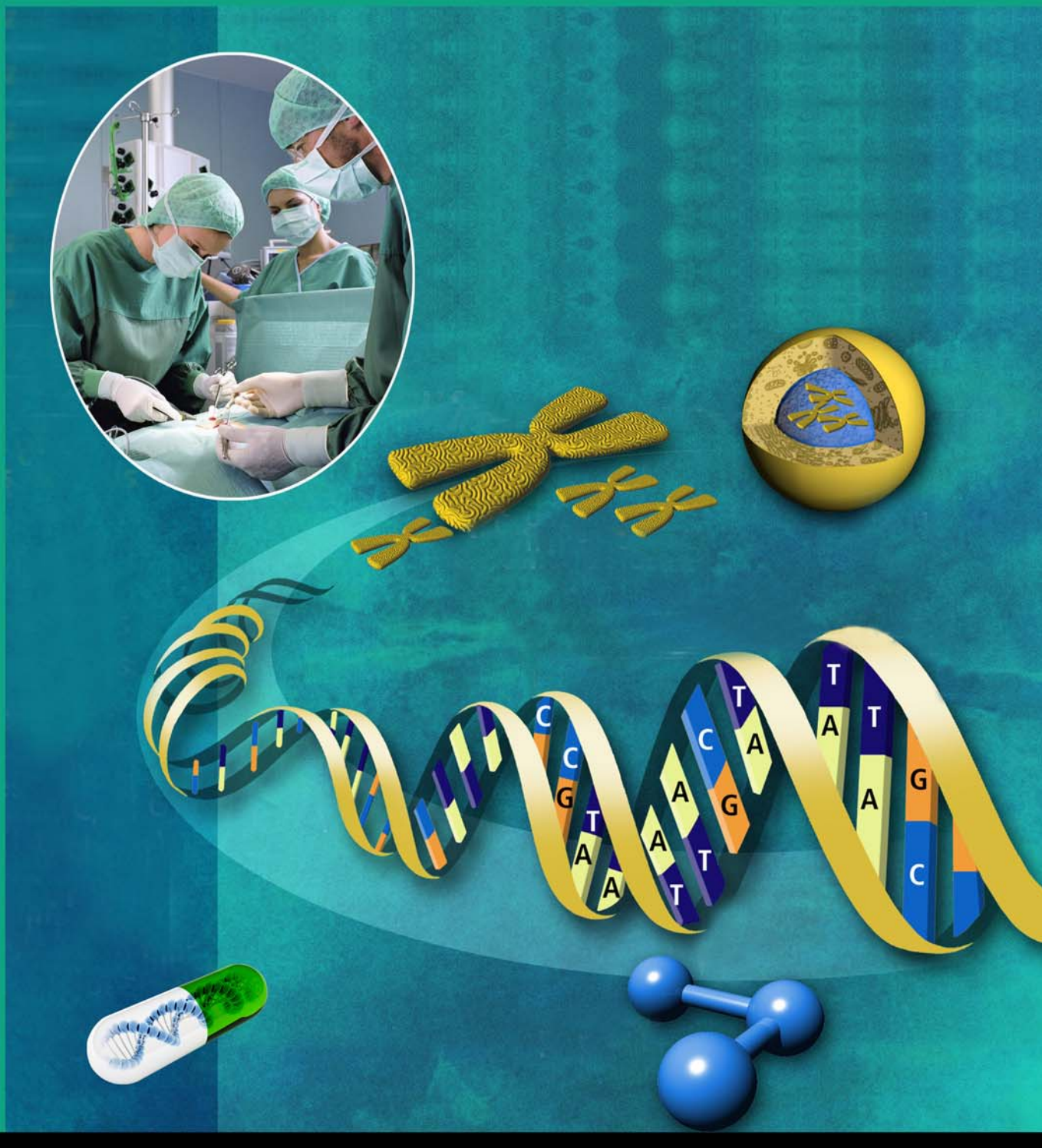
ISSN 2278 - 5221
Vol. 3, No. 1, January 2014

International Journal of Pharma Medicine and Biological Sciences

IJPMBS



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International Journal of Pharma Medicine and Biological Sciences

ISSN 2278 – 5221 www.ijpmbs.com
Vol. 3, No. 1, January 2014

Research Paper

PREVALENCE OF METHICILLIN RESISTANT STAPHYLOCOCCUS AUREUS AND ITS ANTIBIOTIC SUSCEPTIBILITY PATTERN IN A TERTIARY HEALTH CARE

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Background: Methicillin resistant *Staphylococcus aureus* (MRSA) was discovered in1960 in United Kingdom since then MRSA continues to be a major burden on world's health and economy. The prevalence of MRSA with in hospital environment has increased in the recent years. According to several recent reports, the incidence of MRSA has doubled, which has increased the morbidity and mortality among the patients. Aims and objectives: This study was conducted to know the prevalence of MRSA and its antibiotic susceptibility pattern. Materials and methods: MRSA strains were isolated from pus samples over a period of one year by using standard protocols. The sensitivity pattern was found out according to Clinical laboratory standard institute. Results: A total of 4271 pus samples were processed, of these 1250 (29.26%) were *S. aureus*. Out of 1250 *S. aureus* 865(69.2%) were MRSA. These isolates were most sensitive to vancomycin 824 (95.72%) followed by linezolid 725 (83.83%) and amikacin 514 (59.4%). Forty two (4.8%) isolates were resistance to all drugs including vancomycin. Conclusion: Our study shows the prevalence of MRSA in pus samples was 20.25%. Of total isolates 4.8% were vancomycin resistant, which is more as compared to previous studies. So this is suggested to make antibiotic policy to prevent health associated infections.

