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ORIGINAL ARTICLE

Antibiotic Sensitivity Pattern and Prevalence of Methicillin Resistant Staphylococcus Aureus in a Tertiary Care Hospital

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ABSTRACT

Introduction: Staphylococcus aureus is a chief source of both community and nosocomial infections. Isolates of Staphylococcal aureus from tertiary hospitals are resistant to frequently used antimicrobials. The intrinsically established methicillin-resistant S. aureus (MRSA) has been related with increased mortality and morbidity in hospital patients.

Aim: This analysis was performed to determine the susceptibility of antibiotic pattern of staphylococcal aureus isolates with particular emphasis on methicillin-resistant S. aureus.

Place and Duration: In the Department of Medicine and Pathology, Islam Medical and Dental College Sialkot for six-months duration from April 2021 to October 2021.

Methods: Clinical samples from the Medicine ward were analysed and all isolates of S. aureus were involved in the study. Identification of isolates was done using a typical laboratory technique. The susceptibility antibiotic pattern of all strains of staphylococcal aureus was assessed using the improved Kirby Bauer method of antibiotic susceptibility.

Results: Out of 120 isolates of S. aureus, MRSA were found to be in 29 (26.12%). The multidrug resistance percentage was 6.09% for MSSA and 75.86% for MRSA. All isolates of staphylococcal aureus were penicillin resistant. Though, sensitivity of all strains to vancomycin was noticed.

Conclusions: This analysis exhibited an augmented incidence of MRSA in a Tertiary Care Hospital. Consistent investigation of nosocomial infections and susceptibility of antibiotics are essential to reduce the incidence of MRSA in hospitals and its spread in society. This study clearly demonstrates that the 1st line treatment for infection with MRSA is vancomycin. To maintain its worth, the usage of vancomycin must be restricted and only directed when clearly necessary.

Keywords: MSSA, MRSA, Vancomycin, Antibiotic susceptibility and Staphylococcus aureus

INTRODUCTION

S. aureus is a strong human pathogen as it is the utmost communal causes of community-acquired and nosocomial infections[1-2]. It is similarly the furthermost significant known pathogen to cause occasional epidemics and infections[3-4]. Maximum of the infections of S. aureus are instigated by strains of methicillin sensitive S. aureus (MSSA), which are typically susceptible to chief anti-staphylococcal antibiotics classes[5]. However, multi-antibiotic resistance amid nosocomial staphylococcal isolates was identified as the foremost task in controlling the nosocomial infections. In current centuries, the extensive practice of antibiotics has certainly augmented the development of MRSA and has led to the appearance of strains that consistently acquire many resistance genes[6-7]. With the recent advent of resistance of multi-drugs against MRSA in hospitals cause the dramatic increase in the incidence of community-related hypervirulent MRSA and may rapidly evolve and pose novel medical complications[8]. These strains are often associated with hospital outbreaks and serious infections that seem to be spreading around the world in intensive care units for adults, children and new-borns[9]. Overall, MRSA was institute to be frequently used antibiotics resistant against isolated staphylococcus. Also, several MRSA strains are resistant to both aminoglycosides and beta-lactams. These strains were found to be highly resistant to a series of antibiotics, restraining their options of treatment to rarely used agents such as teicoplanin and vancomycin[10-11]. Therefore, information of the incidence and antimicrobial profile of MSSA and MRSA is essential for the assortment of the suitable empirical management for infections and for the control of nosocomial infections. This analysis was conducted to determine the antibiotic susceptibility pattern of isolates of staphylococcal with a focus on MRSA at the Teaching Hospital.

MATERIAL AND METHODS

This study was held in the Department of Medicine and Pathology, Islam Medical and Dental College Sialkot for six-months duration from April 2021 to October 2021. Clinical samples from the Medicine ward were analysed and all isolates of S. aureus were involved in the study. 120 isolates of S. Aureus were taken from samples collected for culture sensitivity from various departments of the hospital. The isolates were non-repeating and consecutive (one for each patient). One patient sample was included as a criterion for inclusion in the study data, while a second sample from the same patient from a different site was not included in the study.

Samples were grown on Mac-Conkey, Chocolate and Blood agar for twenty-four-forty-eight hours in the Microbiology Laboratory. Brain Heart Infusion broth was used for inoculation of Blood culture samples and sub-cultured on Mac-Conkey Blood agar at 24 and 72 hours.

The organism's identification was accomplished using typical procedures of laboratory (Catalase test, Gram staining, slide coagulase test, tube coagulase test and mannitol fermentation). All strains susceptibility pattern to antibiotics was governed by the modified diffusion method of Kirby Bauer disc against the subsequent antibiotics: gentamicin (10 µg), penicillin (10 units), tetracycline (30 µg), erythromycin (15 µg), amikacin (30 µg), cotrimoxazole (25 mg), ciprofloxacin (5 mg), vancomycin (30 mg) and cephalexin (30 µg). The inhibition zone less than 10 mm or any visible increase in the inhibition zone indicated MRSA was cast-off as the usual control strain. MRSA isolates resistance was confirmed by screening of agar using Mueller Hinton agar complemented with 6 micrograms / L oxacillin and 4% NaCl. According to this report, multi-drug resistance (MDR) is based on three or more antimicrobial agents which are resistant to strains. SPSS21.0 tool was applied to determine the P values <0.05 by Pearson's Chi-Square test.

RESULTS

120 isolates of S. aureus have been taken from several clinical specimens. The largest quantity of isolates was from wound exudate and pus, and urine the minimum. (Table 1) MRSA were found to be in 34 (28.3%) (Table-I).

