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A STUDY ON THE PREVALENCE AND ANTIMICROBIAL SUSCEPTIBILITY PATTERN OF METHICILLIN RESISTANT *STAPHYLOCOCCUS AUREUS ISOLATED FROM CLINICAL SAMPLES*

Microbiology

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ABSTRACT

Background: Methicillin Resistant *Staphylococcus aureus* (MRSA) prevalence is increasing worldwide and it remains as a major cause of morbidity and mortality in hospitalised patients due to its versatile behaviour towards antibiotics.
Aims: This study was done to find out the prevalence and antimicrobial susceptibility pattern of MRSA isolates at our hospital setup, in order to guide policy on the appropriate use of antibiotics.
Settings and Design: The study was a prospective observational study, carried out in the Department of Microbiology, Darbhanga Medical College, Laheriasarai, Bihar.
Methods and Material: A total number of 288 strains of *Staphylococcus aureus* were isolated from various clinical samples received in the laboratory. *Staphylococcus aureus* was identified by routine standard operative procedures. Antimicrobial susceptibility testing was done by Kirby-Bauer disc diffusion method and the results were interpreted following Clinical Laboratory Standards Institute (CLSI) guidelines. Methicillin resistance was screened by using oxacillin disks [1 mcg].
Statistical analysis used: Data obtained was analysed and presented in counts and percentages. 95 % confidence interval values were also calculated.
Results: Methicillin resistance was documented in 120 [41.6%] *Staphylococcus aureus* isolates. Most of them were isolated from pus, wound swabs, urine and respiratory samples. All MRSA isolates were resistant to penicillin and cefepime. The resist-ance was high to tetracycline, erythromycin, co-trimoxazolepiperacillin / tazobactam, and ciprofloxacin; moderate to amino-glycosides, clindamycin, chloramphenicol and levofloxacin. All MRSA strains were susceptible to vancomycin. Overall, 63.3% [76/120] of MRSA strains were found to be resistant to more than 6 antimicrobials tested.
Conclusions: Our study emphasizes the need for regular surveillance and formulation of a strict drug policy on the appropriate use of antibiotics to control MRSA infections. This would also minimise the irrational use of vancomycin and the emergence of vancomycin resistant *Staphylococcus aureus* [VRSA].

KEYWORDS

MRSA, Vancomycin, Antimicrobial susceptibility pattern

INTRODUCTION

The isolation of methicillin resistant *Staphylococcus aureus* [MRSA] was reported within one year of introduction of methicillin. Since then, the prevalence of MRSA has increased steadily. In the past 10 years, numerous outbreaks of infections caused by MRSA have been reported. In many hospitals, 40 – 50 % of *Staphylococcus aureus* isolates are now resistant to methicillin.

MRSA isolates are important for their resistance to many commonly used antibiotics. They exhibit remarkable versatility in their behaviour towards antibiotics which poses a serious therapeutic problem. Thus, MRSA remains as a major cause of morbidity and mortality among hospitalised patients despite the availability of numerous effective anti-staphylococcal antibiotics. This emphasizes the need to study the prevalence and antimicrobial susceptibility pattern of MRSA isolates area-wise in order to guide policy on the appropriate use of antibiotics which would minimise the irrational use of vancomycin and so the emergence of resistance to vancomycin.

The present study was carried out to find out the prevalence and antimicrobial susceptibility pattern of MRSA isolates at our hospital set up. The information would also be useful in contributing data to larger more extensive surveillance programs.

MATERIAL AND METHODS

The present study was conducted in the Department of Microbiology, Darbhanga Medical College &Hospital, Laheriasarai, Bihar. A total number of 288 strains of *Staphylococcus aureus* were isolated from various clinical samples received in the laboratory during the period January 2020 to June 2020.

Standard procedures were followed to isolate the organ-isms from the clinical samples. *Staphylococcus aureus* was identified by Gram stain morphology, colony characters on blood agar, biochemical reactions like catalase test, mannitol fermentation, slide coagulase test and tube co-agulase test.

All the *Staphylococcus aureus* strains were then subjected to antimicrobial susceptibility testing by Kirby-Bauer disc diffusion method and the results were interpreted follow-ing CLSI guidelines4. Methicillin resistance was screened by using oxacillin disks [1 mcg]. Anti-staphylococcal antibiotics like penicillin G [10 units], cefepime [30mcg], ciprofloxacin [5 mcg], levofloxacin [5 mcg], erythromycin [15 mcg], tetracycline [30 mcg], chloramphenicol [30 mcg], co-trimoxazole [1.25/23.75 mcg], piperacillin/tazobactam [100/10 mcg], clindamycin [2 mcg], gentamicin [10 mcg], amikacin [30 mcg], tobramycin [10 mcg] and vancomycin [30 mcg] were tested.

The data obtained in this study was summarized by counts and percentages. Antimicrobial Susceptibility rates were also presented in 95% confidence interval values.

RESULTS

A total number of 288 strains of *Staphylococcus aureus* were isolated from different clinical samples obtained from inpatients of the hospital. Methicillin resistance was documented in 120 [41.6%] *Staphylococcus aureus*isolates (Figure 1). Majority of the MRSA strains were isolated from pus and wound samples [58.3%], followed by urine [22.5%], respiratory specimens [16.6%], blood [1.6%] and body fluids [0.8%] (Table 1).

All MRSA isolates were resistant to penicillin and cefepime. Resistance was high to tetracycline, erythromycin, cotrimoxazole, piperacillin/tazobactam, and ciprofloxacin; moderate to

aminoglycosides, levofloxacin, clindamycin and chloramphenicol. All MRSA strains isolated in the present study were susceptible to vancomycin (Table 2).

