

RESEARCH ARTICLE

EVALUATION OF SOME ANTIBIOTIC RESISTANCE IN STAPHYLOCOCCUS AUREUS ISOLATED BY MEDICAL LABORATORIES ADEN, YEMEN

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Abstract

The study was carried out to determine antibacterial resistance profiles of methicillin-resistant *Staphylococcus aureus* (MRSA) isolates from clinical samples of patients during the duration, from January 2019 to July 2020 in five governmental and private medical laboratories of Aden governorate, Yemen. A total of 277 MRSA isolates were tested with a disc diffusion method from 4 clinical specimens. The isolates were examined for methicillin resistance using vancomycin, erythromycin, amikacin, and gentamicin.

The results revealed a large number of MRSA isolates showed resistance to erythromycin (43.5%) and Vancomycin (28%). A lower number of MRSA isolates showed resistance to amikacin (6.25%), gentamicin (11.75%). A majority of MRSA isolates were from urine specimen (162) followed by (56) wounds, (34) pus, and (25) semen specimens. The highest proportion of MRSA isolates were obtained from Al-medina medical laboratory (31%) and Alborg laboratory (24%).

Keywords: Antibiotic, Resistant, *Staphylococcus aureus*.

Introduction

Antibiotics are substances that suppress or prevent the development of microorganisms, including microorganism-produced substances and synthetic antibacterial compounds. Antibiotics are life-saving treatments for infected patients, but they have little effect on non-infected patients, putting them at risk for antibiotic-related side effects. Antibiotic-related side effects included adverse drug reactions, the risk of secondary infections, and antimicrobial resistance [1-4].

There are critical therapies, especially in developed countries where the infectious diseases are the leading cause of death [5]. Self-medication is described as the use of medications to treat self-diagnosed illnesses, symptoms, and pains without seeking medical advice or being under medical supervision and [6]. It is a popular mode of healthcare in most parts of the world, with over-the-counter antibiotics accounting for half of all antibiotics used [7]. The health risks were associated with self-medication by antibiotics, especially in developing countries, are multifaceted, as they are related to insecurity, inaccessibility, and a shortage of medical providers, as well as low-quality healthcare facilities, unregulated pharmaceutical delivery, and consumer myths about practitioners [8]. The health

implications of self-medication with antibiotics, especially in developing countries, are complicated, as they are related to insecurity, inaccessibility, and a shortage of medical practitioners, low quality of healthcare services, uncontrolled delivery of drugs, and patients' misconceptions regarding physicians [9, 10].

Staphylococcus aureus, is a Gram-positive, catalase, and coagulase-positive bacteria which belong to the Micrococcaceae family. The *Staphylococcus* spp. can be detected in the natural and human environments. Despite its porous nature, this bacteria is highly immune to both the natural external atmosphere and disinfectants agents. These resistant isolates can cause a variety of clinical problems between minor infections and severe infections that can be fatal. As a result, *Staphylococcus aureus* can be removed from the population and hospital-acquired infections on a regular basis [11, 12]. *Staphylococcus aureus* is a normal human flora member that can live on the skin's surface and mucous membranes (especially in the nasal area), causing serious infections once it enters the internal tissues or bloodstream [13]. *Staphylococcus aureus* is capable of rapidly developing resistance to any antibiotic and the Antibiotic inactivation occurring by the enzymes, target modification with a reduced tolerance for the antibiotics, antibiotic containment, efflux pumps,

and other pathways for resistance exist [14]. Based on resistance growth, there are two varieties of *Staphylococcus aureus*. Those that are immune to β -lactam antibiotics (a class of broad-spectrum antibiotics that includes penicillin substitutes as methicillin and oxacillin, as well as cephalosporins like cepham, are known as MRSA-Methicillin resistant *Staphylococcus aureus*, while those that are susceptible are known as MRSA-Methicillin susceptible *Staphylococcus aureus* MSSA-Methicillin susceptible *Staphylococcus aureus* is the name given to bacteria that are susceptible to these antibiotics [15].

Antibiotics are unrestricted in many countries and are available without a prescription over the counter. Antibiotics are readily available, abundant, and inexpensive as a result of the lack of supervision, which encourages overuse. Antibiotics are available for prescription online including in countries where they are limited [16]. Antibiotic prescriptions that are suitable for the patient will increase their outcomes while also reducing the growth of bacterial resistance [17, 18]. The incidence of difficult-to-treat bacterial infections is everyday in developing countries, and they have become a significant threat to public health, resulting in higher mortality rates and lower quality of life [19].

