International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2015): 6.391

Antimicrobial Activity of Minocycline against Bacteria and Fungi

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Abstract: ***Minocycline is a semi-synthetic tetracycline derivative and appears to be as effective as other tetracyclines and analogues. The present research work is on anti-microbial assay to demonstrate the minocycline is more effective on selected gram-positive than the gram-negative bacterial strains. It showed the highest zone of inhibition on Bacillus subtilis than Staphylococccu aureus when cultured in Mueller-Hinton agar medium.***

Keywords: Antibacterial, antifungal and minocycline

1. Introduction

Minocycline has the spectrum of antibacterial activity *in vitro*[1]. It has proven that the minocycline shows greater effect than the tetracycline and its analogues[2]. Minocylcline is indicated for the treatment of several diseases including acne vulgaris, urinary tract infections, and central nervous system[3]. In regard with the antibacterial activity of minocycline, *Staphylococcus aureus* has isolated from the aural discharge of purulent otitis was subjected against Benzylpenicillin, Streptomycin, Kanamycin, Erythromycin, Lincomycin, Oleandomycin, Spiramycin, Leucomycin and Chloramphenicol than all these antibiotics, minocycline was more active. As like any other tetracycline, the minocycline is found to be bacteriostatic against the susceptible organisms. The antibacterial activity *in vitro* is influenced by the inoculum's size, pH of the culture medium and the presence of the serum[4]. Mueller-Hinton agar medium creates the optimum environment for the minocycline to be more active[5]. Therefore, in our present study we used Mueller-Hinton agar medium to test against the bacterial strains and a fungi. The minocycline was believed to have the highest activity against *staphylococcus aureus* but in our observation *Bacillus subtilis* had highest zone of inhibition than *staphylococcus aureus*.

2. Materials and Method

Test-pathogenic microorganisms

Two Gram-negative *Klebsiella pneumonia*, *Pseudomonas aeruginosa,* and two Gram-positive *Bacillus subtilis, Staphylococcus aureus* bacterial pathogens and one fungal pathogen *Candida albicans* were used *in vitro* antimicrobial activity. These selected pathogenic strains were obtained from Microbial Type Culture Collection (MTCC), Chandigarh, Punjab, India.

***In vitro* antimicrobial activity**

The antibacterial activity was determined by well diffusion methods[6]. About 25 ml of molten Mueller Hinton agar was poured into a sterile Petri plate (Himedia, Mumbai, India). The plates were allowed to solidify, after which 18 h grown (OD adjusted to 0.6) 100 µl of above said pathogenic bacteria cultures were transferred onto plate and made culture lawn by using sterile cotton swab. After five minutes setting of the pathogenic bacteria, a sterile cork borer was used to make 5 mm well on the agar. The test samples were dissolved in DMSO and loaded in to wells with various concentrations such as 25 µg/well, 50 µg/well, 75 µg/well and 100 µg/well. The Streptomycin added well served as positive control for bacteria and clotrimazole served as control for fungi. The solvent alone served as negative control. The plates were incubated at 37°C in a 40 W florescent light source (~ 400 nm) for 24 h. The antibacterial activity was determined by measuring the diameter of the zone of inhibition around the well using antibiotic zone scale (Himedia, Mumbai, India).

3. Result

Minocycline effectively killed all the test pathogens at all tested concentrations. The lowest concentration of 25 µg/well showed zone of inhibition against all the tested bacterial pathogens ranged between 12mm and 28mm whilst, the highest concentration of 100 µg/well showed zone of inhibition ranged between 19mm and 33 mm using Mimocycline. *Bacillus subltilis* had the highest zone of inhibition with 33mm at 100µg/well than *Staphlococcus aureus,* which showed 31mm of zone of inhibition at 100µg/well. In case of *Candida albicans* 6mm zone of inhibition observed for the highest concentration of 100 µg/well.

Antimicrobial activity of Minocycline

Bacteria				
Concentration per disc	**25mg**	**50mg**	**75mg**	**100mg**
Staphlococcus aureus	25	27	29	31
Bacillus subltilis	28	31	32	33
Klebsiella pneumonia	18	19	20	22
Pseudomonas aeruginosa	12	14	16	19
Fungi				
Candida albicans	10	12	13	15

