

Antibiotic Susceptibility of *Staphylococcus aureus* in Isolates of the Patients with Osteomyelitis

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Abstract: *Staphylococcus aureus* (*S. aureus*) is an important cause of infection both as community acquired and hospital acquired infection. Osteomyelitis is an invasive infectious disease that is hard to treat. It usually needs long periods of treatment. The most prevalent cause of osteomyelitis is *S. aureus*. The present study has been carried out with an aim to know the prevalence and antibiotic sensitivity pattern of *S. aureus* isolates of patients with osteomyelitis with E-test method. Our results showed high resistance of oxacillin, vancomycin, clindamycin, trimethoprim-sulfamethoxazole, tetracycline and ciprofloxacin. We can see that *S. aureus* is becoming more and more resistant to different antibiotics and when this resistance to the essential, last line of treatment antibiotics reaches to its crucial thresholds, it is too late to plan and make policies against irrational antibiotic use, especially in Iran.

Key words: *Staphylococcus aureus* • Methicillin-Resistant *Staphylococcus aureus* • Vancomycin Resistance

INTRODUCTION

Staphylococcus aureus (*S. aureus*) is an important cause of infection both as community acquired and hospital acquired infections [1]. It also may lead to serious complications as pneumonia, septicemia, arthritis and osteomyelitis [2]. Different strains of bacteria have shown antimicrobial resistance due to wide and unwise use of antibiotics [3-5]. There are now various reports of methicillin resistance *S. aureus* (MRSA) in different regions of the world [6-8]. These MRSA isolates are vastly resistant to a range of antibiotics [9]. Nowadays reports of its resistance to second and even third lines of treatment appear to merge as a threat to medicine [10]. It results an increase in morbidity and mortality. It also makes patients to stay more in hospitals as prolonged treatment time and so increase treatment costs [11].

Osteomyelitis is an invasive infectious disease that is hard to treat. It usually needs long term of treatment [12]. Various pathogens play a role in osteomyelitis

nevertheless *S. aureus* is an important and prevalent one [13]. Proper antibiotic therapy is very important in treating Osteomyelitis; when appropriate antibiotic treatment is delayed, more adverse complications and extra hospital costs are expectable [14].

Considerable controversy still exists over the current and future roles of vancomycin in controlling serious MRSA infections. Therefore, periodic studies on Vancomycin resistance *S. aureus* (VRSA) and vancomycin-intermediate *S. aureus* (VISA) are substantial [11].

Previous reports showed a high antibiotic resistance rate among *S. aureus* isolates of samples of patients admitted to Shahidbeheshti hospital and a high rate of VISA have been observed [11]. The present study has been carried out in Alzahra Hospital, a medical college hospital in Esfahan with an aim to know the prevalence and antibiotic sensitivity pattern of *S. aureus* isolates of patients with osteomyelitis, in order to utilize the information obtained and formulate antibiotic policy and appropriate control measures in the future.

MATERIALS AND METHODS

The study conducted on 100 *S. aureus* isolates that obtained from wound or bone biopsy samples of patients admitted to Alzahra Hospital of Esfahan from June 2010 to September 2012. The samples were cultured on blood agar and MacConkey agar plates and incubated aerobically at 37°C for 24 hours. Standard tests like catalase, slide and tube coagulase and growth on mannitol salt agar were used to identify the strains [12] and E-test strips of Oxacillin, Vancomycin, Clindamycin, Trimethoprim-sulfamethoxazole, Tetracycline and Ciprofloxacin placed on distinct plates. MIC (Minimum inhibitory concentration) results were obtained by E-test method. Three interpretive categories of susceptibility results (sensitive, intermediate and resistant) were defined according to company manual. All mentioned substances had been provided by a domestic manufacturer (Padtan Company). Statistical analyses were done with statistical package of social sciences, version 16.0 (SPSS Inc, Chicago, IL).

RESULTS

Fifty nine male (59%) and 41 female (41%) subjects with chronic osteomyelitis with positive growth of *S. aureus* were included in this study. Mean age was 48.39 years with age range of 15 to 75 years. Figure 1 summarizes the results of E-test of *S. aureus* in the samples of the patients.

