JOURNAL OF PURE AND APPLIED MICROBIOLOGY, June 2013. Vol. **7**(2), p. 1379-1382

Prevalence and Antibiotic Susceptibility Pattern of *Staphylococcus aureus* Isolated from Personnel and Patients in Roudbar Hospitals (Northern Iran)

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(Received: 10 September 2012; accepted: 07 November 2012)

Staphylococcus aureus **is a major bacterial pathogen that causes different community and hospital-acquired infections. The sources of infection include patients, healthy carriers and animals. The physicians and nurses that have staphylococcal wounds on their hands or around the nails, in nose and mouth may be the source of new infection for their patients. In this study, 240 samples (53.33% male and 46.66% female) were taken from oropharynx and nasopharynx of patients, nurses, cooks and administrative staff in Roudbar Hospitals (Northern Iran), and identified with tests such as coagulase and culture in blood and mannitol salt agar medium. 82 (31.25% male and 37.5% female) clinical isolates of *S. aureus* were collected. All positive cultures which yielded *S. aureus* underwent antimicrobial susceptibility testing using the Kirby-Bauer disk diffusion method on Mueller-Hinton agar. The results were interpreted after 24 hours of incubation at 37°C. The prevalence of *S. aureus* higher in nurses (66.66%), administrative staff (37.5%) and cooks (30%), as compared to patients. The most and the least positive cases belong to 11-20 (50%) and 51-60 (41.66%) year age groups, respectively. The overall, 100% of *S. aureus* strains were resistant to ampicillin and 92.68% to penicillin, while 92.68% sensitive to co-trimoxazole, 90.24% to ciprofloxacin, vancomycin and gentamicin. Overall, conducting similar researches in other remedial centers of our country and summarizing them can help to determine bacterial prevalence and antibiotic susceptibility pattern in *S. aureus* considerably in Iran. It is not necessary to use antibiotics in order to treat many diseases and arbitrary use of antibiotics should be avoided seriously.**

Key words: *Staphylococcus aureus*, Antibiotic Resistance, Susceptibility, Nosocomial Infection.

The genus *Staphylococcus* is widely distributed in nature being part of the indigenous microflora of the skin and nasal cavities of healthy persons. This association with the skin presents the organisms with an opportunity to cause local infection of wounds [1]. *S. aureus* is a major bacterial pathogen that can cause infection in a variety of body organs and tissues including skin and soft tissue. It may also cause infective endocarditis, bacteremia, pneumonia, osteomyelitis, infective arthritis, and urinary tract infection [2]. Colonization of *S. aureus* in humans is a critical prerequisite of subsequent clinical infection of the skin, blood, lung, heart, and other deep tissues, and also sepsis[3]. *S. aureus* infections are growing problems worldwide with mortality rates ranging from 6% to 40% [4]. Risk factors for colonization include young age, male sex, underlying comorbidities, sharing a carriers household, smoking, having a history of

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hospitalization, and recent contact with animals [5]. *S. aureus* has become resistant to various antimicrobial agents including the commonly used penicillin related antibiotics. Multi drug resistant strains of *S. aureus* have been reported with increasing frequency worldwide [6]. Asymptomatic carriage of *S. aureus* in healthy individuals has a high prevalence and it can be the source of transmission to other susceptible persons [7]. Therefore, identification of *S. aureus* carriers is a key point in an infection control program, enabling treatment before infection develops [8]. The present study was conducted to determine the prevalence and antibiotic susceptibility pattern of *S. aureus* strains isolated from personnel and patients in Rudbar Hospitals, Guilan. Iran.

MATERIAL AND METHODS

This cross sectional study was carried out during winter 2011 to spring 2012. 240 samples were taken from oropharynx and nasopharynx of patients, nurses, cooks and administrative staff in Roudbar Hospitals (Northern Iran). All isolates were cultured on blood and chocolate agar as growth medium and incubated at 37 °C for 18 to 24 h. All positive cultures which yielded *S. aureus* (identified by different tests including Gram Stain, catalase and coagulase tests, and culture of isolates on mannitol salt and DNase agar media), underwent antimicrobial susceptibility testing using the Kirby-Bauer disk diffusion method on Mueller-Hinton agar [9]. The results were interpreted after 24 h of incubation at 37°C, and resistant according to the zone diameter around each antibiotic disk. The antibiotic disks included penicillin, ampicillin, co-trimoxazole, gentamycin, erythromycin, ciprofloxacin, vancomycin, clindamycin, dicloxacillin, amoxicillin and methicillin. Statistical analyses were performed using SPSS software.

RESULTS

A total of 240 samples (53.33% male and 46.66% female) were taken from oropharynx and nasopharynx of patients (44.16%), nurses (7.5%), cooks (8.33%) and administrative staff (40%), 82 (31.25% male and 37.5% female) clinical isolates of *S. aureus* were collected (Table 1).

Table 1. Distribution of *S.aureus* carriers from personnel and patients in Roudbar Hospitals

Personnel	Total (%) (n=240)	Positive (%) (n=82)
Patients	106 (44.16)	28(26.41)
Nurses	18(7.5)	12(66.66)
Cooks	20 (8.33)	6 (30)
Administrative staff	96 (40)	36 (37.5)

Of 106 patients, 38 and 68 samples were illiterate and literate (having high school diploma and college degree), respectively. Among 38 illiterate patients, 8 (2 positive cases) were male and 30 (4 positive cases) were female. Of 68 literate patients, male and female cases were 34 (10 positive cases) and 34 (12 positive cases), respectively. (Table 2).