4. Discussion

The laboratory studies have experimented the potentiality of Minocycline over the Tetracycline and its other analogues in inhibiting the growth of clinically isolated strains of Tetracycline resistant Staphylococci in many countries

around the world[7]. Minocylcine showed little more effective in killing the β-haemolytic streptococci[8]. Against *Streptomyces faecalis* (enterococci), the activity of Minocycline inclined to have more than that of the other Tetracycline[9]. The greater activity was also observed against *Streptomyces Viridians,* were the Minocycline was very effective even at the low concentration[10]. Tetracycline, Oxytetracycline and Demethylchlortetracycline was less effective against *D. pneumonia* when compared with Minocycline, Doxycyline, Methacycline and Chlortetracycline[11]. In our present study Minocycline was very effective on *Bacillus subltilis,* having the zone of inhibition of 33mm at the concentration of 100 µg/well and 28mm of zone of inhibition at 25 µg/well whereas Minocycline against, *Staphlococcus aureus* showed only 25mm and 31mm zone of inhibition at 25 µg/well and 100 µg/well respectively. On the other hand, Minocycline showed less activity on gram-negative when compared with gram-positive bacterial strains. Against, *Escherchia. Coli* and *Haemophilus influenzae,* Minocycline was less active than that of Methacycline, chlortetracycline or doxycycline[12]. In our assessment, as per the observation on *Pseudomonas aeruginosa* against Minocycline showed the zone inhibition with 12mm at lowest concentration of 25 µg/well and at highest concentration 100 µg/well showed 19mm zone of inhibition. *Klebsiella pneumonia* against the Minocycline showed 18mm zone of inhibition at 25 µg/well and 22mm zone of inhibition at 100 µg/well. The activity of Minocycline *in vitro* against the gram-negative species is essentially similar to that of other tetracycline analogues.

5. Conclusion

Minocycline, has long been established as the safe drug for treating human diseases. It is used as antibiotics and has the strong potential to treat multiple microbial infections. *In vitro* antimicrobial assay on minocycline reveals that it is effective over gram-positive than gram-negative strains.

References

[1] Mohammad Mansouri, Gerald P. Bodey, The Broad-Spectrum Activity and Efficacy of Catheters Coated with Minocycline and Rifampin, The Journal of Infectious Diseases, 173:418-424, (1996).
[2] Chopra. I, Howe T. G. B., Linton A. H., Linton K. B., Richmond M. H, D. C. E., Speller, The Tetracyclines: Prospects at the Beginning of the 1980s, Journal of Antimicrobial Chemotherapy 8:5-21, (1981).
[3] Hazem F. Elewa, Hend Hilali B.S., David C. Hess, Livia S. Machado, Susan C. Fagan, Pharm.D. Minocycline for Short-Term Neuroprotection, Reviews of Therapeutics, 26:(4), 516-52, (2006).
[4] Brogden R.N., Speight R.N., Avery G.S., Minocycjine: A Review of its Antibacterial and Pharmacokinetic Properties and Therapeutic Use Evaluations on New Drugs, Drugs, 9:251-229, (1975).
[5] Balaji V, Jeremiah S.S., Baliga P.R., Polymyxins: Antimicrobial Susceptibility Concerns and Therapeutic Options, Indian Journal of Medical Microbiology, 29(3): 230-242, (2011).
[6] Holder I.A., Boyce S.T., Agar Well Diffusion Assay Testing of Bacterial Susceptibility to Various Antimicrobials in Concentrations Non-Toxic for Human Cells in Culture, Burns, 20(5): 426-429, (1994).
[7] Marilyn C. Roberts, Tetracycline Resistance Determinants: Mechanisms of Action, Regulation of Expression, Genetic Mobility, and Distribution, MS Microbiology Reviews, 19: 1-24, (1996).
[8] Ana C. Gales, Ronald N. Jones, Antimicrobial Activity And Spectrum of the New Glycylcycline, GAR-936 Tested Against 1,203 Recent Clinical Bacterial Isolates, Diagnostic Microbiology and Infectious Disease, 36(1): 19-36, (2000).
[9] Macone A. B., Caruso B. K., Leahy R. G., Donatelli J., Weir S., Draper M. P., Tanaka S. K., Levya S.B., In Vitro And In Vivo Antibacterial Activities of Omadacycline, A Novel Aminomethylcycline, Antimicrobial Agents And Chemotherapy, 58 (2): 1127–1135, (2014).
[10] Flávia Rossi, Denise Andreazzi, Overview of Tigecycline and Its Role in the Era of Antibiotic Resistance, The Brazilian Journal of Infectious Diseases, 10(3):203-216, (2006).
[11] Alvis Kucers, Chloramphenicol, Erythromycin, Vancomycin, Tetracyclines, The Lancet, 320 (8295): 425-429, (1982).
[12] Ian Chopra, Marilyn Roberts, Tetracycline Antibiotics: Mode of Action, Applications, Molecular Biology, and Epidemiology of Bacterial Resistance, Microbiol Mol Biol Rev. 65(2): 232–260, (2001)