Original Article

Trends in antibiotic resistance patterns of methicillin resistant and methicillin sensitive *Staphylococcus aureus* in Khwaja Yunus Ali Medical College Hospital

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Abstract

Background: *Antimicrobial resistance in pathogens is a growing concern for health. It is a great concern around the globe about the threat of increasing antimicrobial resistance. In response to this concerns, medical experts have proposed initiatives to curtail the spread of antimicrobial resistance in pathogenic bacteria. We have taken this surveillance study in KYAMCH to contain the spread of antimicrobial resistance.* ***Objectives:*** *To determine the prevalence of MRSA from different clinical samples and to record its current status to commonly used anti Staphylococcus antibiotics.* ***Methods:*** *The clinical samples were taken to the laboratory and within four hours cultured for isolates and identification pathogens. Finally, antibiotic sensitivity testing of the isolated Staphylococcus aureus was performed.* ***Results:*** *More than 80% of MRSA isolates were resistant to ampicillin (98%) followed by amoxicillin, cefixime and azithromycin with 94%, 93.5% and 85% respectively and maximum sensitivity toward tobramycin with 86% followed by 85% gentamicin and 79% meropenem.* ***Conclusion:*** *The detected trend in antibiotic resistance patterns of methicillin-resistant and methicillin-sensitive Staphylococcus aureus in this study is alarming. This has created a huge clinical burden in the hospital settings as well as in the community.*

Key words: *Antibiotic resistance patterns of methicillin resistant and methicillin sensitive of Staphylococcus aureus.*

Date of received: *03. 10. 2017*

Date of acceptance: *05. 01. 2018*

Introduction

Methicillin-resistant Staphylococcus aureus (MRSA) strains are the most prevalent and clinically important form of antimicrobial resistance among the staphylococci. Methicillin sensitive S aureus (MSSA) and methicillin resistant S aureus (MRSA) are the 2 major subtypes of S aureus with methicillin resistance, defined as an oxacillin sodium minimum inhibitory concentration of at least 4µg/.[1] MRSA is sometimes called a "superbug" because it doesn't respond to many antibiotics. Existence of MRSA was reported as early as 1964 in the United States and United Kingdom, and nosocomial outbreaks were becoming common by the late 1970's.[2] Since resistance to multiple antibiotics among MRSA isolates is very common, there is a possibility of extensive outbreaks, which may be difficult to control. MRSA is now one of the commonest nosocomial pathogens, and asymptomatically colonized healthcare workers are the major sources of MRSA in the hospital environment.

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Early detection of MRSA and formulation of effective antibiotic policy in tertiary care hospitals is of paramount importance from the epidemiological point. Therefore, determining the trends in antibiotic susceptibility patterns of methicillin- resistant and methicillin-sensitive Staphylococcus aureus becomes necessary in the selection of appropriate empirical treatment of infections. We determined the prevalence of MRSA from different clinical samples and their in vitro susceptibility pattern to various antimicrobial agents to record the current status of MRSA response to commonly used anti Staphylococcus antibiotics in KYAMCH during 2016.

Materials and methods

The present research work was a descriptive cross-sectional study conducted at the Department of Laboratory Services, Microbiology Laboratory of Khwaja Yunus Ali Medical College Hospital (KYAMCH), Enayetpur, Sirajgonj, Bangladesh in the year 2016. This study comprised 488 clinically ill hospitalized patients including both sexes of all age groups taking medical care at KYAMCH. Clinical specimens such as pus, wound swab, sputum, throat swab, nasal swab, blood, urine and prostatic secretions were collected from the admitted patients in clean, sterile and dry containers. The samples were taken to the laboratory and processed within four hours. The specimens were cultured on blood agar and Mac Conkey agar plates and incubated aerobically at 37°C for 48 hours.

After incubation, visual growth on the inoculated plates was observed and colony morphology was noted. The isolates were identified through morphological appearance of the colonies, Gram's staining and using standard tests like catalase, slide and tube coagulase, and growth on Mannitol Salt Agar.[3] Antibiotic sensitivity testing was performed by Kirby-Bauer disc diffusion method for the following antibiotics: ampicillin (10 µgm), amoxicillin (10 µgm), amoxiclav (30 µgm), amikacin (30µgm), cotrimoxazole (25µgm), cephradine (30µgm), cefixime (5µgm), ceftriaxone (50µgm), ciprofloxacin (5µgm), gentamicin (10 µgm), meropenem (10 µgm), tobramycin (10µgm), azithromycin (15µmg), and novobiocin (30 µmg). The antibiotic discs were placed on a Mueller-Hinton agar plate previously inoculated with 0.5 McFarland bacterial suspensions.