Distribution of MRSA & MSSA among Staph.Aureus isolates (n=288)

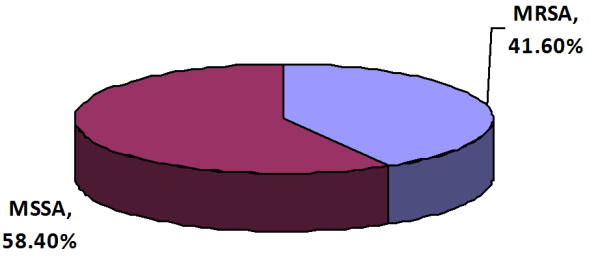

Table – 1 : Distribution of MRSA strains among clinical specimens (n=120)

Clinical specimen	No. of MRSA strains
Pus, wound swab	70(58.3%)
Urine	27(22.5%)
Respiratory sample	20(16.6%)
Blood	2(1.6%)
Body fluids	1(0.8%)
Ear swab	0(0%)
High vaginal swab	0(0%)

Table – 2 :Antimicrobial susceptibility pattern of MRSA isolates (n=120)

Antimicrobial agents	Sensitive No. (%)	95% Confidence Interval	Resistant No. (%)	95% Confidence Interval
Cefepime	0(0%)	0.00-0.31	120(100%)	0.96-1.00
Erythromycin	10(8.3%)	0.04-0.14	110(91.6%)	0.85-0.95
Tetracycline	14(11.6%)	0.07-0.18	106(88.3%)	0.81-0.92
Co-trimoxazole	16(13.3%)	0.08-0.20	104(86.6%)	0.79-0.91
Piperacillin/Tazo bactam	30(25%)	0.18-0.33	90(75%)	0.66-0.81
Ciprofloxacin	36(30%)	0.22-0.38	84(70%)	0.61-0.77
Levofloxacin	54(45%)	0.36-0.53	66(55%)	0.46-0.63
Chloramphenicol	56(46.6%)	0.37-0.55	64(53.3%)	0.44-0.62
Gentamicin	58(48.3%)	0.39-0.5	62(51.6%)	0.42-0.60
Amikacin	62(51.6%)	0.42-0.60	58(48.3%)	0.39-0.57
Tobramycin	70(58.3%)	0.49-0.66	50(41.6%)	0.33-0.50
Vancomycin	120(100%)	0.96-1.00	0(0%)	0.00-0.31

DISCUSSION

MRSA prevalence is increasing worldwide and has become a serious public health issue. The MRSA prevalence rate shows significant regional variance. In the present study, the prevalence rate of MRSA was found to be 41.66 %. This was higher when compared to various studies reported from India, ranging from 29.1% to 34.78% and abroad, ranging from 9 % to 26.9%. However, it was comparable to the prevalence rates reported from Varanasi (38.44%), Chennai (45%), Amritsar (46%) and Visakhapatnam (45%). In contrast, studies from Indore (80.89%) and Pakistan (83%) reported much higher prevalence rates of MRSA. This variation in prevalence rates in different places could be due to differential clonal expansion and drug pressure in the community.

MRSA are often multidrug resistant and studies have indicated that there has been progressive increase in the development of resistance to several antibiotics. In our study, 63.3% [76/120] of MRSA isolates were found to be resistant to more than 6 antimicrobials tested. A study from Varanasi reported that prevalence of multidrug resistant MRSA is high in India and without MRSA surveillance and strict drug policy, the threat would increase.

The antimicrobial susceptibility pattern of MRSA isolates varies with place and time. Ciprofloxacin has been considered as a potent antibiotic in the therapy of MRSA infections and therefore it is widely used on empirical basis. This resulted in a steady increase of resistance to ciprofloxacin among MRSA isolates. Many studies have reported high resistance rates to ciprofloxacin among MRSA isolates ranging from 75.7% to 88.2 %. In the present study it was found to be 70 %. However, this was higher when compared to other studies reported from Eritrea (8 %), Mangalore (31.8%) and Kano (43.7 %).

High resistance was observed in this study among MRSA isolates to antibiotics like co-trimoxazole (86.6%), tetracycline (88.3%), and erythromycin (91.6%). This was indicated in different studies reported from India and abroad. In contrast, low resistance was found in Eritrea to erythromycin (27%) and cotrimoxazole (23%). The emergence of high resistance could be due to excessive use and over the counter availability of these antibiotics in the developing world for the treatment of staphylococcal and many other infections both in man and animals.

All MRSA isolates were found to be resistant to penicillin (100%) and cefepime (100%). Interestingly, the resistance to piperacillin and tazobactam combination (75%) was high even though it was not a commonly used antibiotic at our hospital setup.

Vancomycin was found to be the most effective antibiotic against MRSA isolates in our study, with a susceptibility rate of 100%. This was in line with the observations made in various studies from India and abroad. However, it is quite expensive, toxic and not easily available for regular use and therefore may be reserved for treating life threatening MRSA infections.

In our study MRSA isolates showed moderate resistance rates to gentamicin [51.6%], amikacin [48.3%] tobramycin [41.6%], chloramphenicol [53.3%], clindamycin [53.3%] and levofloxacin [55%] compared to other antibiotics tested. These antibiotics may be tried as an alternative to vancomycin after antimicrobial susceptibility testing is done. This would prevent the emergence of vancomycin resistant Staphylococcus aureus [VRSA].

CONCLUSION

MRSA is a common pathogen at our hospital setup and vancomycin is still the drug of choice. The presence of high percentage of multidrug resistant MRSA is a serious matter of concern. Therefore, regular surveillance and formulation of a strict drug policy on the appropriate use of antibiotics are very much essential in the control of MRSA infections and to avoid the emergence of VRSA. Regular monitoring on quality, availability and the use of antibiotics also helps in preserving the effectiveness of antibiotics.

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