Burden of Infection Caused by Methicillin-Resistant *Staphylococcus aureus* in Bangladesh: a Systematic Review

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Background: Methicillin-resistant *Staphylococcus aureus* (MRSA) is becoming an important public-health problem worldwide as well as in Bangladesh. Objective: The aim of this present review is to see the clinical burden of MRSA in the health care setting and well as the community of Bangladesh. Methodology: Studies conducted on humans in Bangladesh concerning MRSA colonization or infection were identified through computerized literature searches using free text searching, Google Scholar, Banglajol, MEDLINE (National Library of Medicine Bethesda MD) and EMBASE and by reviewing the references of the retrieved articles. Studies were excluded that did not provide appropriate data on the prevalence of MRSA. The search was restricted to full articles published from January 2000 to December 2013. Only English language was applied. Result: Of 125 studies identified during systematic review, 19 studies met the criteria for analysis. The level of evidence and freedom from bias of these studies were generally low. The isolation rate of MRSA among all culture isolates ranged from 4.8-78.7%. All studies had been reported from the hospital setting and only two studies had been reported from community settings though the CDC definition was not followed either study. Conclusion: MRSA have created a huge clinical burden in the hospital settings as well as in the community of Bangladesh.

Keywords: *Staphylococcus aureus*, Methicillin-resistant *Staphylococcus aureus*, CA-MRSA, HA-MRSA, antibiotic therapy, evolution, systematic review

INTRODUCTION

Community and hospital pathogens are emerged after survival in different environments which can interact successfully with the host (Zetola et al., 2005). Among those pathogens *Staphylococcus aureus* is one of the most successful and adaptable human pathogens (David and Daum 2010). This remarkable ability of the bacterium to
acquire antibiotic-resistance mechanisms and advantageous pathogenic determinants has contributed to its emergence in both nosocomial and community settings. It is also the most commonly isolated human bacterial pathogen and is an important cause of skin and soft-tissue infections (SSTIs), endovascular infections, pneumonia, septic arthritis, endocarditis, osteomyelitis, foreign-body infections, and sepsis (Lowy 1998). Some of the strains of Staphylococcus aureus have developed drug resistance. Within them Methicillin-resistant *S. aureus* (MRSA) isolates are resistant to all available penicillins and other beta-lactam antimicrobial drugs (David and Daum 2010). However these were confined largely to hospitals, other health care environments, and patients frequently visiting these facilities. On the contrary, there has been an outbreak of MRSA infections reported for those populations who have lacking the risk factors for exposure to the health care system (Adcock et al., 1998; Baggett et al., 2003; Buckingham et al., 2004; CDCP 1999; CDCP 2003). This increase has been associated with the recognition of new MRSA strains which is called community-associated MRSA (CA-MRSA) strains. It is responsible for a large proportion of the increased disease burden observed in the last decade (Charlebois et al., 2002). These CA-MRSA strains appear to have rapidly disseminated among the general population in most areas of the United States and affects patients with and without exposure to the health care environment (Chen et al., 2006). In this context Bangladesh is very vulnerable to develop CA-MRSA due to irrational use of antibiotics. This will create a huge burden to the physician as well as the patient. In this review it is tried to summarize the available information regarding community-acquired MRSA infections as well as the health care associated MRSA (HA-MRSA), emphasizing the characteristics that have prompted the emergence of MRSA in the community setting and the virulence factors associated with its typical clinical presentations and to find out the future burden of CA-MRSA and HA-MRSA in this country.

