Antibiotic Resistance Profiling of Staphylococcus aureus Isolated from Clinical Specimen from Tertiary Care Hospital

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Abstract: In past two decade broadcasting and spread of antibiotic resistance in staphylococcus aureus micro-organism infect skin and soft tissue posing a great therapeutic challenge. Particular methicillin resistance S.aureus [MRSA] diverse mechanism of resistance based on phenotyping and genotyping. Typing of MRSA is vital to understand epidemiological swing and to initiate infection with control strategies. Also a certain group of S. aureus depute vancomycin resistance chronic creation of VRSA upon exposure to vancomycin. VRSA acquired by mutation based on thickening of cell wall due to accumulation of excess amount of peptidoglycan.

Keyword *MRSA, VRSA, S. aureus, Phenotyping, Genotyping, Resistance*

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I. INTRODUCTION

Staphylococcus aureus is one of the members of genus *staphylococcus*. That occurs ubiquitous and forms the most common cause of localized superlative lesions in human being having ability to developed resistance to penicillin. *Saureus* infection is wide spread concern due to its increasing resistance to miscellaneous type of antibiotic. Although soft-tissue infection are habitual, latest trouble in both inpatient and outpatient with uncomplicated peripheral infection on folliculitis, cellulitis and abscesses ,that intricate infection such as necrotizing fascilitis burn infection and diabetic foot, having consequential role blooming the antimicrobial resistance and illegitimate treated SSTI (skin and soft tissue infection) may primacysedevalution of endocarditis, asteomyclitis brain-lungs abscess or meningitis and toxic shock syndrome, due to familiar organism mannerly encountered in soft tissue infection are gram positive cocci, golden-grapes like cluster , non-motile, non-spore forming which measure around 0.7 to 1.2 um in diameter under microscope notably as *S. aureus*].(1)

THE FASCINATING DISCOVERY OF ANTIBIOTIC

Therapeutically fascinating story of development and evidenced of penicillin, it already design by Ernest Duchesne, (French medical student) but his work was forgotten. Penicillin rediscover by Scottish physician Alexander Fleming. During first world word Fleming had been enthusiastic to discovered unspecified think that would kill pathogen on wound infection

One day in September 1928 *penicillium notatum* spore unexpectedly landed on the surface of an exposed petri dish before it had been inoculated with staphylococci and new medical epoch was born. Although the precise event are still unclear. Ronald Hare has suggested that Fleming left the contaminated plate on a laboratory bench while he was on vacation, the first few days of vacation were cool, the fungus grew more rapidly than the bacteria and produced Penicillin. When the weather then turned worm, the bacteria began to grow and were lysed. On his returned Fleming noticed that a penicillin colony was growing at one edge and the *staphylococci* surrounding it had been destroyed, rather than discarding the contaminate plate, he correctly deduced that his mold contaminant was producing a diffusible substance lethal to *staphylococci*. He found that broth from a penicillium culture contained penicillin and that the antibiotic could destroy several pathogenic bacteria. Unfortunately Fleming next experiment convinced him that penicillin would not remain active in the body long enough after injection to destroy pathogen. After reading Fleming paper on penicillin one of Floreysco worker, Ernst chain in 1940 obtained the penicillium culture from Fleming and set about culture from Fleming and set about culturing it and purifying penicillin. When the purified penicillin was injected into mice they survived. Later Selman Waksman announced in 1944 that he got new antibiotic streptomycin produced by actinomycete streptomycin griseus. (8)

Implementation of Antibiotic in treatment of *S. aures* infection.

