

ANTIBIOTIC SUSCEPTIBILITY OF STAPHYLOCOCCUS AUREUS STRAINS ISOLATED FROM BLOODSTREAM INFECTIONS

KAN DOLAŞIMI İNFEKSİYONLARINDAN İZOLE EDİLEN STAPHYLOCOCCUS AUREUS SUŞLARININ ANTİBİYOTİKLERE DUYARLILIKLARI

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SUMMARY

Bloodstream infections (BSI) have high morbidity and mortality rates. *Staphylococcus aureus* is one of the two most common causes of BSI. Methicillin resistance has been increased in *S.aureus* strains. In this study, antimicrobial susceptibility patterns of *S.aureus* isolated from BSI has been evaluated.

Blood cultures were performed with automated system. The isolates were identified as *S.aureus* by conventional methods and antimicrobial susceptibility were determined by Kirby-Bauer disc diffusion method according to the criteria of Clinical Laboratory Standards Institute

Of the 274 *S.aureus* strains, 132 (48.2%) were MRSA (methicillin resistant *S.aureus*) and 142 (51.8%) were MSSA (methicillin susceptible *S.aureus*). MRSA strains showed resistance to multiple antibiotics. The susceptibility rates of vancomycin, gentamycin, erythromycin, tetracycline and ciprofloxacin in methicillin resistant strains (MRSA) were 100%, 13%, 12%, 10% and 9%, respectively. In the methicillin susceptible group; susceptibility rates of vancomycin, gentamycin, tetracycline ciprofloxacin and erythromycin, were 100%, 97%, 94 %, 93 % and 91 %, respectively. The incidence of methicillin-resistant *S.aureus* was 25.7% in 2003 and increased to 67.8% in 2006 (For 2004, 2005 and 2006 were 36.7%, 42.2% and 67.8%, respectively) but decreased to 57.1% in 2007

In every region; antimicrobial susceptibility profile and colonisation rate of *S.aureus* strains should be provided for better management of the BSI and to develop rational strategies for public health policies.

Keywords: *Staphylococcus aureus*, bloodstream infection, methicillin resistance

ÖZET

Kan dolaşım infeksiyonları (KDİ) yüksek morbidite ve mortaliteye sebep olur. *S.aureus* kan dolaşımı infeksiyonlarına en sık sebep olan iki etkenden bir tanesidir. Metisilin direnci *S.aureus* suşlarında artmaktadır. Bu çalışmada KDİ'dan izole edilen *S.aureus* suşlarının antimikrobiyal duyarlılıkları araştırıldı.

Kan kültürleri için otomatize sistem kullanıldı. İzole edilen suşlar konvansiyonel yöntemlerle *S.aureus* olarak tanımlandı ve antimikrobiyal duyarlılıkları Kirby-Bauer disk difüzyon yöntemi ile CLSI kriterlerine göre araştırıldı.

274 *S.aureus* suşunun 132'si (%48.2) MRSA ve 142'si (%51.8) MSSA'dı. MRSA suşlarının; vankomisin, gentamisin, eritromisin, tetrasiklin ve siprofloksasine duyarlılık oranları sırasıyla; %100, %13, %12, %10 ve %9 olarak bulunmuştur. MSSA suşlarının vankomisin, gentamisin, tetrasiklin, siprofloksasin ve eritromisine duyarlılık oranları ise sırasıyla %100, %97, %94, %93 ve %91 olarak bulunmuştur. MRSA insidansı 2003 yılında %25.7 iken 2006 yılında %67.8'e yükselmiş (2004,2005,ve 2006 yıllarında sırasıyla %36,7,%42,2 ve %67,8).ancak bu oran 2007 yılında %51.7 düşmüştür.

Kan dolaşımı infeksiyonlarını daha doğru tedavi edebilmek ve toplum sağlığını koruma adına planlamalar yapabilmek için her bölgede *S.aureus* suşlarının antimikrobiyal duyarlılık profili ve kolonizasyon oranları bilinmelidir.

Anahtar sözcükler: *S.aureus*, kan dolaşım infeksiyonları, metisilin direnci.