**METHODOLOGY**

Studies conducted on humans concerning the role of antimicrobial therapy as a risk factor for MRSA colonization or infection were identified through computerized literature searches using free text searching, Google Scholar, Banglajol, MEDLINE (National Library of Medicine Bethesda MD) and EMBASE and by reviewing the references of the retrieved articles. Index search terms included the Medical Subjects Heading ‘methicillin-resistant *Staphylococcus aureus* AND Bangladesh’ or ‘community-associated methicillin-resistant *Staphylococcus aureus*’ or ‘CA-MRSA’ or ‘Health-care associated methicillin-resistant *Staphylococcus aureus* AND Bangladesh’ or ‘HA-MRSA’ or ‘antibiotic resistant AND community-associated methicillin-resistant *Staphylococcus aureus*’ or ‘community-associated methicillin-resistant *Staphylococcus aureus* AND Bangladesh’. The search was restricted to full articles published from January 2000 (publication date of the first study identified by the research) to December 2013. Only English language was applied. No attempt was made to obtain information on unpublished studies. The animal studies were excluded from these searches. Reviewed articles were maintained in a master log, and any reason for exclusion from analysis was documented in the rejected log.

**RESULT**

A total number of 2405 article were identifies containing the research question of which 125 studies were taken into consideration; from the 125 articles 19 studies were met the criteria for systematic review analysis. The level of evidence and freedom from bias of these studies were generally low. The isolation rate of MRSA among all culture isolates ranged from 4.8-78.7%. All studies had been reported from the hospital setting and only two studies had been reported from community settings though the CDC definition was not followed either study.

**DISCUSSION**

Emergence of MRSA

**Global Perspective:** Strains of *S. aureus* resistant to methicillin were identified in the United Kingdom (Jevons 1961). in 1961. In Europe (Wielders et al., 2002), MRSA infections were limited largely to hospital outbreaks caused predominantly by *S. aureus* phage type 83A. In the United Kingdom (Griffiths et al., 2002), MRSA was progressively created a burden as a nosocomial pathogen. In 1965 the first case of MRSA infection recorded in Australia (Givney et al., 1996), was detected as nosocomial MRSA infections occurred in many cities. In Japan (Kayaba et al., 1997), MRSA isolates have been prevalent in academic hospitals since the late 1980s and spread into community hospitals in the 1990s. In contrast, in Norway (Andersen et al., 2007), Finland (Kerttula et al., 2007), Sweden (Stenhem et al., 2006), the Netherlands (Skov et al., 2008), and Denmark (Tiemersma et al., 2004), MRSA infections have remained rare even in the health care setting, which has been attributed by many to strict surveillance programs. In India (Kini et al., 1997; Gowrishankar et al., 2013; Juyal et al., 2013), there has been a marked increase in the incidence of MRSA since early 1980s.

**Bangladesh Perspective:** (Khan et al., 1991), was reported about MRSA isolates from clinical specimen in 1991 which is the first documented report published in Bangladesh. However, prior to the mid-1990s, investigation
Figure: Diagram showing the searches of the articles

into the epidemiology of MRSA was limited largely to the health care setting because it was rare that MRSA strains would infect otherwise healthy people. However, MRSA was reported in several times in many studies (Zahan et al., 2009; Murphy et al., 2013; Dutta et al., 2013), in Bangladesh where the burden of MRSA was focused.

