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RESEARCH ARTICLE

SENSITIVITY PATTERN OF METHICILLIN RESISTANT STAPHYLOCOCCUS AUREUS ISOLATED FROM SURGICAL SITE INFECTIONS

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ABSTRACT

Surgical site infections are an important cause of health care associated infections among surgical patients. Patients who develop surgical site infections have longer hospital stays, more expensive hospitalizations, and increased mortality. They are the second most commonly reported nosocomial infection and they count for approximately a quarter of all nosocomial infections. This was a retrospective study conducted at a tertiary care hospital in South India, from June 2010 to December 2011. Testing for Methicillin resistance was performed by modified Kirby Bauer Disc Diffusion method using Cefoxitin (30µg) as recommended by the Clinical and Laboratory Standard Institute. A total of 195 aerobic bacteria were isolated. 114 were Gram positive cocci (58.4%) and 81 were Gram negative bacilli (41.5%). The most common organism was S. aureus, with 69 isolates (31.2%). Out of 61 isolates of S. aureus, 12 (19.6%) were Methicillin resistant. Highest resistance was seen with Penicillin and least resistance to Vancomycin and Linezolid. Resistance to Ciprofloxacin was and Gentamicin was 75% and 58.3% respectively. But the alarming sign is the resistance to Cephalosporins group of antibiotics which was more than 50%. We did not find any resistance to Vancomycin and Linezolid. Several studies all over the world have well established that the early detection of Methicillin resistance is very essential in the prognosis of infections which are caused by S. aureus as many of these infections are life threatening. The regular surveillance of SSIs and monitoring of antibiogram of MRSA will help in formulating a definite antimicrobial policy and reduce the use of powerful antibiotics like Vancomycin and Linezolid and preserve them for the treatment of life threatening infections.

Key words: Surgical site infection, MRSA, antimicrobial susceptibility, nosocomial infections

INTRODUCTION:

Surgical site infections (SSI) are an important cause of health care associated infections among surgical patients. Patients who develop surgical site infections have longer hospital stays, more expensive hospitalizations, and increased mortality [1]. They are the second most commonly reported nosocomial infection and they count for approximately a quarter of all nosocomial infections [2, 3]. Despite an improved understanding of the patho-physiology and improved methods of prevention and prophylaxis, surgical wound infections remain the most common cause of post operative morbidity and mortality and economic burden [4].

Surgical site infection rate has varied from a low of 2.5% to a high of 41.9% [5]. The common pathogenic bacteria in SSIs include Staphylococci, Pseudomonas, Streptococci, Enterococci, E. coli, Klebsiella, Enterobacter, Citrobacter, Acinetobacter, Proteus, etc. S. aureus is the commonest cause of SSI and other nosocomial infections. S. aureus was once susceptible to Penicillin but widely resistant organisms soon emerged. The introduction of Methicillin initially solved the problem, but later, strains which were resistant to Methicillin developed. Thus, an increased number of resistant strains have been seen worldwide [6,7].

Methicillin resistant Staphylococcus aureus (MRSA) appears to be susceptible in vitro to other β-lactam agents such as Cephalosporins; however, they are clinically ineffective [7]. Since MRSAs are resistant to all the β-lactam antibiotics, the therapeutic options are significantly limited. The incidence of MRSA in India ranges from 30-70% [8,9]. Knowledge of incidence of MRSA in SSI and its antibiotic sensitivity pattern will be help in the selection of appropriate antimicrobial therapy. Hence the present study.

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MATERIAL AND METHODS:

This was a retrospective study conducted at a tertiary care hospital in South India, from June 2010 to December 2011. A surgical wound with pus discharge, wounds with serous or seropurulent discharge and negative cultures, but with signs of sepsis present concurrently (warmth, erythema, induration and pain) and the surgeons diagnosis was considered as surgical site infection [10]. Wounds with cellulitis and no drainage, burns wounds and suture abscesses were not included in the study. Wound swabs were collected aseptically with a sterile cotton wool swab from different wards. Samples were inoculated onto 5% Blood agar and MacConkey agar. The plates were incubated at 37 for 18-24 hours. Isolated colonies were subjected to Gram staining and biochemical tests for identification [11].

Testing for Methicillin resistance was performed by modified Kirby Bauer Disc Diffusion method using Cefoxitin (30µg) as recommended by the Clinical and Laboratory Standard Institute (CLSI) [12]. The isolates were considered Methicillin resistant if zone of inhibition was 10 mm or less. The following antibiotics were tested- Penicillin (10 units), Erythromycin (5µg) Ciprofloxacin (5µg), Gentamicin (10µg), Cefuroxime (30µg), Cefoperazone (30µg), Cefotaxime (30µg), Vancomycin (30µg) and Linezolid (30µg) (Hi media, Mumbai). S. aureus ATCC 25923 was used as control strain. The data was recorded and analyzed using Microsoft excel (2010 version) and analyzed. Results are explained in frequency and percentage.