Table 1: Distribution of MRSA and S aureus in several clinical specimens

Clinical specimen	No of S aureus isolate (%)	MRSA (%)
Wound swab and Pus	94 (78.3)	28 (29.8)
Blood	15 (12.5)	4 (26.7)
Urine	11 (9.2)	2 (18.2)
Total	120 (100)	34 (28.3)

Of the 34 isolates of MRSA, MDR strains were found in 26 (76.5%). Of the 86 (71.7%) MSSA, only 8 (9.3%) are MDR strain. The susceptibility antimicrobial pattern of MSSA and MRSA strains are given in Table-II.

Table 2: Antibiotic resistance pattern of MSSA and MRSA

Antibiotic	MRSA		MSSA		P-value
	Number (n=34)	%	Number (n=86)	%	
Penicillin	34	100	86	100	N/A*
Oxacillin	33	97.1	00	00	0.0001
Vancomycin	00	00	00	00	N/A*
Gentamicin	07	20.58	07	8.1	0.03
Amikacin	08	23.5	03	3.5	0.001
Co-trimoxazole	16	47.1	19	22.3	0.011
Tetracycline	07	20.58	10	11.6	0.19
Cephalexin	22	64.71	27	31.4	0.0001
Erythromycin	15	44.12	09	10.5	0.0001
Ciprofloxacin	06	17.64	12	13.9	0.99

More than 27% of isolates of MRSA were resistant to oxacillin, penicillin, cotrimoxazole, cephalexin and erythromycin. Vancomycin has least resistance (0%) than (17.6%) for ciprofloxacin, gentamicin and tetracycline (20.58%) and in the last amikacin (23.5%). – Antibiotics containing lactam such as cephalexin (64.7% resistance) and penicillin (100% resistance) were also not effective against MSSA. The antibiotic which remains exhibited < 20% resistance to the MSSA isolates.

DISCUSSION

MRSA has become a major health for public threat globally. It contributed to the burden on patients by extending stays in hospital and growing mortality and morbidity[10-11]. This analysis found the MRSA incidence as 28.3%. Alabama reported 44.9% hospital-acquired MRSA[12]. Rajbhandari et al and Alabama testified 55.2% of isolates of MRSA from one hospital[13]. The eastern Nepal study exhibited similar results of 25.94% for MRSA[14]. A recent Bharatpur study in Nepal found an alarming isolation rate of 39.6%, while Rijal et al study isolated 75.5% of MRSA from clinical specimens. A similar study was conducted by Tiwari et al in western Nepal[14]. Alabama also showed disturbingly augmented percentage of isolates of MRSA (68.9%), which the writers accredited to the massive antibiotics use and its easy availability in 20 previous studies[15]. The incidence of MRSA far exceeds previous estimates in some situations. There are numerous clarifications for these variances: antibiotic prophylaxis, infection control measures and each facility or hospital treatments plan, and the often and clonal epidemic nature of these microbes[16-17].

The largest quantity of isolates was from wound exudate and pus, and urine the minimum identifying the part of the microorganism as a pyogenic infection source. This is comparable to the Nepal study and Pakistan and India studies[18-19]. The preceding studies showed a link between antibiotics resistance and methicillin resistance. This analysis exhibited that all isolates of MRSA were significantly less susceptible to antibiotics in comparison to isolates of MSSA. A significant variance (P <0.05) was experiential for gentamicin, oxacillin, co-trimoxazole, amikacin, erythromycin and cephalaxin. Though, the transformation seen with ciprofloxacin and tetracycline was not statistically significant (p-value> 0.05). In our study, the characteristic homogeneous insensitivity of MRSA to beta-lactams such as cephalexin and penicillin was pragmatic. This is because of presence of self-fortified lactamases in the MRSA strain. High resistance to co-trimoxazole and erythromycin has also been demonstrated, as these antibiotics are frequently used indiscriminately in the management of generalized and pyogenic infections[20-21].

The multidrug resistance phenotype is a special feature of methicillin-resistant S. aureus strains. This increased the workload on hospital staff to control MDR-MRSA infections[22]. This study shows a disturbingly high percentage of MDR strains amongst isolates of MRSA (76.5%). Research in the western and eastern parts of Nepal also found that MDR-MRSA reached 65-78%. Indian literature also shows up to 77% MDR-MRSA from isolates[23]. Although these MDR strains do not possess the additional characteristics of virulence, their characteristic multiple resistance limits the available treatment options for infections caused by this organism. Vancomycin, a glycopeptide, appears to be the solitary antimicrobial agent with 100% susceptibility and may be the choice of drug in the treatment of multi-drug resistant MRSA infections. However, its noxious side effects, such as kidney failure and high cost, restricted its usage. When considering

vancomycin therapy, selection inevitably requires in vitro susceptibility testing of each MRSA strain in clinical laboratories, due to the emergence of vancomycin-resistant Staphylococcus aureus (VRSA) in various parts of the world[24].

CONCLUSION

Given the high isolation rate of MRSA and its resistance to erythromycin, penicillin, trimethoprim and cephalexin; MRSA infections treatment with these antibacterial drugs will not be effective. Vancomycin sustained to be the first-line drug for infection of MRSA worldwide and, to maintain its worth, its usage must be restricted to cases where it is obviously required. In addition, regular monitoring of nosocomial infections, counting monitoring patterns of susceptibility to MSSA and MRSA antibiotics and developing a final antibiotic strategy, can help reduce the frequency of infections with MRSA. This study is a preliminary study to help epidemiologists recognise the MRSA isolates nature.

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