INTRODUCTION

Bloodstream infections (BSI) have high morbidity and mortality rates through out the world^(1,2,3). The antimicrobial resistance of the pathogens isolated from BSI has been increased^(4,5). *Staphylococcus aureus* was reported as one of the two most common causes of BSI in the United States, Europe and all around the world^(6,7). *S.aureus* is a virulent bacterium⁽⁸⁾. Many of *S.aureus* strains had become resistant to methicillin (MRSA) and currently the prevalence of MRSA infections is increasing^(6,9,10,11). Some previous studies reported that BSI with MRSA have higher mortality rates than those with MSSA, because MRSA strains are more resistant to antimicrobial drugs than MSSA and because of the increased resistance; the treatment of MRSA infections is more difficult^(12,13). So, it is important to know antimicrobial susceptibility patterns of *S.aureus* isolated from BSI as initial antimicrobial chemotherapy is generally empiric⁽⁶⁾. In this retrospective study; antimicrobial susceptibility profiles of *S.aureus* strains isolated from bloodstream infections between 2003 and 2007 have been documented.

MATERIALS AND METHODS

Blood cultures were performed with automated System; Bactec 9240 (Becton Dickinson, Diagnostic Instrument System, Sparks, MI, USA). The isolates were identified as *S.aureus* by conventional methods. Antimicrobial susceptibility of vancomycin, ciprofloxacin, erythromycin, gentamycin and tetracycline were determined by Kirby–Bauer disc diffusion method according to the criteria of Clinical Laboratory Standards Institute⁽¹⁴⁾. For methicillin susceptibility cefoxitin (30 µg) disc (Becton Dickinson) was used.

RESULTS

Between the years 2003 and 2007, 274 *S.aureus* strains were isolated from bloodstream infections (BSI); 134 from internal medicine, 43 from pediatrics, 22 from neurology, 27 from surgery, 18 from emergency, 21 from intensive care unit, 4 from urology, 4 from dermatology and 1 from gynecology departments, respectively (Table 1).

Of the 274 *S. aureus* strains; 132(48.2%) were MRSA and 142(51.8%) were MSSA. MRSA strains

Table 1. The number of isolates per department.

Departments	No of Isolates
Internal medicine	134
Pediatrics	43
Neurology	22
Surgery	27
Emergency	18
Intensive care unit	21
Urology	4
Dermatology	4
Gynecology	1
Total	274

showed resistance to multiple antibiotics. The susceptibility rates of vancomycin, gentamycin, erythromycin, tetracycline and ciprofloxacin in methicillin resistant strains (MRSA) were 100%, 13 %, 12 %, 10% and 9%, respectively. In the methicillin susceptible group; susceptibility rates of vancomycin, gentamycin, tetracycline ciprofloxacin and erythromycin, were 100%, 97%, 94 %, 93 % and 91 %, respectively (Table 2).

The incidence of methicillin-resistant *S.aureus* was 25.7% in 2003 and increased till 2006 (For 2004, 2005 and 2006 were 36.7%, 42.2% and 67.8%, respectively). By contrast, we observed a decrease in the incidence of methicillin-resistant *S.aureus* as it was 57.1% in 2007 (Table 3).

DISCUSSION

S.aureus is a virulent bacterium and worldwide; one of the most common causes of BSI^(7,8). Methicillin resistance rate in *S.aureus* strains is increasing^(9,11). In previous studies, it is suggested that MRSA infections are associated with increased mortality and morbidity than MSSA^(12,13,15). Libert et al.⁽¹²⁾ reported living out of home and prior antibiotic exposure as risk factors for methicillin resistance in *S.aureus* BSI. Additionally; hospital-acquired MRSA is another important risk factor for MRSA BSI. MRSA colonisation can cause nosocomial BSI because of the invasive procedures and long hospital stay increases the risk of colonization with MRSA^(12,16). In a retrospective cohort study of 15-years' period; Wang et al.⁽¹⁷⁾ reported the resistance to methicillin as an important independent prognostic factor for patients with *S.aureus* bacteremia. The incidence of resistance to methicillin in *S.aureus* strains was 36% in France and 33.7% in Taiwan^(1,5).

Table 2. Antimicrobial susceptibility of MRSA and MSSA isolates.