After the antibiotic sensitivity testing of each of Staphylococcal isolates, the organisms were screened for MRSA. The MRSA strains were identified by testing with cefoxitin dics having zone of inhibition less than 21 mm. During identification of organisms, for each test Staphylococcus aureus (ATCC 25923) was used as reference strains for culture and sensitivity testing. The isolates were distinguished as MRSA and MSSA respectively by ODDM (Oxacillin Disk Diffusion Method). Strict aseptic conditions were maintained while carrying out all the procedures.

Result

The data of this study revealed more patients were male 54.5% than female 45.5% (Figure 1). Maximum 112 (23%) patients belonged to 20-31 year age group and minimum 50 (10%) were from 0-10 year age group (Figure 2).

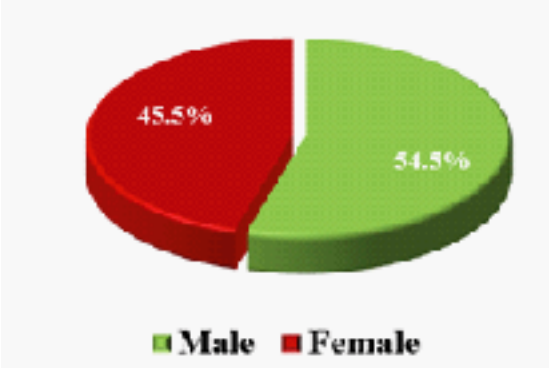

Figure 1: Distribution of MRSA study population among sex

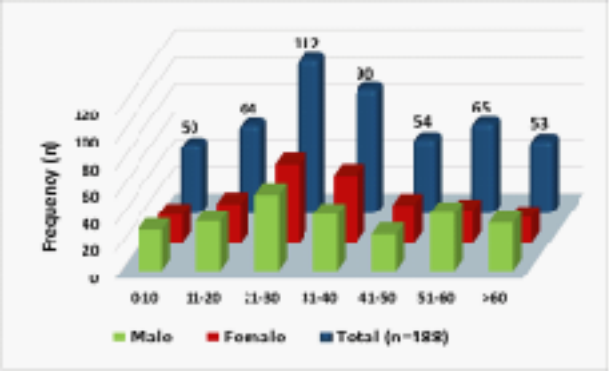

Figure 2: Distribution of MRSA study population among age groups

Pattern of Microbial Growth with sample - Altogether 488 samples were collected from admitted patients. Of them, 267 (54.8%) showed positive growth and rest of them showed no growth (Figure 3). From the positive growth, 226 (85%) were Gram positive and 41 (15%) were Gram negative isolates (Figure 4).

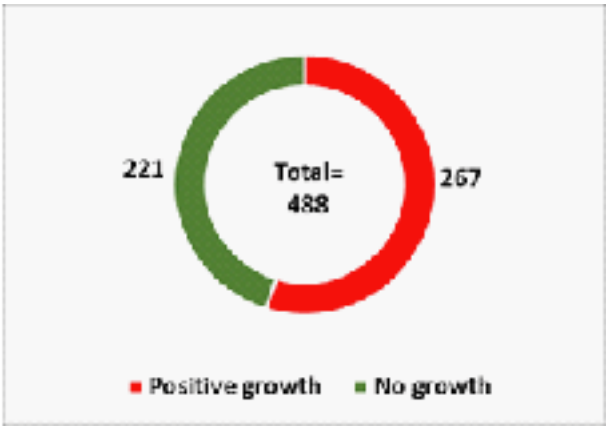

Figure 3: Pattern of total Microbial growth

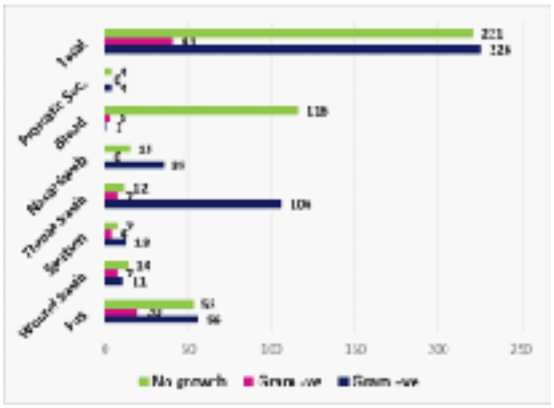

Figure 4: Pattern of Microbial growth with different clinical specimens

Distribution of samples with Staphylococcus aureus isolates - Isolates were obtained from wide variety of clinical specimens. The highest number of isolates were from throat swab samples i.e. 104 (49.5%) followed by pus 44 (20.9%) and the least were from blood 1 (0.5%) (Figure 5-a).

