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Microbiology

PREVALENCE OF METHICILLIN RESISTANT *STAPHYLOCOCCUS AUREUS* IN POST OPERATIVE WOUND INFECTION

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ABSTRACT Objective: To determine the prevalence of Methicillin Resistant *Staphylococcus aureus* (MRSA) in post-operative wound infections and also to define the antimicrobial susceptibility pattern of the strains isolated.

.Patients and Methods: Wound swabs from patients who had undergone surgery and were suspected of having post-operative infection of the wounds were collected and inoculated on blood agar and MacConkey agar plates. After incubation for 24-48 hours, plates were examined for the growth. Anti-microbial susceptibility test of *Staphylococcus aureus* was performed.

Results: The screening and confirmation of MRSA production was done by Cefoxitin disc diffusion method among the *Staphylococcus* aureus isolates. The predominant pathogen was *Staphylococcus aureus* (30.61%) followed by *Escherichia coli* (26.53%) and *Klebsiella* spp (22.44%). Out of 15 *Staphylococcus aureus* isolates 12 (80%) were detected as MRSA. The drugs highly effective for GPC were Vancomycin, linezolid (100%) & teicoplanin (83.3%).

Conclusion: *Staphylococcus aureus* is the most common pathogen in post-operative wound infections with increasing tendency towards MRSA and requires strict intervention for its prevention and control. So combining infection control measures and rational antibiotic policies, we can prevent the emergence and dissemination of MRSA.

KEYWORDS : Post operative wound infections, MRSA, *Staphylococcus aureus*, cefoxitin

INTRODUCTION

Post operative wound infections (POWI) or surgical site infections (SSI) are the common Health care associated or nosocomial infections(1). It may occur after operative procedure and associated with a prolonged hospitalization, pain and discomfort. Microorganisms may enter the operative wound during the course of the surgery(2). The common pathogenic bacteria in SSI include *Staphylococci, Pseudomonas, Streptococci, Enterococci, Escherichia coli, Klebsiella, Enterobacter, Citrobacter, Acinetobacter, Proteus*, etc.. *Staphylococcus aureus* is the cause of SSI and other infections like bacteraemia, lower respiratory tract infections, urinary tract infections and skin infections(3). *Staphylococcus aureus* was once susceptible to Penicillin but became widely resistant organisms soon. Initially treated with Methicillin but became resistant to Methicillin thereafter. A significant number of these strains are Methicillin- Resistant *Staphylococcus aureus* (MRSA) as the years pass, MRSA has established itself as a major nosocomial pathogen world wide(4).

Antimicrobial-resistant pathogens poses an increasing challenge to hospitals, for patient treatment and in the prevention of the cross-transmission of pathogens. Since the regular surveillance and monitoring could play a role for better management, So the aims of our study was to determine isolate and identify the bacteria from patient's wound culture and determine the prevalence of *Staphylococcus aureus and* Methicillin resistant *Staphylococcus aureus* .

MATERIALS AND METHODS

A prospective study was conducted during the period from feb. 2018 to may 2018 in a BIMR hospital, Gwalior, after obtaining informed consent from patients admitted in post operative wards with complaints of wound discharge and pain in the operated site. The pus/ wound swab were collected from total no of 113 patients which showed clinical evidence of post-operative wound infection and transported to the Microbiology laboratory immediately and processed as per standard guidelines.

Preliminary Gram staining was performed to determine the likely organism present. Each specimen was inoculated on blood agar and MacConkey agar plates. Inoculated plates were incubated aerobically for 18-24 hours at 37^{0}C and then examined for growth. Anti-microbial susceptibility test was performed according to modified Kirby-Bauer disc diffusion technique on Mueller-Hinton agar using commercially available anti microbial discs and interpreted according to CLSI (NCCLS) standards(5). For identification of MRSA, cefoxitin (30 µg) disc was applied on Mueller-Hinton agar plates which had been inoculated with a standard inoculum of the isolate and incubated at 35^{0}C for full 24 hours. The isolates were considered as Methicillin-resistant if the zone of inhibition was = or < 21 mm(5). Staphylococcus aureus ATCC 29213 of known susceptibility was included as control strain for comparison. Results were compiled and analysed.

RESULT

During the study period from Feb. 2018 to May 2018, a total of 113 specimens of pus / wound swabs collected from patient's operation wounds in the post-operative period yielded pathogenic organisms on culture.

A total of **49 (43.36%)** samples were shown growth from surgical site infection [Table-1]. Most of the common isolated organisms were *staphylococcus aureus* (30.61%), *Escherichia coli.* (26.53%), *Klebsiella* sp. (22.44%), *pseudomonas aeruginosa* (6.12%), *proteus* sp. (2.04%), *Acinobacter* sp. (2.04%), *Klebsiella* sp.+ *Pseudomonas* sp. (8.16%), *Klebsiella* sp. + *Proteus* sp (2.04%) [Table-2]. A total number of 12 isolates (80%) were identified as MRSA [fig-1]. The antimicrobial resistance patterns of MRSA and MSSA strains show excellent activity against vancomycin and linezolid [Table-3]

Table-1: Prevalence of surgical site infection

Interpretation	No. of cases	Percent
No growth	64	56.63
Growth	49	43.36

Table-2: Distribution of bacteria isolated from surgical site infections

ORGANISMS		NO of isolates	Percentage %
GPC	*Staphylococcus aureus*	15	30.61
GNB	*Escherichia coli*	13	26.53
	Klebsiella spp	11	22.44
	Pseudomonas aeruginosa	3	6.12
	Proteus spp.	1	2.04
	Acinobacter sp.	1	2.04
MIXED	*Klebsiella spp. + Pseudomonas spp.*	4	8.16
	Klebsiella spp.+ Proteus spp.	1	2.04