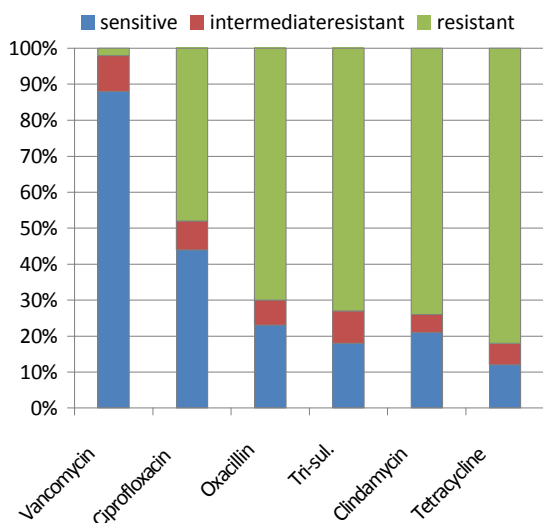


Fig. 1: *S. aureus* resistance to different antibiotics
Tri-sul.= Trimethoprim-sulfamethoxazole

DISCUSSION

Chronic osteomyelitis has a heavy burden on the affected patients and societies. Several orthopedic surgeries and hospitalizations are needed, however, vast expenses of treatment are necessary and many of the patients get serious complications from this chronic disease [15].

We studied the antimicrobial susceptibility of 100 wound or bone biopsy samples with positive growth of *S. aureus* in patients admitted to Alzahra Hospital due to osteomyelitis. Our results showed that 70% of these *S. aureus* samples were MRSA. Resistance rate of these samples to Vancomycin, Ciprofloxacin, Oxacillin, Trimethoprim-sulfamethoxazole, Clindamycin and Tetracycline were 2, 48, 70, 73, 74 and 82% respectively. MRSA strains of *S. aureus* are hard to cure and may cause greater mortality because of treatment failure [11]. Its danger is more felt when we look back at the rates of *S. aureus* resistance rates that the authors of this article previously announced [7, 8, 11]; Prevalence of MRSA in Kashan announced as 24.7% in diabetic patients [7]. In the other study conducted on cultures of 403 children admitted to Shahidbeheshti hospital, 49.1% were colonized with *S. aureus* and 68.6% were MRSA [8]. In the third study that was conducted on 503 *S. aureus* isolates obtained from different origins in Shahidbeheshti hospital of Kashan, 38.5% of *S. aureus* samples were MRSA [11].

There are several regional studies on *S. aureus* isolated from several infection sites except osteomyelitis. Mostafavizadeh *et al.* [16] reported 75% MRSA strains from nosocomial infections by E-test which differs from our MRSA isolation rate. They studied 72 samples from different origins (wound, blood, synovial fluid and abscess). They announced 6.5% VRSA rate, while we only found 2% VRSA in our study. The probable reason for this can be the difference in location of samples (osteomyelitis versus nosocomial infections) and consequently difference in strains [16]. Moreover, this confirms difference in *S. aureus* strains from different locations so if we are aware of MRSA and VISA and VRSA strains in nosocomial infections of Iran, it is needed to carry out similar periodical studies on osteomyelitis or other infection sites.

Izadi *et al.* [17] studied 131 patients with osteomyelitis and found *S. aureus* as the most prevalent cause of this disease. They announced the resistance rates of *S. aureus* to Vancomycin, oxacillin, tetracycline, ciprofloxacin, trimethoprim-sulfamethoxazole and

clindamycin as 0, 68.5, 72, 46.6, 66.6 and 60.7% respectively. These results are in conductance with our results but our results are slightly higher.

In this study two isolates were resistant to vancomycin and 10 isolates had intermediate resistance. Although strains with vancomycin resistant were observed in the previous published results of the authors [7, 8, 11], these results make us think about the possibility of increasing the resistance rate of *S. aureus* to vancomycin that is now the last line of treatment in many ill patients.

CONCLUSION

Our results showed high resistance for Oxacillin, Vancomycin, Clindamycin, Trimethoprim-sulfamethoxazole, Tetracycline and Ciprofloxacin. We can see that *S. aureus* resistance grows to different antibiotics and when resistance arises to the essential last line of treatment, reaches its crucial thresholds; it is too late to plan and make policies against irrational antibiotic use, especially in Iran.

