

Original Research Article

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Study of Antibiotic Susceptibility Pattern in *Staphylococcus aureus* Isolated from Skin and Soft Tissue Infections in a Tertiary Care Hospital

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ABSTRACT

Staphylococcus aureus is responsible for widespread infections in the community as well as hospital settings. Rapid emergence of resistance to antibiotics is well known in this organism; particularly in the Methicillin resistant *Staphylococcus aureus* (MRSA). So present study was carried out to detect current trend in the antibiotic susceptibility of *S. aureus* isolated from skin and soft tissue infections which in turn will be helpful for choosing empirical antibiotics for these infections. The study was conducted in our tertiary care hospital during the period of January to December 2016. *S. aureus* isolated from all the skin and soft tissue infections were included in the study. Antibiotics tested were- penicillin, amoxicillin-clavulanate, cefazolin, doxycycline, erythromycin, ciprofloxacin, trimethoprim-sulfamethoxazole, vancomycin and teicoplanin. Out of 320 *S. aureus* isolates, 138 (43.1%) were MRSA while 182 (56.9%) were methicillin sensitive *Staphylococcus aureus* (MSSA). Highest resistance was observed among ciprofloxacin (86.6%), penicillin (79.7%) and amoxicillin-clavulanate (78.1%). Doxycycline and trimethoprim-sulfamethoxazole had maximum sensitivity of 86.9% and 73.8% respectively. All MRSA showed 100% sensitivity to vancomycin and teicoplanin. With this sensitivity pattern, this study emphasizes that doxycycline and trimethoprim-sulfamethoxazole are the drug of choice for empirical treatment of skin and soft tissue infections caused by *Staphylococcus aureus*.

Keywords

Staphylococcus aureus, MRSA, Antibiotic susceptibility, Antibiotic resistance, Skin and soft tissue infections.

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Introduction

Staphylococcus aureus is a ubiquitous organism responsible for widespread infections both in community as well as in hospital settings (Tianming Li *et al.*, 2013). These infections include pneumonia, skin and soft tissue infections, osteomyelitis, endocarditis, toxic shock syndrome etc. Skin and soft tissue infections ranged from furuncle, carbuncle, boil, impetigo, erysipelas, cellulitis, abscesses to surgical site infections etc. Incision and drainage is the primary therapy for abscesses. Along with surgical

intervention, the empirical antibiotics are given for these skin and soft tissue infections. These include synthetic penicillins, first or second generation oral cephalosporins, macrolides or clindamycin. (Dennis L. Stevens *et al.*, 2005). But staphylococcus is known for its development of rapid resistance to methicillin (MRSA). In MRSA, beta lactam antibiotics are ineffective which are most common antibiotics prescribed for the treatment of skin and soft tissue infections caused by the *Staphylococcus aureus*.

With this background, it is crucial to know the antibiotic susceptibility pattern of *Staphylococcus aureus* in these infections for better management of patients, so present study was carried out in our hospital to find out the current trend in the antibiotic susceptibility of *Staphylococcus aureus* so that it can be utilized to formulate the empirical treatment for these skin and soft tissue infections.

Materials and Methods

The present study was carried out in a tertiary care hospital from January 2016 to December 2016. All specimens from skin and soft tissue infections were included in the study. All the specimens were inoculated on to blood agar and MacConkey's agar and incubated at 35⁰C for 24 hours. *S. aureus* was identified with standard tests such as gram stain, catalase, slide and tube coagulase etc. Antibiotic susceptibility testing was performed using standard disk diffusion method recommended by Clinical Laboratory Standards Institute (CLSI) (CLSI 2015). The following antibiotics were used- Penicillin (10U), Amoxicillin-clavulanate (20/10µg), Cefazolin (30µg), doxycycline (30µg), erythromycin (15µg), ciprofloxacin (5µg), trimethoprim-sulfamethoxazole (1.25/23.75µg), vancomycin (30µg) and teicoplanin (30µg). Methicillin resistance was detected by using cefoxitin (30µg) screening test as per CLSI guidelines. Vancomycin and teicoplanin were tested only for MRSA. ATCC 25923 *S. aureus* was used as quality control for interpretation of antibiotic susceptibility testing.

Results and Discussion

Total 320 *S. aureus* were isolated from skin and soft tissue infections. Out of 320 isolates, 182 (56.9%) were Methicillin sensitive *S. aureus* (MSSA) and 138 (43.1%) were

Methicillin resistant *S. aureus* (MRSA). Sensitivity results of different antibiotics are shown in the table 1 and chart 1.

Highest resistance was observed among ciprofloxacin (86.6%), penicillin (79.7%) and amoxicillin-clavulanate (78.1%). Doxycycline and trimethoprim-sulfamethoxazole had maximum sensitivity of 86.9% and 73.8% respectively. All MRSA were 100% sensitive to vancomycin and teicoplanin.

Treatment of *S. aureus* has always remained challenging because of its rapid resistance to many antibiotics. So selection of appropriate antibiotic for *S. aureus* is essential to avoid treatment failure.