Table 2. Distribution of *S.aureus* carriers according to education levels in Roudbar Hospitals

Education levels	Total n (%)	Positive n (%)
Illeterate	38(15.83)	6(15.7)
High school	64(26.66)	56(87.5)
College educated	138(57.5)	20(14.49)

Total 240 samples for studying existence of *S. aureus* carriers were divided into 8 age groups (Table 3). The most and the least positive cases belong to 11-20 (50%) and 51-60 (41.66%)year age group, respectively.

Table 3. Distribution of *S.aureus* carriers according to age distribution in Roudbar Hospitals

Age groups(years)	Totaln (%)	Positiven (%)
0-10	6(2.5)	2(3.33)
11-20	6(2.5)	3(50)
21-30	50(2.83)	18(36)
31-40	76(31.66)	28(36.84)
41-50	56(23.33)	16(28.57)
51-60	24(10)	10(41.66)
61-70	8(3.33)	2(25)
71-80	14(5.83)	3(21.42)

The sensitivity of *S. aureus* isolates to the tested antibiotics is shown in Table 4. 100% of *S. aureus* strains were resistant to ampicillin and 92.68% to penicillin, while 92.68% sensitive to co-trimoxazole, 90.24% to ciprofloxacin, vancomycin and gentamicin.

Table 4. Antibiotic susceptibility patterns for *S. aureus* isolated from personnel and patients in Roudbar Hospitals

Antibiotic	Sensitive n (%)	Intermediate n (%)	Resistant n (%)
Penicillin	4(4.88)	2(2.44)	76(92.68)
Ampicillin	0(0.0)	0(0.0)	82(100)
Erythromycin	56(68.3)	0(0.0)	26(31.71)
Ciprofloxacin	74(90.24)	4(4.88)	4(4.88)
Vancomycin	74(90.24)	0(0.0)	8(9.76)
Co-trimoxazole	76(92.68)	6(7.32)	0(0.0)
Clindamycin	12(14.63)	50(60.98)	20(24.4)
dicloxacillin	52(63.41)	6(7.32)	22(26.83)
Gentamicin	74(90.24)	8(9.76)	0(0.0)
Amoxycillin	10(12.2)	0(0.0)	72(87.80)
Methicillin	12(14.63)	14(17.07)	56(68.29)

DISCUSSION

S. aureus is known as an important bacterial pathogen that can cause community and hospital-acquired infections with high morbidity and mortality rate in spite of the use of antibiotics. *S. aureus* mainly cause opportunistic infections acquired from different sources like patients, hospital staff mainly through their hands and also from their normal flora. The common types of disease caused by *S. aureus* are various types of infections including, Staphylococcal scalded skin syndrome (SSSS), Osteomyelitis, Meningitis, Pneumonia, Septicemia, Gastroenteritis etc [10]. Strains of *S. aureus* that are resistant to methicillin, oxacillin and all other β-Lactam antibiotics have spread worldwide from the last four decades [11]. In the present study, it was observed that the highest carriage rate was in nurses (66.66%), followed by administrative staff (37.5%) and cooks (30%), while carriage rate among patients was comparatively low (26.41%). In 2003, Dimitrov *et al*, found 21% and 14.4% *S. aureus* carriage in physicians and nurses, respectively [12]. In study Rashid *et al*, The prevalence of *S. aureus* and MRSA nasal carriage was significantly ($p < 0.05$) higher in physicians (51.8%, 18.5%), nurses (66.6%, 27.3%) and sanitary workers (59%, 13.6%) as compared to administrative staff (27.6%, 2.1%) [13]. In study Yazgi *et al, S. aureus* carriage was 27.5% and 34.9% in health care workers [14]. In study Farzana *et al*, prevalence of *S. aureus* carriage was 48%; out of these 29% were MRSA [15]. Akoua *et al*, reported the carriage rate of *S. aureus* 45.4%, out of these 38.7% strains were resistant to methicillin [16]. In current study, 68.29% strains were resistant to methicillin. The highest level of resistance of *S. aureus* strain has been observed with ampicilin (100%), penicillin (92.68%) and methicillin (68.29%). In study Singh Navneet *et al*, showed the highest level of resistance pattern penicillin (100 %), amoxicillin (100%), amoxycillin-clavulinic acid (100%), ciprofloxacin (100%) and cefalexin (100%), methicillin (100%) [11]. Tiwari *et al*, the highest level of resistance of *S. aureus* strain has been observed with penicillin (100%), amoxicillin (91.9%) and cefalexin (55.5%) [17]. In study Khorvash *et al*, The high susceptibility of *S. aureus* to vancomycin (100%), clindamycin (95.2%), and rifampicin (92.9%) [8]. Heysell *et al*. reported all their isolates to be susceptible to vancomycin [18]. In our study high susceptibility of *S. aureus* strain has been observed co-trimoxazole (92.68%), ciprofloxacin (90.24%) vancomycin (90.24%) and gentamicin (90.24%). Generally, in our study, 100% of *S. aureus* strains were resistant to ampicillin and 92.68% to penicillin, while 92.68% sensitive to co-trimoxazole, 90.24% to ciprofloxacin, vancomycin and gentamicin. Different results have been obtained in the performed various studies, but all of them share this point that antibiotic resistance in S. aureus increases more and more. In conclusion, as hospital personnel are at high risk of transmitting *S. aureus*, they should remain vigilant to follow appropriate measures for minimizing transmission. The appropriate use of antibiotics could retard or prevent the emergence and spread of resistant bacteria.

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