The trend of antibiotic resistance of *Staphylococcus aureus* isolated in clinical specimens in a referral hospital Shahid mohammadi hospital at Bandar abbas, South of Iran (2009-2014)

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**Abstract:**

**Background:** Staphylococcus is an important pathogen for humans, which is found on skin, mucous membranes and oropharynx of healthy individuals. The bacteria can cause a range of infections from simple wounds and skin abscesses to severe infections such as pneumonia, septicemia, osteomyelitis and endocarditis. Unfortunately because of emerging drug resistance, infections caused by this organism are difficult to treat and may be a leading cause of mortality. This study was aimed to assess the pattern and trend of resistance in *Staphylococcus aureus* in a referral hospital Shahid mohammadi hospital at Bandar abbas, South of Iran

**Method:** A prospective cross-sectional study was designed from 2009-2014 on 406 strains of *Staphylococcus aureus* isolated from patients admitted to a referral hospital in south of Iran. The samples were collected from urine, wounds, ear discharge, burn wound, throat, tracheal secretions, abscess and joint fluid. Antibiotic susceptibility pattern was tested by disc diffusion. The results were analyzed with SPSS 21, using descriptive statistics.

**Results:** Of the collected isolates, 63% were from Men and 37% were from Women. Mean age of the patients was 35 Years. Highest resistance rate was observed for Amoxicillin (88.6%) and lowest resistance was identified for Ciprofloxacin (19.9%).

**Conclusion:** Emerging of multidrug resistance is alarming among *Staphylococcus aureus* in south of Iran. The abundance of antibiotic prescription and antibiotic sensitivity pattern should be considered because The antibiotic sensitivity varies in different times and different regions. Necessary measures should be taken. Appropriate patient treatment and planning should be designed to control and reduce the resistant species, morbidity and mortality associated with MRSA infections.

**Key words:** *Staphylococcus aureus*, resistance, disc diffusion, MRSA
Introduction

Staphylococcus spp are gram positive, non-motile cocci without flagella. Two important species of Staphylococcus which have clinical importance are *S.aureus* and *S.epidermidis*. *S.aureus* growth and dissemination in food are increasing. pathogenic Staphylococci (disease-causing) are generally opportunistic and only cause disease in immunocompromised hosts (1, 2).

*S.aureus* is an important human pathogen. (3) This bacterium is everywhere and it’s main place is skin’s normal flora and mucous membranes and oropharynx of humans and animals. healthy people can be carriers of this bacterium. (3, 4). The bacteria can cause a range of infections, from simple wounds and skin abscess, to severe infections such as pneumonia, septicemia, osteomyelitis and endocarditis (3, 5).

*S.aureus* is one of the main causes of food-borne diseases in which currently number of resistant strains are reported (3, 4). *S.aureus* infections have become a major health problem worldwide due to the increasing resistance against drugs. Before 1940 penicillin was used as a first line drug in the treatment of *S.aureus* infections (5, 6). Since then other beta-lactams have been used as a treatment for *S.aureus* infection. Methicillin-resistant *S.aureus* (MRSA) is a major cause of nosocomial infections worldwide (6, 7) which requires special attention to prevent subsequent mortalities. Coagulase-negative Staphylococci present in skin and mucosal surfaces are normal inhabitants of the human body and one of the most common normal folra pathogenesis (7).

*S.aureus*, is a cause of nosocomial infection through direct or indirect contact between patients and medical staff, the environment (8). High frequency of MRSA strains as well as resistance to other antibiotics can have serious consequences for spreading to sections such as babies, chemotherapy and ICU patients and causes increased cost for the patients. (8, 5, 9)

The aim of the present study was to evaluate resistance pattern of *S.aureus* isolated from clinical samples and associated factors in referral university hospital in South of Iran from 2009-2014. Results of this study will be used to implicate necessary changes in current treatment of infections to reduce the mortality and morbidity and increase of the infected patients.

Methods & Materials

This cross-sectional study was conducted in a university referral hospital in South of Iran on 406 strains of *S.aureus* collected from clinical specimens from 2009-2014. The samples were obtained from urine, wounds, ear discharge, burns, throat, tracheal secretions, abscesses, indwelling catheters and synovial fluid.

Antibiotic susceptibility pattern of *S.aureus* isolated from samples was checked with standard disc diffusion method using discs Amoxicillin (AMX) 30 μg, Ciprofloxacin (CP) 5 μg, Co-trimoxazol (SXT) 1.25/23.75 μg, Clindamycin (CC) 2 μg, Vancomycin (V) 30 μg, Cephalexin (CN) 30 μg, Oxacillin (OX) 1 μg, Gentamicin (GM) 10 μg, Aziteromycin (AZM) 15 μg.

Variables such as age, sex, clinical samples, name of the admitted ward and duration of hospitalization were checked. Data were analyzed using descriptive statistics and Pearson correlation coefficient by SPSS version 21.

