

Antibiotic Resistance Pattern of *Staphylococcus aureus* in Iran: A Review

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ABSTRACT

Antibiotic resistance has a lower potential for substituting plantar therapeutic treatments than conventional drugs.

Staphylococcus aureus is one of the strains that continue to increase their antibiotic resistance. The aim of this study was to investigate antibiotic resistance pattern of *Staphylococcus aureus* in Iran.

A comprehensive literature review was performed on papers that have been published from 2004 till 2016 in data resources such as NCBI, Science direct, Springer, Web of science and as well as local databases such as Irandoc, Islamic science citation (ISC) and magiran with special focus on those that have been reported native medicinal plants in Iran. The selected keywords were *Staphylococcus aureus*, antibiotic resistant, Iran. Different studies were found that have reported effective antibiotic resistance against *S. aureus*. Based on the reported studies, there are different antibiotic resistances in Iran.

Keywords: *Staphylococcus aureus*, Antimicrobial resistance pattern

INTRODUCTION

Staphylococcus aureus is one of the most important factors in the development of nosocomial infections [1].

The location of this bacterium is in the areas of the skin, perineum, vagina and arm-pit. About 30% of people in the world have this organism as normal in their nose [2].

This bacterium can spread a wide range of infections including pneumonia, endocarditis, osteomyelitis, septicemia, skin infections, mucus, boils and skimmer in humans [3]. Also, this bacterium is considered as one of the most important life threatening factors in hospitalized patients, especially ICUs, burns, as well as immune compromised, diabetic and transplant patients [4].

The most important way of transmitting this bacterium to patients is through the infected hands of health workers. The data show that 6.3 deaths per 100,000 people in the United States in 2005 were due to methicillin-resistant *Staphylococcus aureus* infections [5].

During recent decades, *S. aureus* bacteremia has increased significantly which cause difficulties in infection control [6]. Before antibiotic era, infectious diseases were regarded as a life threatening problem in human life. Fortunately with penicillin discovery, infections control was successful and the infectious diseases mortality was reduced significantly but with frequent use of antibiotics, resistant bacterial strains were found as a result of acquiring resistance genetic

elements, genetic drift, genetic shift and also expressing new metabolic pathways [7].

So, presently antibiotic resistance is a worldwide problem especially in developing countries. It causes mortality following infectious diseases, e.g. in tropical countries near half of mortalities are due to infectious diseases [8]. *S. aureus* is one of the most antibiotic resistant pathogen as more than 90% of its infections do not respond to penicillin or ampicillin [9].

MATERIALS AND METHODS

In this review a comprehensive literature review was performed on papers that have been published from 2004 till 2016 with special focus on those that have been reported native resistant *S. aureus* in Iran. For this purpose, the most related data resources such as NCBI, Science direct, Springer, Web of science and as well as local databases such

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as Irandoc, Islamic science citation (ISC) and Magiran were searched for desired papers. These papers were selected based on the following keywords: *Staphylococcus aureus*, antibiotic resistant, Iran.

RESULTS

Different studies were found that have reported effective antibiotic resistant against *S. aureus*.

DISCUSSION AND CONCLUSION

Staphylococcus aureus is known to be a potential pathogen that can produce several infections. This bacterium is one of the main causes of acquired and acquired hospital infections, which today has gained wide resistance to a wide range of antibiotics including beta-lactams, aminoglycosides, tetracyclines, fluoroquinolones and macrolides. Therefore, in the treatment of these resistant strains, only a limited number of antibiotics such as vancomycin and tiopoplanin as medicines remain effective.

In a study, antibiotic resistance pattern of methicillin-resistant *Staphylococcus aureus* strains in Gorgan was investigated in 1998-1999. Results showed that 104 strains (85.9%) from 121 strains were methicillin. The prevalence of methicillin-resistant strains in urine samples and ulcers was 90.4 (38 samples) and 89.2% (25 samples), more than other clinical specimens. The highest resistance rates of MRSA strains were penicillin in 104 strains (100%), coamucoclave 102 strains (97.6%) and cefotaxime 74 strains (71.4%) and in 67 (64.3%) erythromycin.