Keywords: MRSA, Hospital infection, Vancomycin, Antibiotic susceptibility

INTRODUCTION

Staphylococcus aureus (*S.aureus*) is normal flora that commonly live on the skin, nose, axilla and groin of healthy persons. It occasionally cause infections and most of these infections are minor for example boils, carbuncles, etc., that can be treated without antimicrobials. Some staphylococcal infections are invasive type involving blood and other internal organs that need antibiotic treatment.

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Till 1940s, *S. aureus* was sensitive to penicillin, but by 1950s more than half of *S. aureus* showed penicillin resistance. In 1960, methicillin was developed to treat penicillin-resistant infections. *S. aureus* again, developed resistant to methicillin in 1960s and these were known as methicillin resistant *Staphylococcus aureus* (MRSA).

The over-use of antibiotics has led to increased number of infections that are resistant to common antibiotics and MRSA is one of such emerging antibiotic resistant organism. According to a 2009 report by the Centers for Disease Control and Prevention (CDC), more than 90,000 life-threatening illnesses and nearly 19,000 deaths associated with MRSA occur yearly in the United States (Al-Anazi, 2009).

The prevalence of MRSA in hospital settings has increased in recent years. Many studies have reported that the infection rate has been doubled, which has increased the morbidity and mortality among patients (Anurba *et al.,* 2003; and Bala *et al.,* 2010).Therefore, this study was conducted to document the prevalence and antibiotic susceptibility pattern of both community as well as hospital acquired MRSA in our institute.

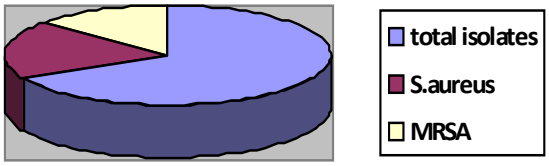
MATERIALS AND METHODS

This retrospective study was conducted in the department of Microbiology of Pt. B D Sharma PGIMS Rohtak during a period of one year from March, 2012 to February, 2013 on a total of 4271 pus samples. All the samples were processed and identification of the *S. aureus* isolates were done by standard protocol (Beaves, 2009). All the *S.aureus* isolates were screened for methicillin resistance by using oxacillin (1 µg disc). Results were interpreted according to Clinical Laboratory Standard Institute (CLSI) guidelines (Bisaga, 2008). All MRSA isolates were tested for antibiotic susceptibility by Kirby Bauer disc diffusion method by using following antimicrobial agents from Hi-Media (Mumbai, India): linezolid (30 µg), erythromycin (5 µg), doxycycline (30 µg), amoxyclavulanic acid (30 µg), cefdinir (30 µg), pristinamycin (10 µg), penicillin (10 µg), gentamicin (10 µg), tobramycin (10 µg), amikacin (30 µg), clindamycin (2 µg), tetracyclin (10 µg), cotrimoxazole (25 µg), vancomycin (30 µg). Results were interpreted according to CLSI guidelines 8. *S. aureus* ATCC 25923 was used as a standard control strain.

RESULTS

During the study period of one year, a total of 4271 pus samples were processed, of these 1250 (29.26%) were *S. aureus*. Out of 1250 *S. aureus* 865 (69.2%) were MRSA (Figure 1). These isolates were most sensitive to vancomycin 824 (95.72%) followed by linezolid 725 (83.83%) and amikacin 514 (59.4%) (Table 1). Forty two (4.8%) isolates were resistance to all drugs including vancomycin.

Figure 1: Prevalence of MRSA in PUS Samples



DISCUSSION

Methicillin-resistant *Staphylococcus Aureus* (MRSA) is resistant to beta-lactams, e.g., methicillin and other more common used antibiotics such as oxacillin, penicillin and amoxicillin. It has been reported that less than 2% of population is colonized with MRSA (Boxerbaum *et al.*, 1988).