Classification of MRSA in Literatures

The community-associated MRSA (CA-MRSA) and hospital acquired-MRSA (HA-MRSA) have been first classified strains described by CDC; however, these two strains have some genotypic, epidemiological as well as clinical differences (David and Daum 2010). An essential component of epidemiological studies has been to define the clinical burden of CA-MRSA and HA-MRSA isolates. In 2000, the CDC created a case definition for a CA-MRSA infection. CA-MRSA is defined as any MRSA infection diagnosed for an outpatient or within 48 hours of hospitalization if the patient lacks the health care-associated MRSA risk factors like hemodialysis, surgery, residence in a long-term care facility or hospitalization during the previous year, the presence of an indwelling catheter or a percutaneous device at the time of culture, or previous isolation of MRSA from the patient (Dutta et al., 2013; CDCP 2005). All other MRSA infections were considered to be HA-MRSA. This case definition at first was used to demonstrate that MRSA infections were occurring among healthy people in the community without health care exposure (Morrison et al., 2006; Naimi et al., 2003; Fridkin et al., 2005). A simpler, temporal definition is often used to designate CA-MRSA. By this criterion, all infections occurring among outpatients or among inpatients with an MRSA isolate obtained earlier than 48 hour after hospitalization would be considered CA-MRSA. Infections meeting either of these temporal criteria are sometimes referred to as “community-onset” MRSA (CO-MRSA) infections (Fridkin et al., 2005; Lee et al., 2013). Other criteria used to define CA-MRSA infections relate to relevant isolate characteristics. CA-MRSA isolates have been pedigreed by their antimicrobial susceptibility profiles (David and Daum 2010), their DNA fragment patterns upon pulsed-field gel electrophoresis (PFGE) (Maslow et al., 1993; McDougal et al., 2003; Tenover et al., 1995), protein A (spa) gene typing (Koreen et al., 2004; Strand et al., 2003; Strommenger et al., 2007), carriage of PVL genes (Lina et al., 1999), multilocus sequence typing (MLST) (Enright and Spratt 1999; Enright et al., 2000), and the type of SCCmec element carried (IWG-SCC 2009). Definitions based on one or more of these isolate characteristics have been used to quantify the MRSA disease burden inside and outside the health care setting, but each one actually provides a different perspective (David et al., 2008). Importantly, none of the genotypic isolate characteristics are helpful to a clinician caring for an acutely ill patient because assessing them requires molecular strain testing that is not routinely or rapidly available. Regarding this issue, nosocomial colonization with MRSA usually goes undetected and may lead to infection many months after hospital discharge even when the patient is in the community. Then it may be difficult to establish the origin of
strains causing MRSA infections in the community. This difficulty differentiating nosocomial MRSA from community-acquired MRSA has led to confusion regarding the prevalence of MRSA in the community. Even significant heterogeneity is found during definition of community-acquired MRSA (David et al., 2008). A third category of MRSA infections has been used by CDC investigators as “health care-associated, community-onset” MRSA (HACO-MRSA) infection (David et al., 2008). In this category it includes cases that would be HA-MRSA infections by history of health care exposure though these have onset in the community. This tripartite classification scheme, HA-, CA-, and HACO-MRSA, still has limitations because a history of exposure to a health care setting does not exclude the possibility of MRSA acquisition and infection in the community (Klevens et al., 2007; Deurenberg et al., 2006).

HA-MRSA versus CA-MRSA: Importance in Bangladeshi Literature

The distinctions between CA-MRSA and HA-MRSA isolates have become increasingly blurred since about 2003 (David and Daum 2010). Defining a case as being community acquired is usually based on the timing of isolation of MRSA in relation to the time of hospitalization. As a result, the vast majority of cases attributed to community-acquired MRSA are associated with recent direct or indirect exposure to the health-care setting like hospitalization, outpatient visit, nursing home admission, antibiotic exposure, chronic illness, or close contact with people with these risk factors which are suggesting that these infections are caused by nosocomial strains that have been carried into the community. These isolates circulate in the community especially among adults47. In addition to that, many reports have demonstrated the MRSA clones bearing SCCmec type IV especially USA300 (Chen et al., 2009). PFGE types of CA-MRSA now cause nosocomial MRSA outbreaks and infections among patients with chronic illnesses in the developed countries like Taiwan (Gastelum et al., 2005; Maree et al., 2007), USA5 (Mean et al., 2007; Saunders et al., 2007; Zhanel et al., 2008). Canada (O’Brien et al., 1999; Naas et al., 2005), Australia (Bogut et al., 2008), France (David et al., 2006). Poland (Seybold et al., 2006), and UK (Chua et al., 2008). In USA, it is reported that 34% of nosocomially transmitted isolates belonged to the USA300 CA-MRSA genotype (Patel et al., 2007; Patel et al., 2008). A study of surgical skin site infections from 2004 to 2005 in USA demonstrated that USA300 was a common nosocomial pathogen (Klevens et al., 2006), which was first appeared in this setting in 2004 (Tattevin et al., 2009). The appearance of CA-MRSA strains in hospitals in the United States is likely responsible for the decreasing non-beta-lactam antimicrobial resistance rates noted for MRSA isolates in ICUs (Chambers 1997). The presence of USA300 increased among MRSA isolates from 11.3% in 2002 to 64% in 2006 which was reported in USA (Sabath 1982).