In the study of Nourbakhsh et al. [10], antibiotic resistance pattern of *Staphylococcus aureus* strains isolated from patients in Isfahan hospitals in 2014 were explored and the results showed that the highest antibiotic resistance to methicillin antibiotics was 90.2%, erythromycin (89.7%), ciprofloxacin (89.5%), penicillin (88%), tetracycline (82.4%), gentamicin (75.8%) and the least resistance to nitrofurantoin antibiotics and vancomycin (10%) [11].

In another study, an antibiotic resistance pattern of methicillin resistant to *Staphylococcus aureus* isolated from Ahwaz hospitals in the years 1388-1388 was investigated, and the results showed that out of 255 suspicious samples of 180 strains of *Staphylococcus aureus* were confirmed out of a total of 59 strain (2.37%) was resistant to methicillin.

In another study, antimicrobial resistance tests of *Staphylococcus aureus* strains isolated from Jahrom Hospitals. Results showed that 11.3% of the carriers had *Staphylococcus aureus* in the nose. 90% of who were health care workers and 10% of service workers. The most susceptibilities were ciprofloxacin, rifampicin, linzolid and sinensid antibiotics (91.1%) and the lowest sensitivity to penicillin antibiotics (7.4%). Of the nine strains resistant to methicillin, one was resistant to vancomycin and two isolates resistant to taco-plagantine and lensolide [12]. The results of this study showed that most of the samples

(90.8%) resistant to penicillin were resistant. The results of this study showed that the results of this study showed that the antibiotic resistance of *Staphylococcus aureus* isolated from the nose of personnel in Shahed University Hospitals was evaluated. Strains resistant to vancomycin and rifampins were not observed. The rate of resistance to other antibiotics is 33.3%, 50.8% tetracycline, 99.8% tetracycline, 8.8% erythromycin, chloramphenicol and ceftriaxone 5.5%, cefazolin, cefalexin and ciprofloxacin each 3.5%, respectively. Clindamycin is 2.8%, gentamicin is 3.2% and cefalotin is 1.2% [13].

In the study of Aligholi et al. [14] who tested antibiotic resistance patterns of *Staphylococcus aureus* strains and hospital samples, 47% of the strains were resistant to oxacillin antibiotics and had the least resistance to vancomycin (16%). MRSA strains had a high resistance to gentamicin (40.5%), erythromycin (40%) and ciprofloxacin (38%) antibiotics [14].

Rezazadeh et al. [15] investigated the antibiotic resistance pattern of methicillin-resistant *Staphylococcus aureus* in the Vali-e Asr Arak educational center and the results showed that among 100 identified samples, 80 methicillin-resistant *Staphylococcus aureus* isolates were isolated, the highest resistance of these strains to penicillin antibiotics (100%), tetracycline (88.3%), levofloxacin (85.7%) and ciprofloxacin (85.7%) [15].

The results of this study showed that antibiotic resistance to methicillin (37.8%), ciprofloxacin (12.6%), clindamycin (44.3%) and methicillin antibiotics (37.8%), erythromycin (46.7%), penicillin (67.47%), gentamicin (32.1%), sulfomethoxazole 17.7% [16].

In a study by Safdari et al. [17] who investigated the resistance pattern of *Staphylococcus aureus* in Ghaem hospitals in Mashhad in 2011, the results showed that 97% of the antibiotics tested were penicillin 97%, oxacillin 63%, erythromycin 57%, cefalexin 43%, clindamycin 33% and vancomycin was 20% [17].

In the study of Akbarzadeh Khayavi et al. [18], an antibiotic resistance pattern of *Staphylococcus aureus* isolated from carriers in Imam Khomeini dialysis patients of Tabriz was explored, and the results of antibiogram of strains in terms of resistance to 12 antibiotics were as follows: vs. gentamicin 20%, oxacillin 28%, neomycin 30%, clindamma [18].