Drug manufacturers are not interested in the discovery of novel antibiotics due to the regulatory climate and financial costs. As a result, they are unable to keep up with the ongoing rise in antibiotic resistance [20]. Despite the importance of consuming antibiotics in human life, bacterial infections continue to become serious hazards causes of morbidity and mortality that created a worldwide problem. Some scientific researches concerning efficacy were carried out in Yemen especially in Aden. This study was essentially designed to determine the antibiotics resistance and sensitivity of *Staphylococcus aureus* performed in private and public medical laboratories in Aden hospitals. The findings from this study will guide the prevalence of misuse of the existing antimicrobials drugs that treat ill patients.

Methodology

1-Study model:

A cross-sectional study That happened during January 2019 to July 2020. The study was led to at different governmental and private hospitals and medical laboratories in Aden, Yemen: Alborg Medical Lab, Al-Madina Medical Laboratories, Modern Medical Laboratories, AL-Reyada Hospital, and Aljumhuriya Hospital. The patient data were gathered from the microbiology laboratory unit registration book archives. Sex, specimen type, bacterial isolates, and antibiotic susceptibility pattern to resistance or sensitivity were collected using a data extraction sheet.

The questionnaire was adjusted to find resistance and sensitivity to *Staphylococcus aureus*.

2-Study Area

The study was performed in private and public laboratories in Aden hospitals, Aden city.

3-Inclusion Criteria

Specimens of *staphylococcus aureus* from both sex (male and female) that resistance or sensitivity encountered during the study were included.

4-The Collection of Data

Data was collected by fifth-year pharmacy students that well trained according to an organized questionnaire.

5-Statistical analysis

The data were analyzed by using Statistical Package for Social Sciences (SPSS) version 21. Descriptive statistics were used to determine the frequency and percentages of antibacterial resistance profiles of (MRSA).

Results

A total number of 277 *Staphylococcus aureus* (MRSA) isolates were collected from various clinical specimens according to resistance and sensitivity pattern. The collected isolates were 148 (53.42%) samples from males and 129 (46.57%) samples from females, as mentioned in Table (1). The collected isolates *Staphylococcus aureus*, 162 (58%) were obtained from urine, 56 (20 %) from wounds, 34 (13%) from pus, 25 (9%) from semen. The distribution of isolated strains according to the clinic specimens is shown in Table 2.

The antibiotic resistance pattern of isolated *Staphylococcus aureus* from different specimens was found to be highly variable. The isolated *Staphylococcus aureus* from the wound and semen were identified as sensitive against amikacin. While vancomycin the pus and semen were sensitive too. Almost all the isolated *Staphylococcus aureus* from urine were resistant to erythromycin, vancomycin, amikacin, and gentamicin. Resistance rates against erythromycin, vancomycin, amikacin, and gentamicin were determined as 54 %, 28 %, 19 %, and 15 %, respectively. The isolated *Staphylococcus aureus* from semen was identified as sensitive of both vancomycin and amikacin, while resistance against erythromycin and gentamicin was 46 % and 13 %, respectively. The wound *Staphylococcus aureus* was sensitive to amikacin and resistant against erythromycin, gentamicin and vancomycin as 53 %, 15 % and 13 % respectively.in the other hand, the pus *Staphylococcus aureus* was sensitive to vancomycin and slightly resistance to amikacin, erythromycin and gentamycin as 4%, 6% and 3% respectively. The result is represented in Table 3

Table 1. Samples were collected from both sexes (males and females)

Sex	Total	Percentage
Male	148	53.42%
Female	129	46.57%

Table 2. The Distribution of bacterial isolates with the different types of specimens

Specimen	No. (%)
Urine	162 (58%)
Pus	34 (13%)
Semen	25 (9%)
Wound	56 (20%)

Table 3. The Comparison of antibiotic resistance Percentage between selected types of specimen and some antibiotics

Specimen	Vancomycin	Erythromycin	Amikacin	Gentamicin
Urine	28	54	19	15
Wound	13	53	00	15
Pus	00	3	6	4
Semen	00	64	00	13
Total	10.25	43.5	6.25	11.75