RESULTS:

A total of 195 aerobic bacteria were isolated. 114 were Gram positive cocci (58.4%) and 81 were Gram negative bacilli (41.5%). The most common organism was S. aureus, with 69 isolates (31.2%). Out of 61 isolates of S. aureus, 12 (19.6%) were Methicillin resistant. The organisms isolated from SSIs from is shown in table 1.

Table 1: Organisms isolated from surgical site infections

Organisms	Number	Percentage
Gram positive		
Staphylococcus aureus	61	31.2
Staphylococcus epidermidis	24	12.3
Enterococcus faecalis	9	4.6
Enterococcus faecium	5	2.5
β-hemolytic Streptococcus	15	7.69
Gram negative		
Escherichia coli	30	15.3
Klebsiella spp	18	9.2
Pseudomonas spp	24	12.3
Acinetobacter spp	3	1.5
Proteus spp	5	2.5
Enterobacter spp	1	0.5
Total	**195**	**100**

Table 2: Age and sex distribution of Methicillin resistant Staphylococcus aureus from isolated cases

Age group (years)	Male	Female	Total
0-10	-	2	2
10-20	2	1	3
20-40	2	2	4
40-60	-	1	1
>60	1	1	2
Total	**5**	**7**	**12**

Highest numbers of cases were in the age group of 20-40 years, and maximum cases were from females.

The sensitivity pattern of MRSA is shown in table 4

Table 3: Sensitivity pattern of Methicillin resistant Staphylococcus aureus (% resistance)

Antibiotic	Number	Percentage
Penicillin	12	100
Erythromycin	10	83.3
Ciprofloxacin	9	75
Gentamicin	7	58.3
Cefuroxime	6	50
Cefoperazone	7	58.3
Cefotaxime	5	41.6
Vancomycin	0	0
Linezolid	0	0

Highest resistance was seen with Penicillin and least resistance to Vancomycin and Linezolid.

DISCUSSION:

The prevalence rate of surgical site wound infections, though preventable, is high [11,12]. In our study, S. aureus was the most prevalent organism (31.2%) among all the pathogens isolated from SSI. The results were consistent with similar studies carried out by elsewhere in India [12,13]. It has been regularly noted that S. aureus continues to be the single most important bacterial species in the primary etiology of surgical site infections since the past 40 years [14,15]. The incidence of Methicillin–resistant S. aureus in our study was 19.6%. This finding is in agreement with the observations of Kownhar et al [16]. But other studies have reported a lesser incidence around 10% [13,17].

Sensitivity of MRSA to various antibiotics is shown in table 3. Highest resistance was seen with Penicillin and least resistance to Vancomycin and Linezolid. Resistance to Ciprofloxacin was and Gemtamicin 75% and 58.3% respectively. But the alarming sign is the resistance to Cephalosporins group of antibiotics which was more than 50%. We did not find any resistance to Vancomycin and Linezolid, but some studies have recorded the emergence of low level and intermediate Vancomycin resistance [18-21]. Resistance of isolated micro-organisms from surgical patients is an emerging problem worldwide [22,23].

Surgical site infections are a major cause of morbidity of post operative surgical patients and in spite of using broad spectrum antibiotics including potent anti staphylococcal drugs for perioperative prophylaxis, S. aureus remains most common cause of SSI. Infection with MRSA is becoming endemic in hospitals worldwide. Several studies all over the world have well established that the early detection of Methicillin resistance is very essential in the prognosis of infections which are caused by S. aureus as many of these infections are life threatening [12, 24]. Infection control measures such as the active surveillance of SSIs, the implementation of a checklist, compliance observations and instruction/training of healthcare workers, as well as Staphylococcus aureus /MRSA screening, clipping instead of shaving, adherence to perioperative antibiotic prophylaxis, maintaining intraoperative normothermia and blood glucose control are essential in order to prevent SSIs [23, 25, 26]. Every hospital is different and so are its infections. The antibiogram of organisms is not constant and keeps changing over a period of time. Regular antibiotic susceptibility studies will help to formulate hospital infection control guidelines and help clinicians in choosing an appropriate empirical and definitive treatment for SSIs.

Limitations of the study

We did not use polymerase chain reaction method for the detection of the mecA gene, which is currently recommended by CLSI, which would have been more sensitive in the detection of the MRSA isolates. Another limitation is this was a retrospective study and sample size was small. Future studies should be prospective with large sample size and should include genotypic method for detection of MRSA

CONCLUSION:

Methicillin resistant Staphylococcus aureus (MRSA) constituted 19.6% of the total SSI isolates. MRSA was resistant to most commonly used antibiotics. Ongoing surveillance on a long-term follow-up basis and a higher degree of collaboration or co-operation between surgeons and microbiologists is necessary for formulating newer definitions and adapting control measures. The

regular surveillance of SSIs and monitoring of antibiogram of MRSA will help in formulating a definite antimicrobial policy and reduce the use of powerful antibiotics like Vancomycin and Linezolid and preserve them for the treatment of life threatening infections.

Conflict of interest: None

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