MRSA strains are rapidly increasing both in community and hospital settings. In the present study 43.1% isolates were MRSA. Similar findings were seen in the study by Indian Network for surveillance of antimicrobial resistance (INSAR) group. They found prevalence of MRSA to be 42% in 2008 and 40% in 2009 (INSAR group, 2013).

Mild skin and soft tissue infections are treated with synthetic penicillins, first or second generation oral cephalosporins, macrolides or clindamycin (Dennis Stevens *et al.*, 2005). This study showed that beta lactam antibiotics like penicillin, Amoxicillin-clavulanate had highest resistance, 79.7% and 78.1% respectively in MSSA. Cefazolin had resistance of 53.4%. These antibiotics are ineffective in MRSA. In Onwubiko *et al.*, study showed sensitivity of penicillin and Amoxicillin-clavulanate to be 7.1% and 63% (Onwubiko and Sadiq *et al.*, 2011). These findings of high resistance with beta lactam antibiotics suggest that they should not be used as empirical treatment even in MSSA.

Doxycycline followed by co-trimoxazole had highest sensitivity of 86.9% and 73.8%

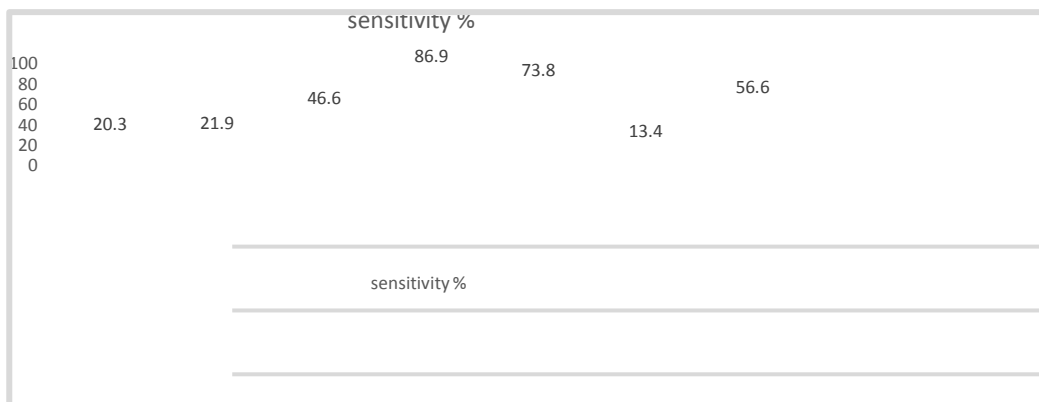
respectively in our study. These findings correlate with other studies where these antibiotics had high sensitivity (Mazhar Salim AL-Zoubi *et al.*, 2015, Abbas *et al.*, 2015, Huang *et al.*, 2006). Gemmell *et al.*, in their guidelines for prophylaxis and treatment of MRSA recommended use of tetracyclines for skin and soft tissue infections (Gemmell *et al.*, 2006). Also both in vitro and clinical studies supported the use of doxycycline

(Ruhe and Menon *et al.*, 2007; Ruhe *et al.*, 2005). Review literature on clinical use of co-trimoxazole by Goldberg and Bishara recommended this drug for treatment of MRSA in skin and soft tissue infections (Goldberg and Bishara *et al.*, 2012). Ciprofloxacin had highest resistance of 86.6% in our study. Similar findings were seen by Gade *et al* study (Gade Qazi *et al.*, 2013).

Table.1 Antibiotic susceptibility pattern of *S. aureus* (n=320)

Antibiotics	Sensitivity (no.,%)	Resistance (no, %)
Penicillin	65 (20.3)	255 (79.7)
Amoxicillin-clavulanate	70 (21.9)	250 (78.1)
Cefazolin	149 (46.6)	171 (53.4)
Doxycycline	278(86.9)	42 (13.1)
Co-trimoxazole	236 (73.8)	84 (26.2)
Ciprofloxacin	43 (13.4)	277 (86.6)
Erythromycin	181(56.6)	139(43.4)

Chart.1 Antibiotic sensitivity pattern of *S. aureus*



Erythromycin was 56.6% sensitive similar to other studies (Onwubiko and Sadiq *et al.*, 2011; Mazhar Salim AL-Zoubi *et al.*, 2015; Abbas *et al.*, 2015). Mild skin and soft tissue infections can be managed with surgical intervention and appropriate antibiotic use. Selection of antibiotics needs regular surveillance of antibiotic susceptibility pattern. Our study suggests use of doxycycline and co-trimoxazole for mild skin and soft tissue infections on the

basis of in vitro susceptibility results. But more in vivo studies are required to evaluate clinical outcome in the patients after treatment with these antibiotics. Vancomycin and linezolid should be preserved for severe skin and soft tissue infections and bacteremia.

In conclusion, mild skin and soft tissue infections caused by *S. aureus* (both MSSA and MRSA) can be empirically treated by

doxycycline, co-trimoxazole or erythromycin. Due to high resistance of beta lactam antibiotics and ciprofloxacin, they should not be used without antibiotic susceptibility testing reports. More clinical studies are needed to evaluate clinical outcome of these drugs. Vancomycin should be used only for severe infections caused by *S. aureus*.

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