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A CROSS SECTIONAL STUDY ON CHANGING PROFILES OF RESISTANCE PATTERN OF METHICILLIN RESISTANT STAPHYLOCOCCUS AUREUS ISOLATES IN BURN PATIENTS ADMITTED AT A TERTIARY CARE HOSPITAL IN CENTRAL INDIA

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ABSTRACT:

INTRODUCTION: *Staphylococcus aureus* is a versatile human pathogen. It was the predominant cause of burn wound infection in Pre antibiotic era and still persists as an important pathogen, strongly considered as a major cause of nosocomial infection. Burn units have become major reservoir for Methicillin Resistant *Staphylococcus aureus* (MRSA) that has the special characteristic for spreading quickly in a hospital environment and is a major challenge to burn patients, with potential to cause significant morbidity and mortality. Burn patients have been shown to become colonised and infected more readily than other patient groups. Extensive burn injuries are particularly susceptible to infection as a result of the disruption of the normal skin barrier and accompanying depression of immune responses. Extended hospitalisation and antibiotic therapy are additional risk factors for MRSA carriage and infection.

So the present study was carried out with

OBJECTIVE to study the changing resistance patterns of MRSA isolates in burn patients admitted in our hospital.

MATERIALS AND METHODS: The present Cross sectional Retrospective study was conducted from January 2018 to December 2020 in the Department of Microbiology, Government Medical College Akola, a tertiary care teaching hospital. A total of 71 infected patients admitted in burns unit were included in the study. Swabs were taken and cultured for bacterial isolation and identification was done using standard operative procedures. Antimicrobial susceptibility test was performed by Kirby Bauer's disc diffusion method using Cefoxitin disc (30 µg) according to CLSI 2018 guidelines.

RESULTS: Among the MRSA isolates, high resistance was observed for ciprofloxacin (76.4%) and gentamicin (64.7%). High occurence of Ciprofloxacin resistance was detected in the study. MRSA isolates with 'D' test positive was 53.52%. All MRSA isolates were sensitive to Vancomycin and Linezolid. **CONCLUSION:** Periodic evaluation of resistance patterns and antibiotic therapy guided by susceptibility testing helps in better understanding and proper control of MRSA in burn patients.

KEY WORDS: Burn wound, Inducible Clindamycin Resistance, MRSA.

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INTRODUCTION:-

Burns remain a significant public health problem in terms of morbidity, long term disability and mortality throughout the world. Thermal injury destroys the skin barriers that normally prevent invasion by microorganisms[1,2]. Burn patients become more susceptible to infection s due to the loss of protective skin barrier and decreased cellular and humoral immunity[3].Gram Positive bacteria in the depth of sweat glands and hair follicles may survive the heat of initial injury. Following Colonisation, these organisms of the surface start to penetrate the burn eschar to available extent and viable sub eschar tissues become invaded.

Staphylococcus aureus is the most important pathogen among Gram positive cocci which causes pyogenic local and systemic infections in both hospitals and community [4]. Methicillin Resistant *S. aureus* (MRSA), are strains of *S. aureus* which express an altered penicillin binding protein (PBP2a), thus conferring resistance to beta lactam antibiotics. MRSA strains had caused several documented outbreaks of hospital cross infections throughout the world in 1970s and since then, they have drawn special attention in hospital acquired infections [5]. Severe and drug resistant infections which were predominantly restricted to hospitals are now becoming rampant in community, as novel MRSA strains, which have been described as community acquired MRSA (CA-MRSA) [6].MRSA are notorious for their wide variations in antibiotic resistance patterns. They not only develop chromosomal resistance to penicillins and cephalosporins but also frequently show resistance to a wide range of antibiotics which are commonly used in hospitals [7].Patients with extensive burn injuries are especially susceptible to infection with MRSA.

There may be local variations in predominant hospital and community strains of MRSA within a country [8,9]. The resistance pattern of CA-MRSA is essentially different from that of hospital acquired MRSA (HA-MRSA). Unlike CA-MRSA, hospitals strains display more drug resistance in order to survive in hospital environment. The resistance patterns of prevalent MRSA strains in any setup are liable to continuous changes over a period of time, owing to changes in antibiotic prescription patterns, infection control measures and awareness among healthcare workers. As a result of increasing antibiotic pressure in hospitals, new strains with higher antibiotic resistance emerge and they replace the previous strains. While methicillin resistance in *S. aureus* is less in countries like Norway and Sweden (1%), Netherlands (2%) and Canada (5-10%), it is 25-50% in the United States, 54% in Portugal and 43%-58% in Italy [10]. High prevalence of MRSA is an emerging problem in India. Several authors have reported a substantial increase in MRSA prevalence in India. In 2009, it has increased from 12% in 1992 to 40% [11.12]. Increasing resistance of MRSA in recent years has had a significant impact on several aspects of patient care and infection control. Antibiotic policies need to be updated regularly, along with comprehensive monitoring of antibiotic prescribing and antibiotic consumption in healthcare settings. These facts clearly highlight the need of a characterization of MRSA strains at a regular basis at all levels. Therefore, the present study was carried out to determine changing resistance patterns of MRSA isolates in our hospital.