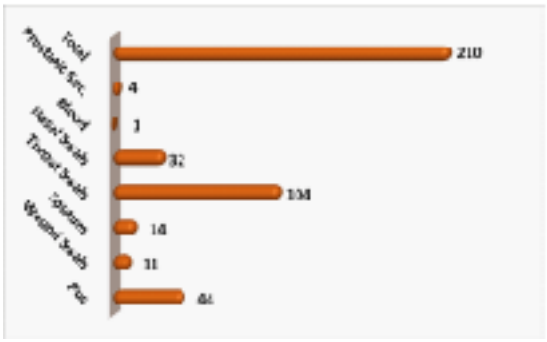

Figure 5-a: Distribution of samples with Staphylococcus aureus isolates

Distribution of MRSA and MSSA among the Staphylococcus aureus isolates - In this study 210 Staphylococcus aureus and 57 other microorganisms (non - staphylococcus) were isolated from the clinical samples. Multidrug resistant Staphylococcus aureus were 200 (Figure 5-b).

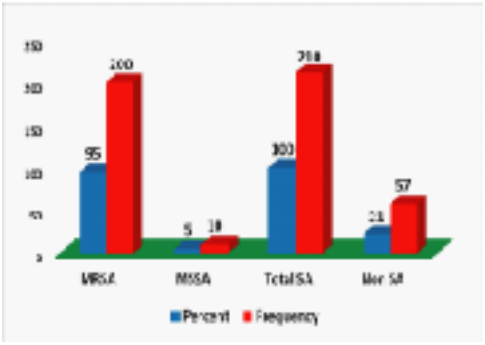

Figure 5-b: Distribution of MRSA and MSSA among the Staphylococcus aureus isolates

Determination of prevalence rate of MRSA- Out of 210 S. aureus isolated from various clinical specimens, 200 (95%) of isolates were MRSA and 10 (5%) were MSSA (Figure 5-b). Out of 200 MRSA, 98% isolates were MDR strain. Similarly, maximum MDR strains were found 90% out of 10 (5%) MSSA.

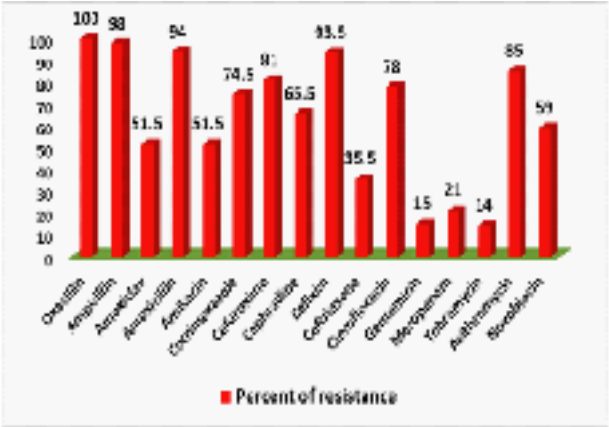

Figure 6: Frequency of antibiotic resistance of MRSA strains

Antimicrobial resistant patterns of MRSA and MSSA isolates - The antimicrobial resistant patterns against commonly used antibiotics are summarized in (Figure 6 & 7). More than 80% of MRSA isolates were resistant toward ampicillin (98%) followed by amoxicillin, cefixime and azithromycin with 94%, 93.5% and 85% respectively and maximum sensitive toward tobramycin with 86% followed by 85% gentamicin and 79% meropenem (Figure 6). Similar picture of antimicrobial resistant pattern in MSSA isolates were noticed as more than 75% of them resistant with ampicillin and amoxicillin (90%) followed by 80% ciprofloxacin and no resistant species were found with to bramycin, gentamicin, cefixime and cotrimoxazole (Figure 7).

