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Research Paper

Prevalence of MRSA Among Post Operative Surgical Site Infection of Laparotomy Cases in a Tertiary Care Hospital

Medical Science

KEYWORDS : SSI , MRSA ,Cefoxitin disc diffusion , prevention.

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ABSTRACT

This study was conducted to investigate the prevalence rate of MRSA and their susceptibility pattern among surgical site infection (SSI) in laparotomy cases for 1 year period to provide guidelines for empirical antibiotic therapy and prevention of transmission of MRSA in post operative infections. During the study period , 720 patients underwent Laparotomy surgery , among them SSI was observed in 100 cases . In that about 52% were Gram positive organisms and 46% were Gram negative organisms and 2% were culture negative. Staphylococcus aureus was the predominant causative agent (40%) followed by Escherichia coli (17%) . Among 40 Staphylococcus , MRSA was identified in 15 isolates(15%) by disc diffusion method using cefoxitin and rest of them are MSSA (25%). In that more than 80% of MRSA were resistant to Ampicillin, Gentamycin & Doxycycline & 100% sensitive to Vancomycin, Linezolid & Teicoplanin.

INTRODUCTION

Surgical site infection (SSI) is always a major complication of surgery. Despite the significant improvements in the field of microbiology, antibiotics , superior instruments and improved techniques, surgical site infections [SSI] remain the most common post operative complication after almost all forms of surgery. SSI and its prevalence among other infections constitute 38% of all surgical patients that remains high and represents a substantial burden of disease [1]. Among the organisms that cause SSI in laparotomy cases , Gram positive organisms predominate ,including Staphylococci,Enterococci and CoNS and Gram negative organisms such as the Enterobacteriaceae which are generally confined to skin sites adjacent to major reservoirs like GIT [2] . Staphylococcus aureus is a major cause of skin, soft tissue, eye, respiratory, bone, joint and endovascular infections, ranging in severity from localized and easily treatable to invasive and life threatening.[3,4].

The transmission of Staphylococcus aureus in hospital is often as a result of exposure of patients to health care workers who are S.aureus carriers or from infected patients.It is the significant pathogen because of extra cellular virulence factors that facilitate pathogenesis and colonisation of the host .[5]

Staphylococcus aureus is a hardy bacterium and also has the ability to develop resistance to the drugs commonly used to treat the infections .MRSA acquires its resistance via the methicillin resistance gene mecA, which encodes a low-affinity penicillin-binding protein PBP2′ (or PBP2a) that is absent in susceptible S. aureus strains [6]. MRSA infections are more difficult to treat than Methicillin susceptible isolates and MRSA can spread easily among patients in hospital. MRSA is endemic in many hospitals throughout the World affecting vulnerable patients, who had undergone major surgery and those in SICU. Cefoxitin, which is a potent inducer of the mecA regulatory system is being widely used as a surrogate marker for detection of mecA gene-mediated methicillin resistance. CLSI has recommended cefoxitin disc diffusion method for the detection of MRSA.

Treatment of Staphylococcus aureus has become difficult, because of the ability of the bacteria which rapidly develops multi drug resistance . Almost 50% strains were resistant to penicillin in USA [7] .In 2002, 90% staphylococcus aureus strains isolates found in hospitals, World wide were resistance to penicillin [5] . According to MRSA researcher , research has shown that in vitro antibiotic susceptibility recommends using five antimicrobial agents with consistently high demonstrated degrees of effectiveness in vivo against MRSA: quinupristin/dalfopristin, minocycline, daptomycin, linezolid, and vancomycin. All of these are available in intravenous form, but minocyline and linezolid are both available in oral form, allowing patients to medicate at home at a low cost compared to the intravenous options [6]

MATERIALS AND METHODS

This study was approved by the ethical committee of our institute and informed consent was obtained from all patients , who are included in this study.It was carried out in the Department of Microbiology, Thanjavur Medical College over a period of one year from April 2009 to March 2010.