Antimicrobial	Susceptibility %	
	MRSA *	MSSA **
Vancomycin	100	100
Gentamycin	13	97
Erytromycin	12	94
Tetracycline	10	93
Ciprofloxacin	9	91

* Methicillin resistant *S.aureus*** Methicillin susceptible *S.aureus*

SENTRY reported the ratio of oxacillin-resistant *S aureus* as 27.7% in Europe and 32.4% from Latin America and North America⁽¹⁸⁾. In another study reported from USA, oxacillin-resistance rate was 49.3%⁽⁶⁾. This shows that local data is essential for better management of BSI. The prevalence of MRSA among blood isolates is very high and differs between countries and hospitals according to EARSS (European Antimicrobial Surveillance System)⁽¹³⁾. Another study from Europe reported MRSA rate as 25% between 1997 and 1999⁽¹⁹⁾. This study showed that MRSA strains were resistant to different antimicrobial agents too⁽¹⁹⁾. MRSA prevalence was reported as 27.1% to 51.1% between 2003 to 2005 in Mediterranean countries⁽²⁰⁾. In Korea; methicillin resistance rate was 64% and resistance to antibiotics of the MRSA was high⁽²¹⁾. A study from Turkey found MRSA and MSSA prevalence as 41% and 59%, respectively. The resistance rates of a group antimicrobial were more higher for the MRSA strains than MSSA⁽²²⁾. Eksi et al.⁽²³⁾ from Gaziantep; an east part of Turkey, reported that 61.2% of *S.aureus* strains were resistant to methicillin. And in that study according to the susceptibility results, it was seen that MRSA strains were more resistant to antimicrobials than MSSA and all strains were susceptible to vancomycin⁽²³⁾. Dizbay et al.⁽¹⁰⁾ also found all MRSA isolates as susceptible to vancomycin. In contrast to Iran where more than 50% of staphylococci isolates were intermediately susceptible to vancomycin, all our isolates were susceptible

to this antimicrobial agent⁽⁴⁾. However, especially in the treatment of MRSA infections glycopeptides are frequently used so in the future it is not impossible to see increasing vancomycin resistance rates^(5,10). In our study; the rate of MRSA and MSSA were 48.2% and 51.8%, respectively. We also detected the susceptibility of gentamycin, tetracycline, ciprofloxacin and erythromycin. In this study, similar to previous studies, MRSA strains were more resistant than MSSA strains for these antimicrobial agents.

In the light of these results, the prevention of transmission and colonization of MRSA is very important for patients⁽⁹⁾. Isolation of the patients colonized by MRSA may be useful for prevention of spreading MRSA strains⁽⁹⁾. As patients with MRSA colonization are risk for MRSA infections and also previous studies have reported that MRSA infections have a higher mortality rate than MSSA; screening the patients for MRSA have great importance to reduce transmission, morbidity and mortality rates^(8,12,15,24,25,26). Pan et al.⁽²⁴⁾ reported that 'search and isolate' strategy to prevent nosocomial transmission of MRSA may reduce the prevalence of MRSA infections⁽²⁷⁾. To avoid the spread of MRSA; education of health care workers about isolation techniques such as gloves and the importance of hand hygiene should be useful⁽²⁸⁾. We observed that oxacilline resistance rates have been increasing from the year 2003 to 2006 (25.7%, 36.7%, 42.2% and 67.8%, respectively). In the year 2007, we observed that the resistance to methicillin decreased to 57.1%. This year, in our country there was a new organisation about hospital infection control studies. We consider that as a result of these studies methicillin resistance is going to decrease.

In a region; monitoring the resistance patterns of commonly used antimicrobial agents will help clinicians for selecting the appropriate drug combi-

Table 3. MRSA rates 2003-2007 (For each year MRSA rates)

Year	Rates of MRSA
2003	25.7
2004	36.7
2005	42.2
2006	67.8
2007	57.1

nation for the treatment of bloodstream infections caused by staphylococci and other pathogens. Antimicrobial susceptibility profile must be known at hospital level because as it is known; susceptibility profiles may differ between hospital to hospital in the same region.

In conclusion, every hospital should provide antimicrobial susceptibility profile and colonisation rate of *S.aureus* strains. This data can be useful in management the BSI and development of rational strategies and aggressive hospital infection control measures for public health policies.

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