In the study of Rahimi [19], a total number of 216 (30%) strains were found to be MRSA isolates. The highest antibiotic resistance was to penicillin, clindamycin, tobramycin and tetracycline, respectively. 93 and 61% of MRSA and MSSA isolates were multidrug resistant (MDR), respectively. However, no strain was resistant to vancomycin, synercid, linezolid and chloramphenicol. 69% of MRSA isolates showed high level of resistance to oxacillin (MIC $\geq$ 256 μ g/mL). *mecA* gene was detected among all MRSA isolates [19].

In the study of Saadat et al. [20], the frequency and pattern of antibiotic resistance of *Staphylococcus aureus* in the staff of Shiraz hospitals and the pattern of antibiotic resistance were determined, the results showed that among the isolates of *Staphylococcus aureus*, the most antibiotic susceptibility to vancomycin antibiotics, ticoplanin, linzolid quinapristin (95.3%) and the least sensitivity to amoxicillin and ampicillin antibiotics (3.5%) were observed [20].

In another study, the isolation and identification of antibiotic resistance genes in isolated *Staphylococcus aureus* etiologies isolated from respiratory tract infections in Shahrekord, the results showed that resistance to penicillin and cefotaxime 100 antibiotics, tetracycline 33 (58%), oxacillin 40%, chloroxacillin 40%, ciprofloxacin 25%, ceftazidime 25%, cefatin 20%, gentamicin 16.66%, amoxiclav 16.66%, erythromycin 5%, rifampin 5%, cefalexin 33.3%, Vancomycin 5% and methicillin 48% [21].

In the study of Mahmoudi et al. [22], an antibiotic resistance pattern of *Staphylococcus aureus* isolates in nursing staff of Shaheed Beheshti Hospitals in Yasuj, the results showed that 93 isolates (26.28%) of nasal cartilage were *Staphylococcus aureus*. Of these, 19 isolates (37.5%) were resistant to methicillin. All isolates were resistant to penicillin (100%).

Resistance to erythromycin was 12.9%; cotrimoxazole was 38.5% [22]. The results of this study showed that resistance to antibiotics ciprofloxacin (30.23%), opluxacin (27.9%), norfloxacin (27.5%) and resistance to antibiotics (27.9%), levofloxacin (25.58%), erythromycin (27.9%), penicillin (86.5%), tetracycline (30.23%), cotrimoxazole (6.97%), rifampin 20.93%) and clindamycin (23.25%) [23].

Ysyn 26%, 30% erythromycin, trimethoprim-sulfamethoxazole, 44%, 32% chloramphenicol, tetracycline 36%, and ciprofloxacin were 10% [18]. In the study of Saadat et al. [20], they explored the prevalence of antibiotic resistance in *Staphylococcus aureus*; staff Silicon and ampicillin (3.5%) were observed (20). In one study, it was aimed to isolate and identify genes for antibiotic resistance in *Staphylococcus aureus* isolated from respiratory tract infections in this city and the results showed that the resistance to the antibiotics penicillin and cefotaxime 100, tetracycline 33/58%, oxacillin, 40%, cloxacillin 40%, ciprofloxacin 25%, ceftazidime 25%, cephalothin 20%, gentamicin 66/16%, Amoxyclav 66/16%, erythromycin 5%, rifampin 5%, cephalixin 33/3%, Vancomycin 5% and methicillin 48%. In the study of Mahmoudi et al. [22], the antibiotic resistance pattern of Staphylococcal isolates, of these, 19 isolates (37.5%) were resistant to methicillin. All isolates were resistant to penicillin (100%). The resistance to the antibiotics ciprofloxacin (23/30%), ofloxacin (9/27%), Norfluxacin (9/27%), levofloxacin (58/25%), erythromycin (9/27%), penicillin (05/86%), tetracycline (30.23%), cotrimoxazole (6.97%), rifampin (20.93%) and clindamycin (23.25%) [21].

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