SPECIMEN COLLECTION

The suspected wound area was cleaned with normal saline. Two sterile cotton swabs were used to collect pus from active infective site, by rolling gently and firmly on the base of wound .Collected samples were transported immediately to the laboratory and processed. A direct Gram staining was done with one swab and culture inoculation with the second swab was done on Nutrient agar and Blood agar and incubated at 37^0 C for 24 hours. In the following day, culture plate was examined for the presence of bacterial colonies and the growth was identified as Staphylococcus aureus with Grams staining, catalase, , Slide and tube coagulase test, growth on mannitol salt agar, oxidation-fermentation test, urease and Voges Proskauer test .

CONFIRMATORY TESTS FOR MRSA:

Disc diffusion test : As per the CLSI recommendations, STAPHYLOCOCCUS AUREUS ATCC 25923 was used as reference strain for the standardization of antibiotic susceptibility testing. The broth culture is prepared in peptone water and incubated at 35 ˚C for 2-6 hrs until achieving turbidity of 0.5 McFarland standard.Mueller-Hinton agar plates are supplemented with 4% sodium chloride (w/v 0.68 mol/l) as per the NCCLS recommendation, was inoculated with test strains and the ATCC strain 25923 as lawn culture in separate plates used as screening test for MRSA. Cefoxitin (30 micro gm) antibiotic disc was placed in appropriate positions and then incubated for 18-24 hrs. The zone of inhibition around the cefoxitin disc was measured as either less than 21mm (MRSA) or more than 22mm (MSSA).

As per the CLSI standards, all the isolated Staphylococcus

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aureus were tested for antimicrobial susceptibility tests by Modified Kirby –Bauer disc diffusion method in MHA plates for betalactams ,macrolides, aminoglycosides , quinolones and others like vancomycin, clindamycin, teicoplanin, Doxycycline and Cotrimoxazole.

RESULTS

Of the 100 post operative laparotomy wound infections screened, 98 cases showed positive cultures and two were negative . In that about 52% were positive for Gram positive organisms and 46% were positive for Gram negative organisms and 2% were culture negative.

In our study , 65% infection was noticed around 31-60 years age group and only 24% among those below 30years .

TABLE - 1 SSI , IN AGE WISE DISTRIIBUTION

AGE (In Years)	FEMALE		MALE	
	NO-28	PERCENT	NO-72	PERCENT
13-30	09	32.1%	15	20.8%
31-60	15	53.6%	50	69.4%
Above 60	04	14.3%	07	9.7%
Total	28	100%	72	100%

Among Gram positive organisms causing SSI , Staphylococcus aureus was predominant showing 40%, followed by Coagulase Negative Staphylococcus 10%, and Enterococci only 2%. All the Staphylococcus aureus were tested for second line drugs and confirmation for MRSA also done. Among the 100 isolated organisms, prevalence of MRSA was 15% and MSSA was 25% , which indicates that rate of MRSA prevalence of the study was 37.5% (For total 100 samples).

TABLE - 2 PREVALENCE OF MRSA /MSSA

Name of The Organisms	No. of Isolates	% of Isolates
Staph. aureus	40	40 %
MSSA	25	25%
MRSA	15	15%

In the Gram positive pathogens, Staphylococcus aureus showed 100% susceptibility with Vancomycin , Linezolid and Teicoplanin and less than 30% with other drugs like Erythromycin, gentamycin, Levoflox , Clindamycin and Cephalexin .