AIM & OBJECTIVE: To study the changing profiles in the resistance patterns of MRSA isolates in burn patients admitted in our hospital.

MATERIAL AND METHODS:

The present study was Retrospective Cross sectional study carried out for a period of three years from January 2018 to December 2020. Total of 71 MRSA isolates in burn patients were studied. All the samples were processed in Microbiology laboratory as per standard guidelines. *S. aureus* isolates were identified by standard laboratory procedures. Disc diffusion test which used a 30µg Cefoxitin disc were performed and isolates were subjected to the D-test by using Clindamycin and Erythromycin discs as per Clinical and Laboratory Standards Institute (CLSI 2018) guidelines, to detect MRSA stains [6]. A panel of commonly used antibiotics (Himedia, Mumbai, India) which comprised of Ciprofloxacin (5µg), Gentamicin (10µg), Amikacin (30µg), Erythromycin (15µg), Vancomycin (30µg), Linezolid (30µg), Clindamycin (5µg), were tested by Kirby Bauer disc diffusion method for susceptibility patterns.

RESULTS:

Total of 71 MRSA isolates from burn patients were studied during the study period. Among these, 41 (57.74%) were females and 30 (42.26%) were males and the gender distribution is represented in Figure No.1. The resistance patterns of MRSA isolates to standard drugs from 2018 to 2020 has been compared in Figure No.2 and Table No.1. Out of 71 cases, 38 patients had inducible clindamycin resistance. Figure No.3 shows increase in inducible clindamycin resistance from 2018 (14.28%) to 2020 (82.05%). All MRSA isolates were sensitive to Linezolid and Vancomycin by disc diffusion.

FIGURE NO.1: GENDER DISTRIBUTION AMONG MRSA ISOLATES IN BURN PATIENTS

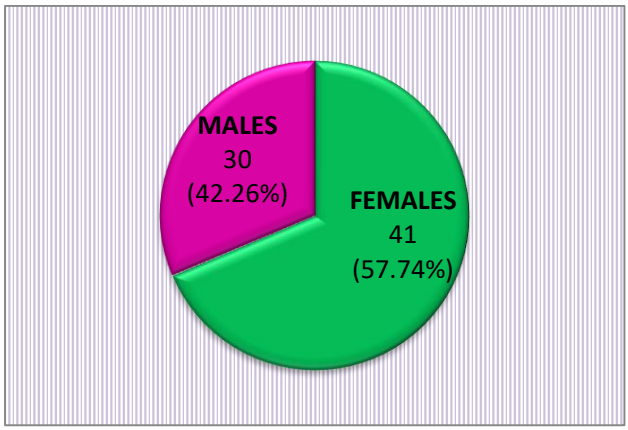
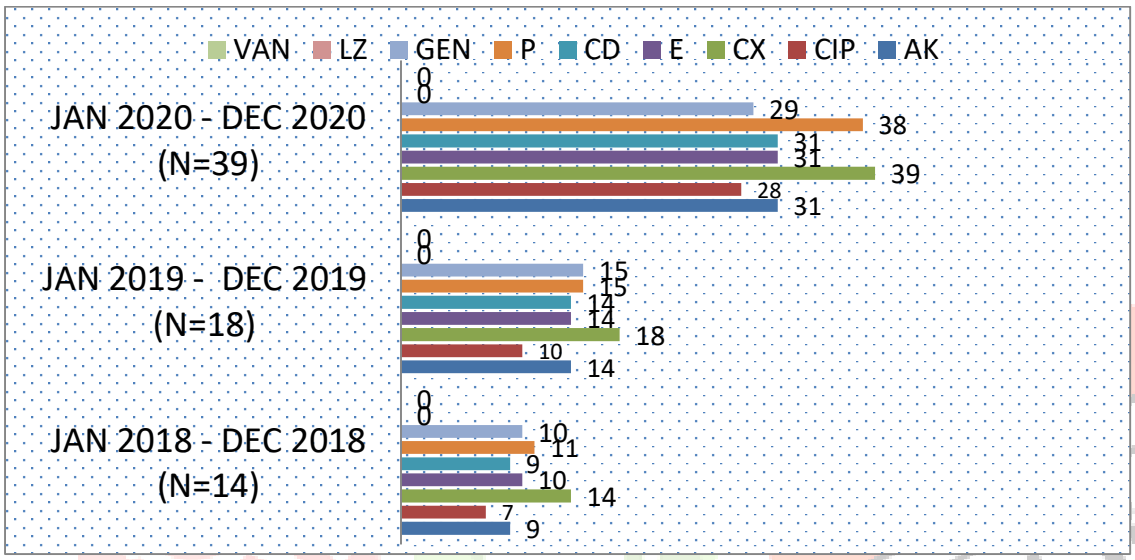