Discussion:

The data were collected from five main hospitals and medical laboratories in Aden city. Each laboratory throughout the study period reported variable numbers of antimicrobial-resistant to *S.aureus* bacteria. The isolated bacterial were of 4 clinical specimens types distribution, and frequency varied in different clinical specimens. The result of this study describes the antimicrobial susceptibility pattern of *S.Saureus* strains. In this study, most *Staphylococcus aureus* strains were isolated from urine, wound, pus, and semen. This study represents that result, the majority of isolates were from urine specimens. As a previous study from Ethiopia reported the urine specimen (100%) during 2013-2017 [21]. This is consistent also with a previous study done in Nigeria which represented a majority of the isolates were from urine specimens (76%) [22].

The recorded data represented that a (20%) of the wound, (13%) of pus, and (9%) of semen were resistant against selected antibiotics. As well study done in Taiz, Yemen of Bacterial Isolates from Patients with Skin Infections (wound, and another specimen) showed that prevalence in wound (33.7%) [23].

Furthermore, another finding noted the prevalence of *Staphylococcus aureus* (39.70%) in a study done in Sana'a, Yemen, was antimicrobial resistance in wound infection [24]. It is known that *Staphylococcus aureus* is one of the most common bacterial pathogens in most settings, and it is a well-known multi-drug resistant pathogen causing different kinds of infections. The overall burden of staphylococcal disease, mainly caused by methicillin-resistant *Staphylococcus aureus*, increases in many healthcare and community settings [25].

The majority resistance was seen with penicillin category, and macrolide, gentamicin, and amikacin by different ratios depending on the specimen. Similar results were obtained in a previous study [26]. We identified

almost similar findings from studies in Ethiopia and overseas. Similar to our study found resistance between (21%) and (82%) against erythromycin penicillin [27-30]. Also, a study in Sana'a shows resistance was seen with erythromycin (71.5%), and this was lower compared to our study where resistance for erythromycin (54%) [31]. The most common reason for multidrug-resistant MRSA is the indiscriminate use of antibiotics without drug sensitivity testing due to lack of advanced laboratory facilities or negligence on medical practitioners' or patients' low economic status that consume sub doses [32]. This study provides an outline of the existing resistance level that can be used as a guide for effective treatment. The all resistance rate in Yemen can cause increased mortality and morbidity due to treatment failures and lack of effective therapy. Moreover, in a country with poor resources, such as Yemen, the economic consequences may be even more detrimental, as increased treatment costs consume funds. The development of highly resistant pathogens is the inevitable outcome of the frequent, irrational use of broad-spectrum antibiotics as well as the availability of antibiotics as over-the-counter medicines in this city. Antibiotic resistance is a global problem. In recent days, these issues are generally considered as a public health problem and continued to rise in Aden city a year ago [33].

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مقالة بحثية

تقييم مقاومة بعض المضادات الحيوية في بكتيريا (*STAPHYLOCOCCUS AUREUS*) المعزولة من المختبرات الطبية عدن، اليمن

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المُلخَص

اجريت هذه الدراسة لتحديد بروفيل المقاومة للمضادات البكتيرية لبكتيريا العنقودية (MRSA) لعزلات من العينات السريرية للمرضى خلال الفترة يناير 2019م حتى يوليو 2020م في خمسة من المختبرات الطبية الحكومية والخاصة. تم اختبار 267 عزلة (MRSA) بطريقة الانتشار (disc diffusion) من أربع عينات سريرية، مثلت غالبية العزلات عينات البول (162)، تليها عينات الجروح (56)، القيح (34) والسائل المنوي (25) عينة. تم اختبار حساسية العزلات على أربع مضادات حيوية (Erythromycin, Amikacin, Vancomycin and Gentamicin). اظهرت النتائج مقاومة عالية للعزلات ضد الاريثروميسين (Erythromycin) وفانكوميسين (Vancomycin)، بينما نسبة مقاومة اقل للجنتاميسين (Gentamicin) واميكاسين (Amikacin). تم الحصول على اعلى نسبة للعينات من مختبر المدين الطبي (31%) ومختبر البرج (24%).

الكلمات الرئيسية: مضاد حيوي، المقاومة، بكتيريا (*Staphylococcus Aureus*).

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