TABLE – 3 THE COMPARATIVE RESISTANT PATTERN OF MSSA AND MRSA AS FOLLOWS:

ANTIMICROBIALS	MSSA(N-25)	MRSA(N-15)
Cotrimoxazole	40%(10)	60%(9)
Erythromycin	72%(18)	66.67%(10)
Gentamycin	64.%(16)	80%(12)
Clindamycin	16%(4)	66.7%(10)
Ampicillin	64%(16)	86.71%(13)
Doxycycline	72%(18)	80%(12)
linezolid	0	0
Teicoplanin	0	0
Vancomycin	0	0
Cephalexin	84%(21)	66.7%(10)
levoflox	24%(6)	62.7%(9)

DISCUSSION

Surgical site infections are increasingly becoming an institutional marker of quality assurance. These infections, representing a global threat and are associated with great complication [7]. The most important post operative complications are increased duration of hospital stay, re-admission rates, mortality rates and most dreading is ever increasing rate of antibiotic resistance and emergence of multi drug resistant bacteria [8]

In the present study, the prevalence of SSI rate was 13.8% (n=100 out of 720 cases) over a period of one year. Olson ,Minneapolis U.S et al documented a rate of SSI as 2.5% after 10 years study [1984] [9]. According to a Bolivian study, the overall SSI rate was 12.1% and in Columbia 2.6 % . But in the study of efficacy of nosocomial infection control (SENIC) it is 4.1% [10] .

In our study , infection rate was higher in 31-60 years age group . Interestingly the affected rate among elders in the present study was 11% which is related to selection bias or a "hardy survivor'"effect .Several other investigators conclude that the increasing age with co-morbid conditions like diabetes mellitus ,anaemia etc certainly enhance the risk of SSI [11].

The present study prevalence of Staphylococcus aureus was 40 %, and it is in line with the published studies and also confirms as a predominant organism involved in SSI. The high prevalence of Staphylococcus aureus infection may be because it is an endogenous source of infection.

Nasal carriage of S.aureus is an important risk factor for developing SSI as it is a normal flora in the nostrils and the skin. Risk factors for SSI are divided into patient related (preoperative), procedure related (peri operative), and post operative categories. Patient related factors again categorised into modifiable (obesity, diabetes mellitus, immuno suppressive drugs, prolonged pre operative stay) and unmodifiable (age) factors.The peri operative,procedure related factors are class of wound type (clean, clean - contaminated, contaminated, dirty and infected), length of surgery, hair removal, hypoxia and hypothermia. In the immediate post operative period, glucose control, oxygenation, hypothermia and wound care are the major risk factors [12]. In developing countries like India, entry of visitors could not be controlled and hospital workers also do not adhere to infection control policy. These two environmentally modifiable factors have been considered in the control of SSI and infection control programmes.

Prevalence of MRSA in this study was 37.5 % [Total SSI was 100] as compared with Mehta et al (33%), Raja duraipandi et al (southern districts Tamil Nadu) and Lilani(33.6%) Mumbai India [13,14,15], and Khorvash et al from Pakisthan (78.9%) [16] Bharthi Arora (35%) from Haryana , Vidhani et al (51.6%) from Mumbai, Deverick Anderson et al (46%) from Reire de janero, Sanjay Kumar from central India (51.6%) [12 ,17]as the prevalence of MRSA in SSI.

MRSA showed 100% susceptibility with Vancomycin , Linezolid and Teicoplanin and less than 30% with other drugs like Erythromycin, gentamycin, Clindamycin and Cephalexin. As Bharathi Arora ,Lilani et al showed a very high resistance to Erythromycin, Gentamycin, chloramphenicol, ciproflox Trimethoprim and sulfamethoxazole and penicillin (80-100%) [12, 16]. Agarwal Rao, Majumdhar ,Rajaduraipandi, Anvikar et al reported that most of the strains (23%) of them were Multidrug resistant [11].

To conclude , it is of utmost importance to enforce ASEPTIC MEASURES in order to prevent post operative wound infections [9] . And restriction of duration of surgery , which otherwise may enhance the risk of SSI. Prophylactic antibiotics, if essential to be started 30 minutes before surgery for adequate coverage [10]. Proper care of wound after the surgery is the other prophylactic measure .Early and reliable detection of MRSA in the laboratory through surveillance, patient isolation after screening , good professional practice by all Health –care workers, effective Hospital Hygiene programmes and sensible use of antibiotics have been very successful in reducing the prevalence of MRSA.[6]

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