Evolution of Methicillin Resistance: Genetic Perspective

Penicillin resistant Staphylococcus aureus is now widespread and may be conferred by the production of a beta-lactamase coded by the blaZ gene (Zetola et al., 2005). Methicillin resistance results from the production of an altered penicillin binding protein known as PBP2a and it has decreased affinity for most beta-lactam antibiotics (Sabath 1982; Ito et al., 2003). The mecA gene encodes PBP2a and it is carried on a mobile genetic element known as the staphylococcal cassette chromosome (SCC) mec (Oliveira and de Lencastre 2002). Besides the mecA gene itself, the SCCmec element contains regulatory genes, an insertion sequence element (IS431mec), and a unique cassette of recombinase genes (ccr) responsible for the integration and excision of SCCmec (Oliveira and de Lencastre 2002). Based on the class of mecA gene complex and the type of ccr gene complex, at least five types of SCCmec elements have been identified and are numbered from I to V (Ma et al., 2002). Another SCCmec typing system has also been used by multiplex PCR assay to accurately identify types I–IV (Hiramatsu et al., 2002). Type I SCCmec contains the mecA gene as the sole resistance determinant, whereas SCCmec types II and III contain multiple determinants for resistance to non-beta-lactam antibiotics and are responsible for the multidrug resistance commonly found in nosocomial MRSA isolates (Zetola et al., 2005). However, most probably due to their larger size, the horizontal transfer of SCCmec types II and III occurs with less ease compared with type IV (Daum et al., 2002; Hiramatsu et al., 2003), and spread of MRSA strains harbouring these elements mainly occurs as a result of the selective pressure of antibiotic exposure over time which is known as vertical spread (Ma et al., 2002). Several subtypes of type IV SCCmec are now recognized based on the polymorphism of the region upstream of the ccr genes, a location known as L-C (Ma et al., 2002; Wisplinghoff et al., 2003). Like type I, type IV elements lack other resistance determinants (Luong et al., 2002). Strains of community-acquired MRSA that have emerged over the past decade have mostly harboured the SCCmec type IV element (Luong et al., 2002; Babu et al., 2009), and they are typically susceptible to multiple antibiotics with non-beta-lactam susceptibility patterns resembling those of methicillin-susceptible Staphylococcus aureus (MSSA) strains prevalent in the community (Zetola et al., 2005). Therefore, most authorities feel that it is the acquisition of the SCCmec IV element by MSSA strains in the community that has given rise to the emerging community-acquired
MRSA strains (Wisplinghoff et al., 2003; Armand-Lefevre et al., 2005). In addition to intra-species transfer of resistant determinants, other commensal Staphylococcal species may act as a reservoir for antibiotic resistance islands which may be transferred to Staphylococcus aureus (Zetola et al., 2005). From the 1970s the SCCmec type IV element was found to be prevalent in isolates of Staphylococcus epidermidis and rarely in Staphylococcus aureus isolates even before 1990 (Haque et al., 2011). In addition to that three other SCCmec elements which contain genes encoding biosynthetic enzymes for capsular polysaccharides have been identified in MSSA, Staphylococcus epidermidis and Staphylococcus hominis strains (Alam et al., 2011; Hossain et al., 2002). These elements share most of the essential characteristics of SCCmec, including regulatory genes and insertion sequences, but lack the mecA gene (Islam et al., 2008). Interestingly, sequences found within the L-C region of SCCmec type IV were found to be virtually identical to those found in Staphylococcus epidermidis, suggesting extensive horizontal exchange between staphylococcal species (Rahman et al., 2002). In Bangladesh the genomic analysis has been performed of which Hossain et al (Hossain et al., 2002) was done a genomic analysis.