Fig-1: Prevalence of MRSA in *Staphylococcus aureus positive results*

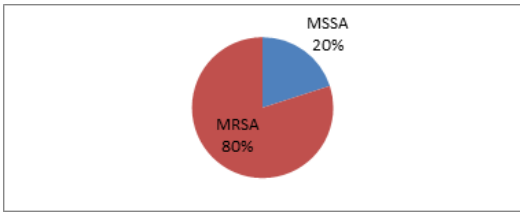

Table-6: Antimicrobial sensitivity patterns MRSA and MSSA strains

Antimicrobials	MRSA (12)	% sensitivity	MSSA (03)	% sensitivity
Penicillin	-	00	03	100
Amoxyclav	-	00	03	100
Ampicillin	-	00	03	100
Ceftriaxone	-	00	03	100
Cefoxitin	-	00	03	100
Clindamycin	04	33.3	01	33.3
Ciprofloxacin	04	33.3	01	33.3
Tetracycline	05	41.67	03	100
Gentamicin	06	50	02	66.6
Trimeth/Sulfa	06	50	03	100
Daptomycin	08	66.6	03	100
Teicoplanine	10	83.3	03	100
Moxifloxacin	12	100	02	66.6
Vancomycin	12	100	03	100
linezolid	12	100	03	100

AntimicrobialsMRSA (12)% sensitivity MSSA (03)% sensitivity Penicillin -0003100Amoxyclav -0003100Ampicillin

DISCUSSION

SSI causes discomfort along with prolonged hospitalization and sometimes associated with death of the patients and economical burden on the patients. It is one of the preventable causes of nosocomial infections. The rate of SSI varies greatly worldwide and from hospital to hospital. In our study Out of 113 samples, 49 (43.36%) samples were culture positive [Table -1]. Rate of SSI is an important quality indicator of surgical procedures in a hospital and it is diverse in different set up. The higher rate may be due to lack of attention towards the infection control measures, inappropriate hand hygiene practices and over-crowded hospitals.

Among the 49 culture positive, 15 were Gram Positive Cocci (30.61%) and 34 were Gram Negative Bacilli (69.31%). Among the isolates, *Staphylococcus aureus (30.61%)* was the predominant isolate, followed by *Escherichia coli* (26.53%) and *Klebsiella spp* (22.44%), *Pseudomonas aeruginosa* (6.12%) and *Proteus and acinetobacter spp* (2.04%) each. In mixed infections *Klebsiella and Pseudomonas* (8.16%), *Klebsiella and Proteus* (2.04%) [Table -2].

Staphylococcus aureus comprised of (30.61%) in our study, which was comparable to studies in Karnataka,(6) (31.3%) and Uttarakhand,(7) (50.4%). Various studies revealed that 80% of healthy individuals across the world colonize *Staphylococcus aureus* in their skin or anterior nares, and integrity of the skin if breached during any surgery could commonly cause skin and soft tissue infections with this organism. All these factors have made up *S.aureus* as the most common organism causing SSI (8). In our study Among the Gram negative organism, *E.coli* and *Klebsiella* spp. were the major followed by *Pseudomonas*, *Proteus* and *Acinetobacter* spp.. *E.coli* was reported as the most common Gram negative organisms causing SSI in the studies from Uttarakhand (7) and Karnataka (6) also, but *Pseudomonas* spp. were as the second highest Gram negative organism responsible for SSIs in both the studies. Another study revealed *Pseudomonas* spp. (21%) as the most prevalent organism producing SSIs(9). So there was a great variation among Gram negative organisms causing SSIs in different geographical areas.

Out of 15 *S. aureus,* 12 (80%) isolates were MRSA(Fig-1) which was quite similar to study done by S.Kulkarni et al.,(10) (70.33%) while lower prevalence was reported by Aggarwal et al.(11), in which methicillin resistance in 10% of the isolates, by Kownhar et al.,(12) who reported 21.7%. These differences in MRSA incidence were due to inappropriate usage of antibiotics and duration of antibiotics.

We found that all the *S. aureus* strains irrespective of methicillin resistance were sensitive to vancomycin and linezolid. Antimicrobial sensitivity of Gram positive cocci showed highest sensitivity for Vancomycin and linezolid (100%) with similar result was in study by S. Kaup et ai.,(13). The lowest sensitivity pattern was towards Clindamycin and Ciprofloxacin 33.3% for both in MSSA and MRSA which is consistent with study in Akhter R (14). Sensitivity of MRSA to tetracycline (41.67%), gentamycin and cotrimoxazole (50%) in our study. All MRSA isolates in this study were completely resistant (100%) to beta lactam group of antibiotics. Similar results were observed among MRSA strains in Chandrashekhar DK,(15). Another observation that was made in our study was that MSSA strains were generally sensitive to most of the antibiotics tested as compared to MRSA isolates. Mulla and colleagues(16) also observed in their study that multidrug resistance was more common in MRSA than MSSA.

Therefore we concluded that MRSA is of great concern with regard to SSI and its susceptibility patterns, using the result of this study we have an idea for establishing improved hospital antimicrobial policy and antimicrobial prescribing guidelines. Also the inappropriate and prolonged use of antibiotics should be avoided as this can lead to the development of resistant micro organisms.

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