In 1880 era S.aureus bacterium perceived as *staph* at this epoch *S. aureus* infection inducement for painful skin and soft tissue. In 1940 penicillin born against *S. aureus*. In late 1940-1950 *S. aureus* strain resistance to penicillin, then high levels of penicillin resistance followed by the development and spread of strain resistance to the semi synthetic penicillin (methicillin, orocillin a nofcillin in 1961. In 1968 the first human case of MRSA reported in United States subsequently new strain evolution become resist to drags designed assist to

attack infection MRSA are resistant to all betalactum antibition. In 1996 the first MRSA to acquire resistance to vancomycin was isolated from a Japanese patient. In 2002 US documented that *S. aureus* resistant to the vancomycin so called Vancomycin resistant *S*. aureus

VRSA Development of Drug Resistance–

MRSA announced for resistive disparate antiseptics due to cellular changes that negatively affect the accumulation of antiseptic agents' comparise cell envelope expressed effiux mechanism. In *S. aureus*maltidrug resistance while quac A/B/G/H are multidrug family found in plasmid. (12)

Efflux Mechanism of MRSA and Drug development

MRSA strain fetch mecA gene encodes for low affinity penicillin binding protein (PBP) designated PBP2a. Predominantly mecA gene is part of chromosomally integrated mobile genetic element Known as *staphylococcal* cassette chemosemec (SCC mec) .This PBP2a possess Peptidoglycan transpeptidase activity yet low affinity for B-lactum antibiotic PBP2a exhibit not only constant rate of reducing acylation but also replitedalissociation constant by B. lactum so called as Betalactumase resistance.(10)

Vancomycin Resistance S.aureus and their Mechanism

MRSA has accounted in many Countries since its discovery in 1961, however in recent era the increasing frequency of MRSA infection. Due to in unequivocal cell-killing affect, and capable of eliminating MRSA from the patient body. So increased use of vancomycin, thus drug with rather weak cell-killing Potency against prevailing MRSA. Two class of vancomycen resistance Strain .VRSA that has a vancomycinmnimum inhibitory concentration (MIC Breckpoinout) of 8mg/l and hetro VRSA that spontaneously generates VRSA within the cell population (9)

Mechanism of VRSA

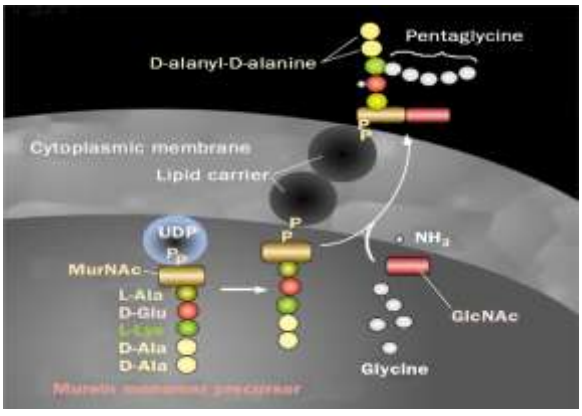

Figure 1. Synthesis of murein monomer (monomeric component of peptidoglycan). Murein monomer is composed of two amino sugars (N-acetyl muramic acid [MurNAc] and N-acetyl glucosamine [GlcNAc]) and ten amino acids. Murein monomer precursor is composed of MurNAc and stem peptides (L-alanine, D-glutamine acid, L-lysine, and two D-alanines). It is synthesized in the cytoplasm and attaches to a lipid carrier in the cytoplasmic membrane. Then, during its transfer to the outer surface of the cytoplasmic membrane, GlcNAc and five glycine are added, and its isoglutamic acid is amidated to become mature mureinmonomer.

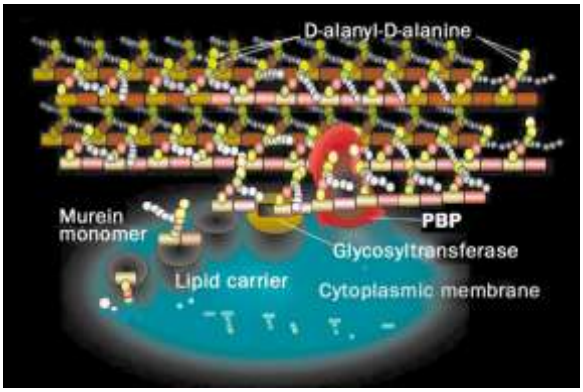

Figure 2. Assembly of peptidoglycan viewed from outside of the cell. In blue is the cytoplasmic membrane. Glycosylic transferees polymerizes therein monomer to produce a nascent peptidoglycan single chain. Penicillin-binding protein (PBP) grasps at the D-alanyl-D-alanine residues of stem peptide and cleaves in between the residues to ligate the penultimate D-alanine to the pentaglycine of the neighboring peptidoglycan chain. The twisting of peptidoglycan chains is omitted from the illustration for visual simplicity.

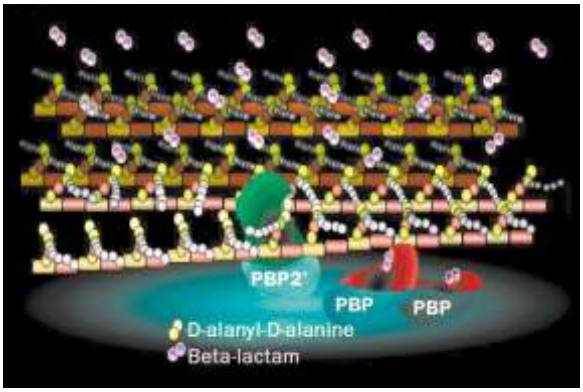

Figure 3. Action of beta-lactam: Beta-lactam (purple double cubes) is a structural analogue of D-alanyl-D-alanine residues. It inactivates S aureus PBPs (in red), but cannot bind to PBP2_ (in green; MRSA-specific PBP) with high affinity. Therefore, MRSA can continue peptidoglycan synthesis in the presence of beta-lactams whereas methicillin-susceptible S aureus cannot.

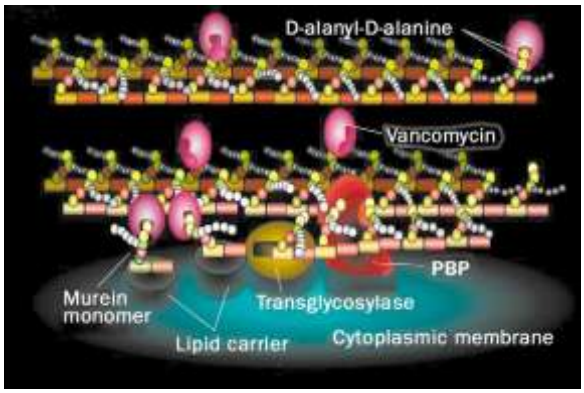

Figure 4. Action of vancomycin and teicoplanin. Drug binds to D-alanyl-
D-alanine residues of murein monomer. The murein monomer bound by vancomycin does not serve as a substrate for glycosyltransferase.

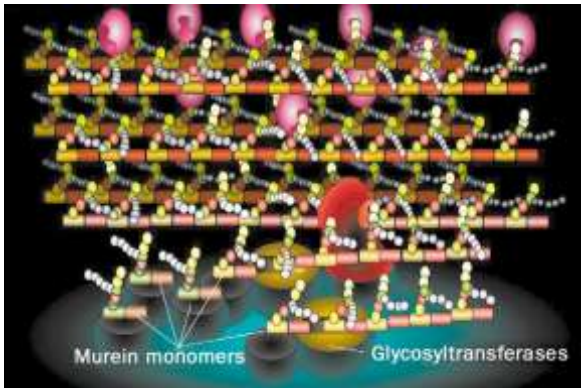

Figure 5: Thickened cell wall of Mu50. Affinity trapping mechanism of resistance Mu50 has 30–40 layers of peptidoglycan. Supply of mureinmonomer is increased and more monomers are incorporated into nascentpeptidoglycan chains. Increased D-alanyl-D-alanine residues are present in the completed peptidoglycan layers. More vancomycin molecules are trapped in the peptidoglycan layers and less reach the cytoplasmic membrane than usual.

II. CONCLUSION

Theoretical research with the ultimate goal to develop and promote enhance diagnosis, better conceptual treatment and new vaccines that are consequence against MRSA/VRSA that gives increasing prevalence of MRSA/VRSA in both hospital and community setting. In this study reports that commonest organism like *S. aureus* encountered in skin and soft tissue infections. However, in this view varied bacteriology and antobiogram of SSTI. So on this based efflux mechanism of MRSA/VRSA discussed with antion of their drug resistance.

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