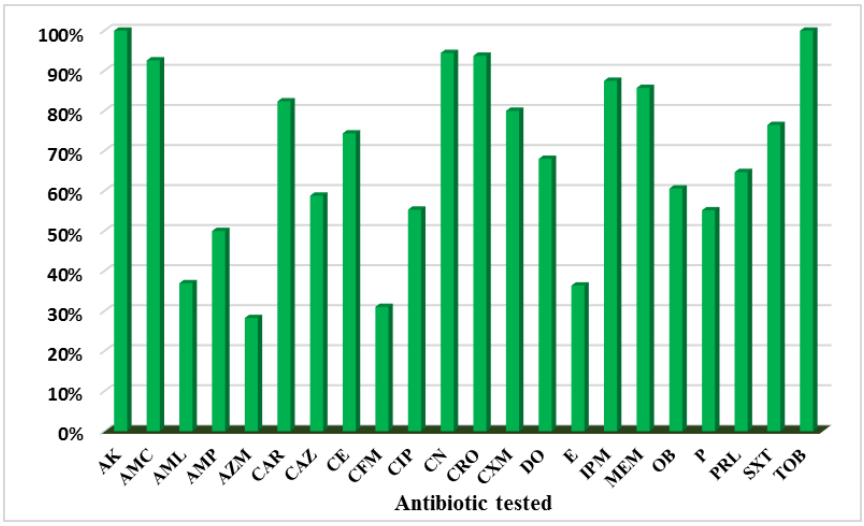

Figure 3: Antibiotic susceptibility pattern of clinical isolates of *Staphylococcus aureus.*

Antibiotic susceptibility tests in Figure 3 shows that, out of the 22 antibiotics tested, Amikacin and Tobramycin worked best on *Staphylococcus aureus* isolates with a susceptibility rate of 100% for each. Other antibiotics with higher sensitivity pattern were amoxiclav (92.59%), Carbenicillin (82.35%), Gentamycin (94.44%), Ceftriaxone (93.75%), Cotrimoxaxole (80%), Imipenem (87.50%), and Meropenem (85.71%). The similar susceptibility patterns against the pathogen were observed in other studies in different parts of the world [30-33].

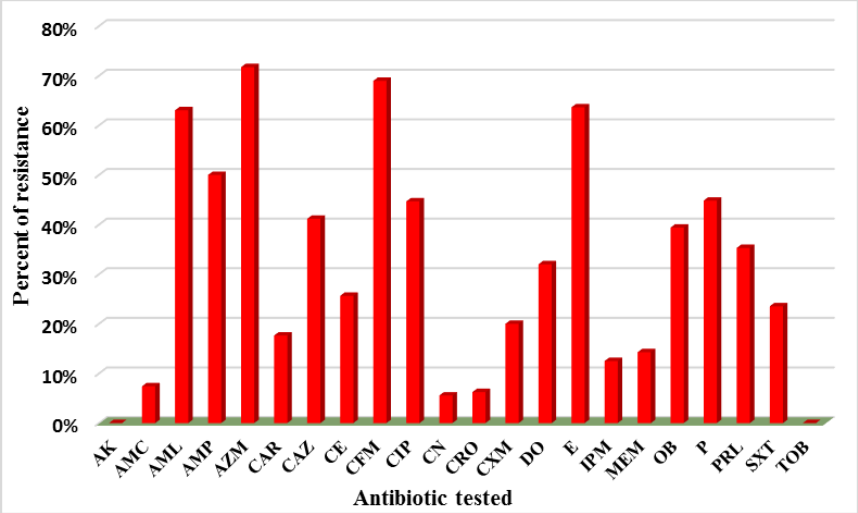

Figure 4: Antibiotic resistance pattern of clinical isolates of *Staphylococcus aureus.*

Figure 4 shows that the most resistance antibiotic against the isolates was Azithromycin (71.74%) followed by Cefixime (68.97%), Erythromycin (63.64%) and amoxicillin. Such trend was also reported by other studies [34-36].

4. CONCLUSION:

Regular monitoring using sensitivity tests should be performed as antibiotic susceptibility profile varies from time to time, and control measures should be put in place in hospitals. This study focuses the need for continuous surveillance of antibiotic sensitivity pattern of *Staphylococcus aureus* with a view to selecting appropriate antimicrobial therapy. Further research should be undertaken to ascertain the prevalence and antibiotic susceptibility pattern of methicillin resistant *Staphylococcus aureus* (MRSA).

ABBREVIATIONS

AK= Amikacin, AMC=Amoxiclav, AML= Amoxycillin, AMP= Ampicillin, AZM= Azithromycin, CAR=Carbenicillin, CAZ= Ceftazidime, CE= Cephradine, CFM= Cefixime, CIP= Ciprofloxacin, CN= Gentamycin, CRO= Ceftriaxone, CXM= Cefuroxime, DO= Doxicycline, E= Erythromycin, IPM= Imipenem, MEM= Meropenem, OB= Cloxacillin, P= Penicillin G, PRL= Piperacillin, SXT= Cotrimoxazole, TOB= Tobramycin.

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PLACE OF STUDY:

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