REFERENCES

1. Al-Baidani, A.H., W.A. El-Shouny and T.M. Shawa, 2011. Antibiotic Susceptibility Pattern of Methicillin-Resistant *Staphylococcus aureus* in Three Hospitals at Hodeidah City, Yemen. *Global Journal of Pharmacology*, 5(2): 106-111.
2. Akindele, A.A., I.K. Adewuyi, O.A. Adefioye, S.A. Adedokun and A.O. Olaolu, 2010. Antibigram and Beta-Lactamase Production of *Staphylococcus aureus* Isolates from Different Human Clinical Specimens in a Tertiary Health Institution in Ile-ife, Nigeria. *American-Eurasian Journal of Scientific Research*, 5(4): 230-233.
3. Moinszadeh, F., Z. Arabi and A. banazadehi, 2013. Prevalence and Antimicrobial Susceptibility Patterns of Uropathogens among Patients Referring to Valieasr Laboratory in Najafabad, Isfahan, Iran. *Middle-East Journal of Scientific Research*, 13(1): 85-90.
4. Ponnusamy, P. and R. Nagappan, 2013. Extended Spectrum Beta-Lactamase, Biofilm-producing Uropathogenic Pathogens and Their Antibiotic Susceptibility Patterns from Urinary Tract Infection- An Overview. *International Journal of Microbiological Research*, 4(2): 101-118.
5. Sharif, M.R., J. Alizargar and A. Sharif, 2013. Antimicrobial Resistance among Gram-Negative Bacteria Isolated from Different Samples of Patients Admitted to a University Hospital in Kashan, Iran. *Advances in Biological Research*, 7(5): 199-202.
6. El-Jakee, J.K., N.S. Atta, A.A. Samy, M.A. Bakry, E.A. Elgabry, M.M. Kandil and W.A. Gad El-Said, 2011. Antimicrobial Resistance in Clinical Isolates of *Staphylococcus aureus* from Bovine and Human Sources in Egypt. *Global Veterinaria*, 7(6): 581-586.
7. Alizargar, J., M.R. Sharif and A. Sharif, 2013. Risk Factors of Methicillin-Resistant *Staphylococcus aureus* Colonization in Diabetic Outpatients, A Prospective Cohort Study. *International Journal of Microbiological Research*, 4(2): 147-151.
8. Sharif, M.R., J. Alizargar and A. Sharif, 2013. Prevalence of Methicillin-Resistant *Staphylococcus aureus* Nasal Carriage in Children Admitted to Shahidbeheshti Hospital. *World Journal of Medical Sciences*, 9(2): 109-112.
9. Khatoon, A., M. Kamal, S.F. Hussain, W. Alam, O. Rauf and S.M. Shahid, 2010. Antimicrobial Susceptibility Patterns and Identification of Plasmid-born Methicillin Resistant *Staphylococcus aureus*. *American-Eurasian J. Agric. and Environ. Sci.*, 7(2): 139-145.
10. Sadek, S.A., A.T. Abdelrahman, N.G. Abdelkader and M.E.A. Abdelrahim, 2013. Clinical and Microbiological Effect of Linezolid on Methicillin-Resistant *Staphylococcus aureus* (MRSA) Colonization in Healthcare Workers in Egypt. *Middle-East Journal of Scientific Research*, 15(10): 1440-1449.
11. Sharif M.R., J. Alizargar and A. Sharif, 2013. Prevalence and Antimicrobial Susceptibility Pattern of *Staphylococcus aureus* Isolates at Shahidbeheshti Hospital. *World Journal of Medical Sciences*, 9(2): 84-87.
12. Muñoz, P. and E. Bouza, 1999. Acute and Chronic Adult Osteomyelitis and Prosthesis-related Infections. *Baillieres Best Practice and Research Clinical Rheumatology*, 13(1): 129-147.
13. Darley, E.S.R. and A.P. MacGowan, 2004. Antibiotic Treatment of Gram-positive Bone and Joint Infections. *Journal of antimicrobial chemotherapy*, 53(6): 928-935.

14. Gentry, L.O., 1998. Osteomyelitis: Options for Diagnosis and Management. *The Journal of antimicrobial chemotherapy*, 21(Suppl C): 115-131.
15. Mader, J.T., M.E. Shirtliff, S.C. Bergquist and J. Calhoun, 1999. Antimicrobial Treatment of Chronic Osteomyelitis. *Clinical Orthopaedics and Related Research*, 360: 47-65.
16. Mostafavi zadeh, K., F. Khorvash, S. Mobasheri zadeh and M. Fasihi dastjerdi, 2008. Study of Drug Resistance of *Staphylococcus aureus* by Etest Method. *J Med Coun I R of IRAN*, 26(4): 522-529.
17. Izadi, M., S.A. Mosavi, H. Araqizadeh, K.S. Forutran, Sh. Shirvani, N. Joneidi, M. Jannesari, B. Kalantari and R. Bidar, 2008. Clinical and Paraclinical Features of Chronic Osteomyelitis in War Handicapped Patients in Sasan Hospital in 1385-1387. *Journal of Military Medicine*, 10(1): 63-68.