Antibiotic Effect of Tigecycline on Gram Negative Bacilli

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Abstract

Introduction: Resistance to multiple antibiotics among Gram negative bacilli (GNB) is high in India. Tigecycline, a glycylcycline antibiotic is a newer treatment option for emerging single or multidrug-resistant (MDR) GNB.

Material and Methods: All the samples received in the Microbiology laboratory were processed according to standard protocols. Once identified, they were subjected to antibiotic susceptibility testing by disk diffusion method on Mueller Hinton agar. We evaluated the in vitro activity of tigecycline and compared it against other antimicrobials. Among 356 isolates, [Escherichia coli (126), Klebsiella spp (61), Pseudomonas aeruginosa (133), Acinetobacter spp. (23) and Proteus (13)] from patients with, skin and soft tissue (SSTI) including surgical site, urinary tract and respiratory infections were isolated in our laboratory, Department of Microbiology, Mandya Institute of Medical Sciences, Mandya. Susceptibility to antimicrobials besides tigecycline included amikacin, imipenem, levofloxacin, meropenem, and piperacillin/tazobactam was determined by disk diffusion method.

Results: Tigecycline was active against all E. coli and Klebsiella spp by disc diffusion method. MDR Acinetobacter spp. showed lower susceptibility (70.6%) to tigecycline and Pseudomonas spp and Proteus spp showed high resistance. Increased resistance was seen to other antimicrobials among Extended Spectrum Beta Lactamases(ESBL) producing E. coli, Klebsiella spp., Metallo Beta Lactamase (MBL) producing P. aeruginosa.

Discussion: Tigecycline shows high potency against Gram-negative bacilli belonging to family Enterobacteriaceae in whom multi-drug resistant strains have emerged as important nosocomial pathogens. Tigecycline is highly active against Enterobacteriaceae, regardless of the presence or absence of ESBLs, >99% of all of the tested strains were inhibited.In the present study we found that tigecycline had good activity against tested E.coli and Klebsiella spp.

Conclusion: Tigecycline is an alternative option for emerging multidrug resistant (MDR) pathogens exhibiting promising spectrum/potency exceeding currently available agents seen in India.

Keywords: Antibiotic resistance, Tigecycline, Multi Drug Resistance GNB, Extended Spectrum Beta Lactamases, Metallo Beta Lactamase.

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Introduction

In India, multiple antibiotic resistance to Gram negative bacteria is very high.[1] For the past few decades, incidence of resistance among both the Gram negative and Gram positive organisms has reached a very high level, leading to more and more cases of treatment failure.[2]The alarming increase in resistance is leading us to a point of no return — a day when no antimicrobial agent would be available to treat infections.

Infections due to Extended Spectrum Beta Lactamases producing Klebsiella have become a serious problem to the clinicians which complicates the therapy and has limited treatment options due to their resistance to broad range of beta lactams including third generation cephalosporins.

The mortality rate is high among the patients infected with these strains. Compared to the other patients, the patients infected with ESBLs producing Klebsiella appears to be more-sicker, resists more antibiotics and needs hospitalization for longer duration.

A semi synthetic glycylcycline, Tigecycline which is derived from minocycline has shown to be active against tetracycline resistant gram negative pathogens which are refractory, whose refractoriness is due to efflux and ribosomal protective mechanisms.

It has been documented that, tigecycline has its activity against microorganisms that are resistant to wide range of antimicrobial agents and has almost same effect as that of other standard antimicrobial agents for the treatment of adults with complicated intra-abdominal infections, serious infections of skin and soft tissues and community acquired pneumonia.

Unlike tetracycline, tigecycline resists their deactivation by certain tetracycline resistant mechanisms. Because of these effective anti-microbial activity and pharmacodynamics and pharmacokinetic

profile, tigecycline is considered to be effective alternative against MDR pathogens.

In this study, the evaluation has been carried on the efficacy of tigecycline against a spectrum of Gram negative organisms under in vitro conditions.

Materials and Methods

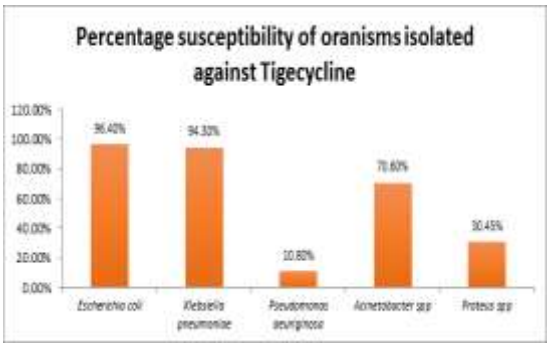
All the samples received in the Microbiology laboratory were processed according to standard protocols & antibiotic susceptibility testing by Kirby-Bauer disk diffusion method on Mueller Hinton agar. The evaluation has been done on the activity of tigecycline along with the other antibiotics in vitro.

A total of 356 samples were taken from the patients suffering from skin and soft tissue infections (including surgical sites), UTI, respiratory tract infections in our laboratory, department of microbiology, MIMS, Mandya. Determination of antibiotic susceptibility was based on interpretive criteria of CLSI. Antibiotic susceptibility was tested for tigecycline (15 µg), polymyxin B (300 units), imipenem (10 µg)piperacillin + tazobacatam (100/10 µg), amikacin (30 µg), ceftriaxone (30 µg), cefepime (30 µg), ciprofloxacin (5 µg), amoxicillin + clavulanic acid (20/10 µg), aztreonam (30 µg), and cefoxitn (30 µg).

Results

Among 356 isolates, *Escherichia coli (126), Klebsiella spp (61), Pseudomonas aeruginosa (133), Acinetobacter spp. (23) and Proteus (13)* were isolated according to standard protocol. Disk diffusion method had shown tigecycline to be active against *E. coli* and *Klebsiella,* MDR *Acinetobacter* showed lower susceptibility (70.6%) to tigecycline and *Pseudomonas spp* and *Proteus spp* showed high resistance.

Organisms Isolated	Number of isolates	Percentage
Escherichia coli	126	35.39%
Klebsiella pneumoniae	61	17.13%
Pseudomonas aeruginosa	133	37.35%
Acinetobacter spp	23	6.46%
Proteus spp	13	3.65%



Discussion

On an approximation about 50% of the strains were susceptible to imipenem and are within the range of CLSI susceptible range which correlates with the findings of Castanheira et al(2008) and Behera et al(2009).

This study along with other recent surveillance confirms that this novel compound can be valuable option for treatment which corroborates with the study by Simith Kumar et al(2013).

The results of present study suggests tigecycline to be an effective drug over the drugs that are in current use for the treatment of infections caused by MDR pathogens, showing excellent invitro activity against strains that have limited treatment options. Based on the documented clinical efficacy in various severe infections, tigecycline is a promising agent likely to have a key role in the treatment of nosocomial infections.

However, for blood stream infections, tigecycline has not been approved as a treatment. It requires more experience to understand its role in infections caused by *Klebsiella pneumoniae* and other MDR gram negative bacilli in a better way.

In summary, tigecycline can be promising therapeutic option against the MDR pathogens. Generation of much more information regarding local and epidemiological data on the resistance profile of clinically important pathogens necessitates continued surveillance.

Conclusion

Tigecycline is highly active against Enterobacteriaceae in whom MDR strains have emerged as important nosocomial pathogens.

In the present study we found that tigecycline had good activity against tested *E.coli* and *Klebsiella spp*.

This study along with other recent surveillance initiatives confirms that tigecycline can be a promising therapeutic option for the treatment of infections caused by resistant Enterobacteriaceae and also non fermenters.

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