Results

In this study, 406 samples were collected. 63% were from Men and 37% were from Women. The average age of subjects was 35 years, median 30 years and the age range varied from zero to 91 years.

Most resistance was observed with Amoxicillin (AMX) 88.6%, and the lowest resistance with Ciprofloxacin (CP) 19.9%. The survey also showed that resistance to Oxacillin (OX) was 52.4% and it’s intermediate was 0.8%. The results are displayed in fig 1.

![Figure 1 Resistance pattern of S.aureus to checked antibiotics](image-url)
The sensitivity pattern during these five years is displayed in table 1.

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*Table 1 Sensitivity pattern of S. aureus*

In this 5 year study, the correlation between frequency of resistance to antibiotics and frequency of administered antibiotics were determined using Pearson correlation coefficient. From the obtained results, resistance to AMX was most frequent in during these 5 years. In recent 90 years, this resistance reached to its peak in these five years. Lowest resistance was seen in GM (nearly zero percent).

*Figure 2 Percentage of antibiotic resistance in years 2009-2014*

In the diagram below (fig 3), which is related to many antibiotics, it is seen that (Clindamycin) has been more prescribed and consumed in these 5 years and mostly in the last 89 years. In this period, other antibiotics have been more prescribed and consumed within 5 years of more consumption of it has been occurred in 89 years. also other antibiotics have had the highest consumption in 1389 than other years and the lowest consumption was for AZM.

In this analysis, antibiotic resistance and antibiotic prescription and consumption and increased cost had a significant correlation. As it is deducted from the figures and tables, AMX had highest resistance, but the frequency of consumption was lowest compared to other antibiotics. But from another point of view with this antibiotic’s growth of resistance in 1390, it’s consumption has been higher than the other years.

**Discussion**

About resistance to vancomycin, disk diffusion method that is performed in hospital, is not appropriate. We cannot therefore deduce vancomycin resistance from this
report. For this reason, reports of the vancomycin resistance results are not correct according to this method.

As the amoxicillin resistance is high, mainly because of presence of beta lactamase enzymes, combination of amoxicillin with clavulanic acid shows to be promising for prevention of S.aureus infection. (9) A meta-analysis on antibiotic prophylaxis for MRSA shows that prophylaxis with co-amoxiclav reduces MRSA infection compared with placebo in people without malignant disease, undergoing invasive gastric procedures to prevent the wounds from becoming secondarily infected with MRSA (9). A review on combination of amoxicillin/clavulanic acid in severe S.aureus infections states that this compound is experimentally highly effective in MRSA and MSSA endocarditis in animal model. In humans this compound was empirically efficacious for community acquired or nosocomial pneumonia caused by MRSA, and concludes that MSSA infections seem to respond adequately to this antibiotic, but it is still experimental in MRSA infections and not advised for these infections in humans (10).

The proportion of hospital acquired infections increased during 8 years. Most of HA MRSA were multidrug resistant and 1.2% were Vancomycin intermediate resistant (VISA) (11) which is consistent with our results. A study in China assessed the antibiotic resistance in nosocomial infections, and in this study, S.aureus has lowest resistant to Vancomycin (0.1%), antibiotic resistant pathogens have gradually increased from 2011 to 2014 (12) which is in line with our findings. Overall, improved surveillance of hospital acquired infections and effective infection control methods may be efficacious in solving antibiotic resistance pattern.

Generally, hospital acquired infection surveillance improvement and effective infection control procedures, might be effective in solving the antibiotic resistance pattern. Other issue is controlling mechanism of evolving resistance, which is controlled by mec OPERON and mecA gene and vanA gene, and further studies should be focused on these molecular mechanisms to solve the resistance problem in S.aureus. In order to reduce the MRSA strains.

FDA has issued specific guidelines appropriate treatment options to use vancomycin. If the bacteria are not resistant to vancomycin it is recommended that in methicillin sensitive cases, the treatment option should consist of flucloxacillin or even penicillin (13).

Conclusion

Regarding high prevalence of antibiotic resistance and multidrug resistance infections of S.aureus in a university referral hospital in south of Iran, several issues to be considered are age more than 35 years, prior lengthy hospitalizations, length of current hospitalization, type clinical sample and antibiotic usage. Frequency of antibiotic administration and antibiotic susceptibility pattern should also be sought and it should be considered that antibiotic susceptibility varies in different times and the region patient resides. Appropriate actions should be taken for patient treatment and controlling infection by considering the factors associated with increased resistance and appropriate planning to eliminate those factors and prescription of the antibiotics after culture and sensitivity testing. it’s recommended that the guideline for standard analysis of the resistance towards vancomycin be notified to all laboratories so that the standard method could be applied and accurate information regarding the resistance degree could be reported.

References: