

Linezolid A Drug of Choice for Treatment of Skin and Soft Tissue Infections Caused By Methicillin Resistance Staphylococcus Aureus

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Abstract: Linezolid is a drug of choice for the treatment of methicillin resistant *Staphylococcus aureus* (MRSA) infections. However, resistance to this antibiotic have been reported. This study has been conducted to determine linezolid resistance among MRSA. A descriptive study was conducted in microbiology department. In the present study a total of 150 *Staphylococcus aureus* (*S. aureus*) were subjected to antibiotic susceptibility test by Kirby Bauer disc diffusion method as per CLSI guidelines. The detection of MRSA was done by cefoxitin disc (30µg) and linezolid disc (30µg) was included to detect its susceptibility. The prevalence MRSA was reported as 73 (48.7%) and linezolid and vancomycin were found to be 100% sensitive in the present study. The sensitivity against penicillin was found to be the lowest i.e. 7.3%. It could be concluded from the findings of the present study that linezolid is still the preferred drug for the treatment of infections caused by MRSA.

Keywords:-- MRSA, Linezolid, antibiotic susceptibility test, skin and soft tissue infections.

I. BACKGROUND

Staphylococcus aureus (*S. aureus*) is a pathogen of great concern due to its intrinsic virulence, capacity to adapt to different conditions of environment and its ability to cause a variety of life threatening infections.[1] Methicillin resistant *Staphylococcus aureus* (MRSA) was identified in 1960 and continues to be a significant pathogen worldwide known to cause various infections ranging from minor skin and tissue infections to severe sepsis, bacteraemia and osteomyelitis.[2] *S. aureus* is recognized as causative agent of hospital acquired and community acquired infections in almost every region of world.[3]

In 1959 methicillin was firstly introduced to treat the infections caused by penicillin resistant *S. aureus*. In 1961 MRSA was first reported in United Kingdom and were than soon recovered from other European countries and later from Japan, Australia and United States.[4] Due to emergence of multi-resistant among *S. aureus* isolates, the effective drugs for the treatment MRSA are vancomycin and linezolid.[5,6] The therapeutic failure of vancomycin therapy due to poor penetration of the drugs to certain tissues and emergence of reduced susceptibility of some isolates, calls for a need of alternative therapy to treat MRSA.[6] Linezolid is however an effective therapeutic option for the treatment of SSTIs caused by MRSA.[7]

The mode of action of linezolid is novel as it binds to the 50S subunit of the ribosome thereby preventing the formation of the initial complex for protein synthesis.[8] Whereas, other antibiotics such as chloramphenicol, aminoglycosides, lincosamides, macrolides and tetracyclines inhibit peptide elongation.[9] It was expected that due to this novel mechanism the resistance against linezolid might slowly emerge. Within one year of approval of linezolid for treatment the first case of linezolid resistance appeared.[10] Linezolid is a commonly used drug in our hospital for the treatment of infections caused by MRSA. This study was aimed to know the linezolid susceptibility among methicillin resistant and sensitive *Staphylococcus aureus* from pus samples of skin and soft tissue infections.

II. MATERIAL AND METHODS

The study was conducted on all the pus sample received from surgery department of the hospital. The samples were collected under aseptic conditions and were further processed and identified using standard microbiological procedures. The confirmation was done by biochemical reactions like catalase, slide coagulase and tube coagulase.^[11]

A 0.5 McFarland turbidity inoculum was prepared of each isolate and then the antibiotic susceptibility testing was done

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on Mueller Hinton Agar by Kirby Bauer disk diffusion method. Lawn culture was made on MH agar and antibiotic sensitivity of isolates was checked using penicillin (10 µg), gentamicin (10 µg), erythromycin (15 µg), clindamycin (2 µg), ciprofloxacin (5 µg) and doxycycline (30 µg). Methicillin resistance and linezolid resistance was detected cefoxitin (30 µg) and linezolid (30 µg) disc. The culture plates were than incubated at 37°C for 24hrs in incubator. The results were interpreted according to Clinical and Laboratory Standard Institute (CLSI).^[12]

For the detection of vancomycin resistance CDC method was used. The overnight bacterial growth was inoculated on BHI agar containing 6 µg/mL of vancomycin. The plates were incubated at 35°C for 24-48 hours.^[13]

III. RESULTS

A total of 150 *S. aureus* were collected from pus samples. The maximum isolates were from patients with folliculitis (64.7%) followed by furuncles (28%), carbuncles (6%) and least from cellulitis (1.3%) as shown in Table I.

Table I: Rate of isolation of *S. aureus* from various skin and soft tissue infections

Type of skin and soft tissue infection	Rate of isolation of <i>S. aureus</i>
Folliculitis	64.7% (97)
Furuncles	28% (42)
Carbuncles	6% (9)
Cellulitis	1.3% (2)

Out of 150 *S. aureus* isolates the prevalence of MRSA was 73 (48.7%) and MSSA was 77 (51.3%) as shown in Table II.

Table II: Prevalence of MRSA and MSSA

ISOLATE	PREVALENCE
MRSA	73 (48.7%)
MSSA	77 (51.3%)

The antibiotic resistance pattern of all 206 *S. aureus* isolates was maximum against penicillin (92.7%), followed by doxycycline (64%), ciprofloxacin (55.3%), gentamicin (40.7%), erythromycin (37.3%) and clindamycin (29.3%). It was observed in the present study that all the isolates of *S. aureus* were found to be sensitive to linezolid and vancomycin as shown in Table III.

Table III: Antibiotic Susceptibility Pattern of *S. aureus*

ANTIBIOTIC	RESISTANCE	SENSTIVE
Penicillin	139 (92.7%)	11 (7.3%)
Gentamicin	61 (40.7%)	89 (59.3%)
Doxycycline	96 (64%)	54 (36%)
Ciprofloxacin	83 (55.3%)	67 (44.7%)
Erythromycin	56 (37.3%)	94 (62.7%)
Clindamycin	44 (29.3%)	106 (70.7%)
Vancomycin	0 (0%)	150 (100%)
Linezolid	0 (0%)	150 (100%)

MRSA isolates showed 100% resistance against penicillin, followed by ciprofloxacin 80.8%, doxycycline 63%, erythromycin 54.8%, gentamicin 53.4% and clindamycin 38.4%.

Among MRSA no isolate was found to be resistant to linezolid and vancomycin as shown in Table IV.

Table IV: Antibiotic Susceptibility Pattern of MRSA isolates

ANTIBIOTIC	RESISTANCE	SENSTIVE
Penicillin	73 (100%)	0 (0%)
Gentamicin	51 (69.9%)	22 (30.1%)
Doxycycline	46 (63%)	27 (37%)
Ciprofloxacin	55 (75.3%)	18 (24.7%)
Erythromycin	43 (58.9%)	30 (41.1%)
Clindamycin	28 (38.4%)	45 (61.6%)
Vancomycin	0 (0%)	73 (100%)
Linezolid	0 (0%)	73 (100%)

IV. DISCUSSION

The treatment of *S. aureus* has always been a challenge due to rapid changing antibiotic susceptibility pattern. It is important to select an appropriate antimicrobial agent to treat *S. aureus* infection thereby avoiding treatment failure. The MRSA strains shows rapid emerging in both nosocomial and community acquired infections.^[14] In the present study the prevalence of MRSA was reported as 73 (48.7%). In a study conducted by Indian network for Surveillance of Antimicrobial Resistance (INSAR) group, India in different leading hospitals of India for studying

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prevalence and susceptibility pattern of MRSA. The overall prevalence observed was 42% in 2008 and 40% in 2009 for MRSA. In the same study AIIMS, New Delhi showed 53% prevalence in 2008, Fortis Hospital, Mohali was 43% in 2008 and 44% in 2009 and Regional Institute of Medical Science, Imphal was 50% in 2009.^[15] The results were almost similar to the present study.

All the MRSA isolates in the present study were sensitive to Vancomycin and Linezolid. This finding is similar to the studies conducted by Arora *et al.* (2010)^[16] and Sharma M *et al.* (2013)^[17] where Vancomycin and Linezolid were found to be 100% sensitive.

The trend of antibiotic resistance among MRSA isolates when compared to other studies was found to be nearly similar with very little differences in the resistance pattern.^[15,16]

V. CONCLUSION

It could be concluded that linezolid can be effectively used for the treatment of skin and soft tissue infections caused by MRSA. It is also observed from the present study that both linezolid and vancomycin have similar clinical efficacy against MRSA infections. The progressive increase in positivity of MRSA isolates calls for routine testing of methicillin resistance by using Cefoxitin disc diffusion method or Minimum Inhibitory Concentration (MIC) detection method.

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