FIGURE NO.2: PROFILES OF RESISTANCE PATTERN IN MRSA ISOLATES OF BURN PATIENTS FROM JAN 2018 – DEC 2020



VAN- Vancomycin LZ- Linezolid GEN- Gentamicin P-Penicillin CD-Clindamycin E-Erythromycin CX-Cefoxitin CIP- Ciprofloxacin AK-Amikacin

TABLE NO.1: COMPARISON OF RESISTANCE PATTERN OF MRSA ISOLATES IN BURN PATIENTS FROM JAN 2018 – DEC 2020

ANTIBIOTICS	JAN 2018 - DEC 2018 N= 14	JAN 2019 – DEC 2019 N= 18	JAN 2020 – DEC 2020 N=39
Vancomycin	00	00	00
Linezolid	00	00	00
Ciprofloxacin	7 (50%)	10(55.55%)	28(73.68%)
Erythromycin	10(71.42%)	14 (77.77%)	31 (81.57%)
Clindamycin	9 (64.28%)	14 (77.77%)	31 (81.57%)
Cefoxitin	14 (100%)	18 (100%)	39 (100%)
Penicillin	11 (78.57%)	15 (83.33%)	38 (100%)
Amikacin	9 (64.28%)	14 (77.77%)	31 (81.57%)
Gentamicin	10 (71.42%)	15 (83.33%)	29 (76.31%)

FIGURE NO.3: DISTIBUTION OF INDUCIBLE CLINDAMYCIN RESISTANCE (D TEST POSITIVE) AMONG MRSA ISOLATES IN BURN PATIENTS FROM 2018 TO 2020

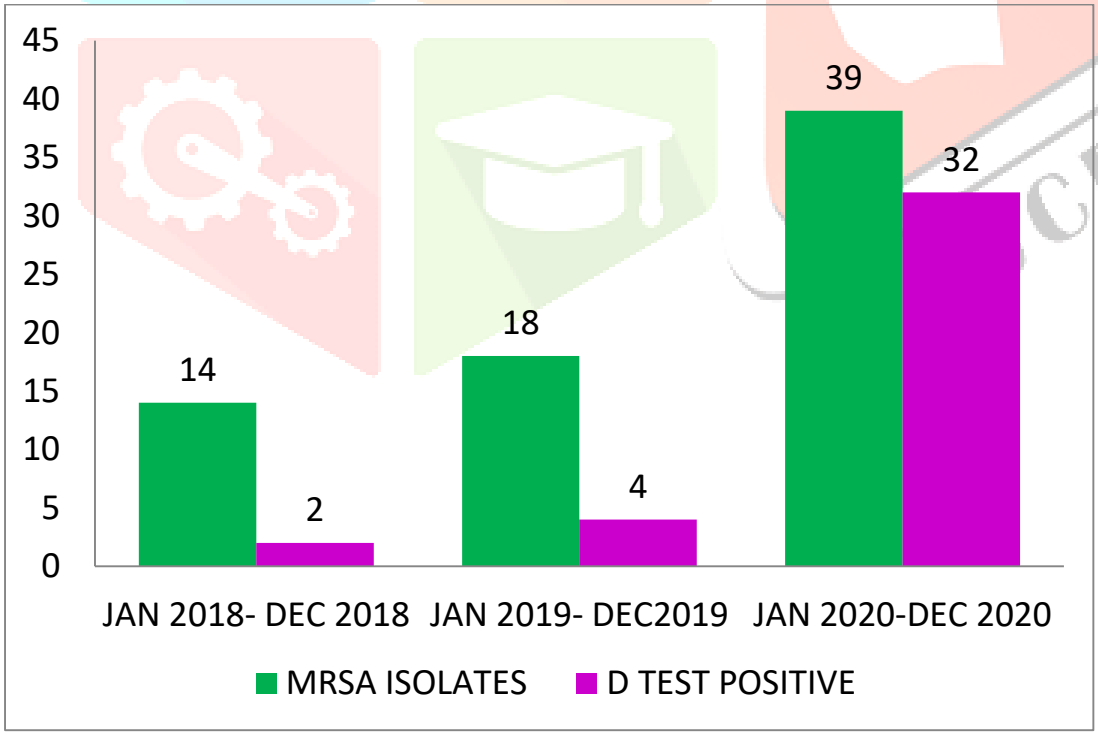
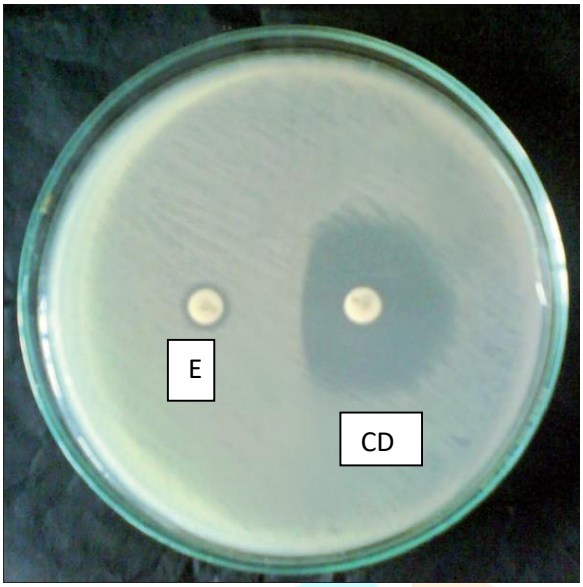