Global Burden of MRSA Infection in Bangladeshi Literatures

Majority studies (Khan et al., 1991; Zahan et al., 2009; Dutta et al., 2013; Haque et al., 2011; Iqbal et al., 1999), published in Bangladesh have highlighted about the burden of MRSA in the hospital settings globally. However, it is very surprising that no study has mentioned about the burden of CA-MRSA in the community of Bangladesh. Once the CDC case definition is used to define the burden of disease caused by CA-MRSA isolates, two interesting event can be demonstrated. The application of the definition to the cases of infection with MRSA with onset in the community accurately identifies patients with infections caused by CA-MRSA isolates (David et al., 2008). However, if one uses the case definition to identify patients with infection caused by CA-MRSA isolates, the burden of disease caused by CA-MRSA isolates will be greatly underestimated (David et al., 2008), and this analysis yields a reciprocal overestimation of health care-associated MRSA disease (David and Daum 2010). If the CDC case definition of CA-MRSA were used in the acute-care setting to aid in the selection of empiric antibiotic therapy, many people who could be managed with clindamycin, would be unnecessarily treated with intravenous antimicrobial drugs because they have an illness caused by a CA-MRSA isolate and not a multiple resistant HA-MRSA isolate (Rahman et al., 2002).

Clinical Burden of MRSA infection in Bangladesh

Several studies have been done in Bangladesh to see the burden of MRSA infection with their sensitivity pattern. (Haque et al., 2011), has reported that the current prevalence of β-lactamase-producing methicillin-resistant S. aureus (MRSA) in clinical samples is 43-7% isolates. This study was carried out in the two private clinics at Dhaka city. For this reason it doesn’t represent the whole country scenario about the prevalence of MRSA. In another study (Alam et al., 2011), has investigated the distribution of the mecA gene in a total of 94 clinical strains of Staphylococcus aureus which are isolated from patients admitted in Bangladeshi Medical Hospital. The mecA gene was detected by PCR in 25.0% of human clinical isolates of Staphylococcus aureus. This is an interesting findings comparing with the previous one. In this study author doesn’t mention the number of hospitals from where the human samples are collected. This gives a Berksonian bias to the result and thus it doesn’t represent the actual burden of MRSA. (Hossain et al., 2002); has done an antimicrobial susceptibility testing against Staphylococcus aureus isolated at a tertiary care hospital outside Dhaka and found a high rate of MRSA isolates. (Shamsuzzaman et al., 2007), has identified the pattern of aerobic bacteria with their antibiotic susceptibility isolated from infected patients in one of the surgical units at a tertiary care hospital outside Dhaka and reported that out of 74 clinical samples, Staphylococcus aureus was found in 8 cases. It was suggested to be careful regarding selection of antibiotic regime in surgical cases to minimize incoming higher magnitude of drug resistance among bacteria in near future. B (Begum et al., 2011), has reported eight Staphylococcus aureus isolates from different specimens and surprisingly has found no MRSA strains. The reason may be due to small sample size and the study was performed 14 years back. However, among the all Staphylococcus aureus two strains are resistant to oxacillin which is very rare. Khan et al 85 has performed coagulase typing of Staphylococcus aureus isolates, with particular emphasis to Methicillin Resistant Staphylococcus aureus (MRSA) among strains isolated from various types of specimens collected at a tertiary care hospital outside Dhaka. A newly developed panel of anti-sera against different coagulase enzymes was used for coagulase typing. The study included 79 strains of S aureus and of those, 40(62.6%) were identified as MRSA on the basis of resistance to oxacillin discs. Murshed et al. has compared the detection rate of MRSA between two tertiary care hospital at Dhaka city and has found a high rate of MRSA in both hospitals. (Shahidullah et al., 2012), has reported from specialized cardiology hospital at Dhaka from different specimens and found only 10.5% isolates of Staphylococcus aureus. In this study MRSA was not
detected. (Ahmed et al., 2008), has reported aerobic bacterial agents isolated from puerperal sepsis among the patients admitted at a tertiary care hospital and found that 46.2% cases are MRSA strains. Interestingly all the strains are vancomycin sensitive. (Barai et al., 2010), has performed a study to know the antibiotic resistance pattern of the common isolates from blood, urine, respiratory secretions and pus/wound swab of patients admitted in ICU at BIRDEM (Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorder) hospital, during a one year period from March 2006 to February 2007. A total of 1660 samples were analyzed of which about 77.0% of isolated Staphylococcus aureus were methicillin resistant (MRSA). (Jinnah et al., 1998); has published that 139(12.6%) Staphylococcus aureus are isolated from 1100 wound specimens from the diabetic patients at diabetic specialized hospital in Dhaka and the rate of isolation of MRSA was 78.7% which is very high like the previous study. The reason of disproportionate rate of MRSA isolation is due to the sample collection from the diabetic patients. (Kawsar et al., 2008), has reported a three months long study carried out the Department of Pathology at Armed Forces Medical College, Dhaka and has found 50 cases of Staphylococcus infection of which 42(84.0%) cases are Staphylococcus aureus. Interestingly out of 42 cases of Staphylococcus aureus 37(85.7%) are found as beta lactamase producers and only 2(4.8%) cases are MRSA.