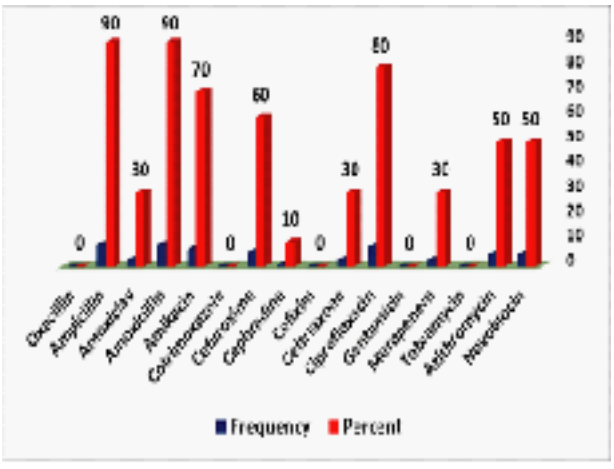

Figure 7: Frequency of antibiotic resistance of MSSA strains

Discussion

Methicillin-resistant Staphylococcus aureus (MRSA) is one of the major pathogens associated with community-acquired serious nosocomial infection because these strains generally show multiple drug resistance which limits treatment possibilities.[4] In this study, the isolation rate of MRSA on gender basis revealed more from male (54.5%) than female (45.5%). Persons younger than 30 years of age were found to be more MRSA carrier 112 (23%) and less found among below 10 years of age 50 (10%) (Figure 2). Our age and gender based findings did not agree with those findings obtained by other studies where no significant variations were noticed.[5] Population of this study is villagers of working group (30 years) who are financially important. Through medical care they became subject of this study. On the contrary, other studies are carried out in the city where all residents irrespective of gender and age are equally receiving medical care. In our study, the highest number of Staphylococcus aureus isolates were from throat swab samples 104 (49.5%) followed by pus 44 (20.9%) (Figure 5-a). Similar study of Tamilnadu in India as high as 35.7% of MRSA strains were obtained from throat swabs and 33.6% of strains were obtained from pus among clinical isolates in 2006.[6] Other study made by Mehta, who in his study on control of MRSA in a tertiary care center, had reported an isolation rate of 33% from pus and wound swabs.[7] However, Qureshi from Pakistan reported a high isolation rate of up to 83% MRSA from pus.[8]

The trends in antibiotic resistance in Staphylococcus aureus varies with time and is unique for different hospitals. While evaluating our study, report on frequency of antibiotic resistance in 210 isolated Staphylococcus aureus revealed multidrug resistance strains (Figure 6 & 7). More than 70% MRSA were resistant to commonly used antibiotics like ampicillin (98%), amoxicillin (94%), cotrimoxazole (74.5%), cefuroxime (81%), cefixim (93.5%), ciprofloxacin (78%). Azithromycin (85%). Same trend in antibiotic resistance was found by Khushbu Yadav in Nepal during 2015 towards penicillin and ampicillin with 81.7% followed by 43.7% cotrimoxazole and 38% cefoxitin. The highest resistant pattern was shown for penicillin and ampicillin with 81% resistance. Similar types of resistant pattern were shown in various previous studies.

Study conducted by Shrestha (2012)[9] showed 94.85% resistant towards penicillin. Many factors may have contributed to such level of resistance, including misuse of antibiotics by health professionals, unskilled practitioners and lay persons. In Bangladesh, it is a common practice that antibiotics can be purchased without prescription, poor hospital hygienic conditions, inadequate surveillance which lead to misuse of antibiotics by the public contributing to the emergence and spread of antimicrobial resistance.[10] Our findings were in agreement with others in which antibiotic sensitive results showed that all MRSA isolates were significantly more resistant to rest of the antibiotic classes compared to the MSSA isolates in Pondicherry, India and in London Hospital, England.[11]

Conclusion

The detected trend in antibiotic resistance patterns of methicillin-resistant and methicillin-sensitive Staphylococcus aureus in this study is alarming. This has created a huge clinical burden in the hospital settings as well as in the community. This study suggests that efficient control protocols should be adopted in hospitals to prevent the transfer of these strains between patients. Moreover, the rational use of effective antibiotics and prevention of their sale over-the-counter should also be considered.

Acknowledgments

We are grateful to the Chairman of the Trusty Board and Director of Khwaja Yunus Ali Medical College Hospital to conduct this study. We thank Mr. Md. Abdul Karim, Medical Technologist and Mr. Md. Mazharul Islam, Medical Technologist of the department of Laboratory Services of Khwaja Yunus Ali Medical College Hospital for assisting in laboratory work.

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