FIGURE NO.4: D TEST POSITIVE – INDUCIBLE CLINDAMYCIN RESISTANCE



DISCUSSION:

MRSA is a major cause of nosocomial outbreaks and serious infections that can lead to increased mortality and morbidity[6] . Clindamycin, a Lincosamide antibiotic, has been an option for treating Staphylococcal skin, soft tissue and bone infections because of its proven efficacy, low cost, the availability of its oral and parenteral forms, tolerability, excellent tissue penetration, its good accumulation in abscesses and because no renal dosing adjustments are required. It also directly inhibits the Staphylococcal toxin production and is a useful alternative for patients who are allergic to penicillin [13]. Good oral absorption of Clindamycin makes it an important option in the therapy of the outpatients or as a follow up after an intravenous (IV) therapy for de-escalation. This permits an early transition to the outpatient management of the susceptible infections without the complications of a continued IV access [14]. It is effective against both the methicillin resistant and the methicillin sensitive Staphylococcal isolates [15]. The increased frequency of the Staphylococcal infections, along with the changing drug susceptibility patterns, have led to a renewed interest in the Clindamycin usage [16] , but the possibility of an inducible resistance to Clindamycin remains a major concern and this could limit the use of this drug . To report the Clindamycin susceptibility accurately, the *Staphylococci* which are isolated from the clinical specimens should first be subjected to the D-test, to exclude the isolates with an induced Clindamycin resistance (MLSBi); as such isolates, when treated with Clindamycin, can undergo a rapid in vitro conversion to a constitutive resistance (MLSBc) and this may result in the Clindamycin treatment failure.

In this study, females predominated 40 (57.14%) over males 30 (42.85%) which is in accordance to studies done by Pragathi et al and Dash et al[17,18]The present study analysed antibiotic susceptibility pattern of 71 MRSA isolates and three major changes were identified in the pattern of antibiotic resistance over three years. First, an increased

resistance towards ciprofloxacin, Amikacin, Gentamicin is identified. Secondly, all the isolates were sensitive to Vancomycin & Linezolid and lastly an increase in inducible Clindamycin resistance is noted from 2018 (14.28%) to 2020 (82.05%).

CONCLUSION:

The present study showed the changing patterns of antimicrobial resistance of MRSA strains in our hospital. MRSA had shown an increased resistance to most of the antibiotics except Linezolid & Vancomycin, along with a substantial increase in multi-resistant MRSA strains over a period of three years. Resistance to Ciprofloxacin, Gentamicin and Amikacin was high in both recent and old MRSA isolates and therefore, these drugs are not suitable for empirical therapy of suspected Staphylococcal infections.The Study has highlighted the alarming increase of inducible clindamycin resistance from 14.28 % to 82.05% over three years.*S. aureus* is a pervasive pathogen in both hospital and community settings with constantly changing patterns in virulence, resistance and epidemiology and thus, monitoring of clinical and microbiological parameters is necessary, for modifying the existing infection control measures and treatment options accordingly.

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Conflict of interest: None declared

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