CA-MRSA infection in Bangladesh

There is only study that has been performed on CA-MRSA in Bangladesh which was done by (Iqbal et al., 1999). In that study it has been reported that CA-MRSA was present in the community in 25.0%. Interestingly, the author has mentioned that urine collected from the OPD of the hospital has found 40.0% MRSA isolates. (Haq et al., 2005), reported the findings of a multicentre study on the incidence of MRSA in Bangladesh and has mentioned that a total of 14.1% Staphylococcus aureus was isolated from different specimens. The rates of isolation of Staphylococcus aureus in the Dhaka hospital and outpatients were 14.1% and 11.7%, respectively, whereas rates were 20.7% in Chittagong, 14.7% in Rajshahi and 18.3% in Mymensingh. The lower rate of isolation of S. aureus in Dhaka hospital and the outpatients was because urine constituted 82.5% and 59.7% of samples, respectively. On the other hand, a higher rate of isolation of S. aureus in Chittagong, Rajshahi and Mymensingh was due to fewer urine sample and more samples of pus. About 11.0% S. aureus were isolated from urine samples in Dhaka, as many of the samples came from patients with urinary catheters. The rate of isolation of MRSA in the four hospitals ranged between 32.0% and 63.0%, but was 40.0% in outpatient isolates of Dhaka hospital. The origin of these communities acquired MRSA is not known. One possibility is that they had come from patients who had previously been admitted to Dhaka hospital and had then been seen as outpatients. However, exact data regarding the proportion of patients with a history of hospital stay was not recorded. MRSA were detected in pus, urine and sputum. All MRSA were sensitive to vancomycin (MIC < 4mg/L). Over 90.0% of all Staphylococcus isolates from all regions were resistant to penicillin and ampicillin. Beta-lactamase production was similar in both MRSA and non-MRSA (85.11% versus 85.0%). The prevalence of MRSA has increased substantially over the last 4-5 years in hospital patients in Bangladesh and this multicentre study showed there was a high incidence of MRSA in large hospitals in four different regions of Bangladesh and in the community in Dhaka.

Sensitivity Pattern of MRSA in Bangladesh

(Islam et al., 2008), has detected the MIC of cloxacillin against 10 MRSA strains and has found 100.0% resistant to penicillin as well as amoxicillin. However, this 10 MRSA are 100.0% sensitive to vancomycin, ciprofloxacin, erythromycin, fusidic acid and rifampicin. Interestingly ceftriaxone (20%) and cephradine (40%) are also resistant to MRSA. (Haque et al., 2011), has identified the pattern of aerobic bacteria with their antibiotic susceptibility isolated from infected patients in one of the surgical units at a tertiary care hospital outside Dhaka and reported that out of 74 clinical samples, Staphylococcus aureus was found in 8 cases. Majority (61.5%) of culture positive results were found in wound swabs. Over 87.0% strains of S. aureus were resistant to penicillin but sensitive to erythromycin whereas, 100% of those strains were sensitive to cloxacillin. (Rahman et al., 2002), has reported similar result. In another study in Bangladesh, (Shamsuzzaman et al., 2007), has reported about the trend of increase resistant of Staphylococcus aureus which has been markedly increase in resistance against almost all antibiotics even against ciprofloxacin (17% to 43%; p<0.05) and ceftriaxone (28% to 83%; p<0.001) except co-trimoxazole (55% to 57%); on the other hand, oxacillin resistance increased from 22% to 42% but no resistance against vancomycin was noted during this period. (Begum et al., 2011), was found reduced sensitivity pattern to some important antibiotics. (Khan et al., 2007), has performed antimicrobial susceptibility testing and coagulase typing of Staphylococcus aureus isolates, with particular emphasis to Methicillin Resistant S. aureus (MRSA) among strains isolated from various types of specimens collected at a tertiary care hospital outside Dhaka. A newly developed panel of anti-sera against different coagulase enzymes was used for coagulase typing. The study included 79 strains of S. aureus and of those, 40 were identified as MRSA on the basis of resistance to oxacillin discs. The
Table 1. Studies of MRSA in Bangladesh