Table 1: Antibiotic Sensitivity Pattern of MRSA Isolates: (865)

Drugs	No. of isolates(%)
Oxacillin	16(1.8%)
Penicilin	43(4.9%)
Cotrimoxazole	49(5.6%)
Cefdinir	147(16.16%)
Amoxyclavulanic acid	181(19.8%)
Tetracycline	205(23.6%)
Clindamycin	211(24.4%)
Doxycycline	219(25.3%)
Erythromycin	289(33.4%)
Gentamicin	384(44.4%)
Tobramycin	415(48%)
Amikacin	514(59.4%)
Linezolid	725(83.83%)
Vancomycin	824(95.2%)

Two basic types of MRSA exist: One is healthcare associated (HA-MRSA) and the other one is community acquired (CA-MRSA) (Centers for Disease Control and Prevention, 2009)

MRSA has established itself as an important nosocomial pathogen in all age groups (CLSI, 2006; Collee *et al.,* 1996; Craven *et al.,* 1986*;* Daum *et al.*, 2002). Several risk factors for acquisition of MRSA have been identified which includes (Fey *et al*., 2003):

- Prolonged hospital stay
- Stay in an intensive care or burn unit
- Major chronic illness
- Invasive procedures or devices
- Recent or intensive antibiotic therapy
- Age extreme

Community-Acquired (CA)-MRSA in adults has emerged (Gorak *et al.,* 1999; Gorwitz *et al*., 2008 Groom *et al.,* 2001) in 1980's, initially in intravenous drug users or members of other high-risk groups with frequent contact with the health care system. From the 1990s, it has emerged as a pathogen without traditional risk factors for MRSA acquisition in community (Herold *et al.,* 1998; Ibarra *et al.,* 2008; Jarnagin, 2010; Levine *et al.,* 1982; Miller *et al.,* 2008).

Resistance to β-lactam antibiotics is conveyed by acquisition of a chromosomal *mecA* gene that encodes for a penicillin-binding protein with a low affinity for this antibiotic class. The *mecA*genes are found on mobile genetic elements called staphylococcal chromosomal cassettes (SCC*mec*).

CA-MRSA predominately lead to superficial and deep soft-tissue infections, which are susceptible to multiple classes of antibiotics other than β-lactams as compared to HA-MRSA. These differences reflect coevolution of MRSA in the community setting, with strains unrelated to those in hospital settings (Mongokolrattanothai *et al.,* 2003; Moreno *et al.,* 1995; Okuma *et al.,* 2002).

In the present study, the prevalence of MRSA in pus samples was found to be 865 (20.25%) A high prevalence rate of 77.6% (Rathore and Kline, 1989) and low prevalence rate of 31% (Salaria and Singh, 2001) and 45.2% was reported in other studies.

MRSA isolates resistant to β-lactams antibiotics and other groups of drugs including sulfa drugs , tetracyclines and clindamycin are often sensitive to vancomyin (Saravolatz *et al.,* 1982). Newer drugs such as linezolide, daptomycin, tigecyline and combination quinpristin/dalfopristin are being reported to be effective against MRSA.

Table 2: Different Resistance Pattern of MRSA

Resistance Pattern	MRSA(n=865)
Resistance to more than three antimicrobials other than Vancomycin	346(40%)
Resistance to all antimicrobials other than Vancomycin	170(19.7%)
Resistance to all antimicrobials including Vancomycin	42(4.8%)

Similar facts has also been demonstrated in the present study, isolates were most sensitive to vancomycin 862 (99.7%) followed by linezolid 725 (83.83%) and amikacin 514 (59.4%) (Table 1). Resistance to all antibacterial other than vancomycin was found in 170 (19.7%) isolates and 42 (4.8%) isolates were resistant to all drugs including vancomycin (Table 2). Association of multi drug resistance with MRSA further aggravate the problem in treatment of patients with MRSA infections.

Vancomycin and linezolid are being used for treatment of MRSA infections, it has been supported in the present study and by other authors (Van Belkum and Verbrugh, 2001)

In intensive care unit patients with MRSA pneumonia and those on mechanical ventilation can spread infection during coughing and physiotherapy. Good hygiene practices such as stringent hand washings with alcohol base solutions are one of the most effective and widely accepted strategy to prevent spread of MRSA infection (Saravolatz *et al.,* 1982).

In the present study the prevalent MRSA strains are resistant to commonly used antimicrobials, but have a high sensitivity to vancomycin and linezolid. Here by, it is suggested that there should be periodic review of hospital associated infections including antimicrobial sensitivity testing. It would be helpful in making antibiotic policy for infection control and reducing the incidence of MRSA.

Limitation of the study: This was a retrospective study so there is an increased chances of misclassification of MRSA as community acquired or hospital acquired. Because patients and complete medical report were not available, therefore this was not possible for us to classify the infection into CA or HA MRSA. Finally, there can be underestimation of burden of MRSA in population. Secondly, the differentiation required the genotyping for confirmation, which was not available in our institute.

CONCLUSION

The prevalence of MRSA isolates is increasing in hospital settings and these isolates were more resistant to vancomycin than previously isolated MRSA. So, there is a need to make a strict antibiotic policy and maintaining strict hand hygiene practices in medical staff to avoid cross contamination among patients and to prevent MRSA spread.

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ISSN 2278-5221
9 772278 522003 01