<table>
<thead>
<tr>
<th>Authors Name</th>
<th>Year</th>
<th>Study Type</th>
<th>Place of Study</th>
<th>Isolation rate</th>
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<tr>
<td>Dutta et al&lt;sup&gt;27&lt;/sup&gt;</td>
<td>2013</td>
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<td>Original Article</td>
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<td>Shahidullah et al&lt;sup&gt;87&lt;/sup&gt;</td>
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<td>Original Article</td>
<td>Hospital</td>
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<td>2005</td>
<td>Letters to Editorial</td>
<td>Multicentre study</td>
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*NM= not mentioned

The rate of resistance of *S. aureus* was 88.61% to penicillin and 48.10% to oxacillin. However, none of the isolates showed vancomycin resistance. Both MRSA and non-MRSA strains were found belonging to Coagulase type VI. Jinnah et al<sup>90</sup> has published that 139(12.6%) *S aureus* are isolated from 1100 wound specimens from the diabetic patients at diabetic specialized hospital in Dhaka and the rate of isolation of MRSA was 78.7% which is very high like the previous study. The reason of disproportionate rate of MRSA isolation is due to the sample collection from the diabetic patients. The study reported that 77.0% strains were penicillin and ampicillin resistant which is very alarming; however, cloxacillin resistant was in 37.2% cases. (Iqbal et al., 1999), has documented the incidence of ciprofloxacin-resistance among MRSA patients. In this study clinical isolates from outdoor patients were tested to see the ciprofloxacin resistance among MRSA strains, using in vitro susceptibility tests by standard disk diffusion technique. Results show significantly high incidence of ciprofloxacin resistance among MRSA isolates in these patients.

**Prevention of MRSA Infections**

Antibiotic resistant occurs due to irrational use of antibiotics (Tattevin et al., 2009; Waness 2010). In the health care setting infection control practice depends on guidelines from professional, governmental as well as non-governmental bodies (Morgan 2007; Toeda et al., 2001).

The standard hospital guidelines regarding MRSA prevention stress that antibiotic-resistant pathogens are sensitive to routinely used hospital disinfectants, but it is essential that correct and meticulous cleaning and use of disinfectants be performed (Tacconelli et al., 2004). However, most specific interventions like isolation of colonized individuals, active identification of MRSA carriage by surveillance cultures of high-risk populations, decolonization of MRSA carriers, environmental disinfection by chemical means or even light or some combination of the above-described interventions, have failed to reliably limit transmission or spread (Goering et al., 2008). In community and other institutional settings, there is far less evidence to support the use of these approaches even after this uncertainty and as the CA-MRSA epidemic continues, the need for effective interventions has become more acute. The Government of this country is very much concern regarding the antibiotic resistant and try to establish different programs to prevent this. Infection Control & Prevention Program in Bangladesh (ICPPB) with the collaboration of USA is successfully continuing the infection prevention in different sectors of this country.

**CONCLUSION**

MRSA have created a huge clinical burden in the hospital settings as well as in the community. Clinicians and the
health care workers of this country must be aware of the wide and unique spectrum of disease caused by MRSA. Increased vigilance should be employed in the diagnosis and management of suspected and confirmed *Staphylococcal* infections.

**REFERENCES**


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