ORIGINAL RESEARCH PAPER
Volume - 15 | Issue - 07 | July - 2026 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

TO EVALUATE THE IN-VITRO ANTIMICROBIAL ACTION OF LEVONADIFLOXACIN ON CLINICAL ISOLATES OF GRAM-POSITIVE COCCI.

Microbiology

Manisha Chahar Msc Microbiology,Max Super Speciality Hospital, Dwarka, New Delhi, India

Sunanda Joshi M.D. Microbiology Associate Consultant of Microbiology, Max Super Speciality Hospital, Dwarka, New Delhi, India

Imola Jamir M.D. Microbiology Assistant Professor Department of Microbiology, Nagaland Institute of Medical Sciences & Research, Kohima, India

Jharna Mandal* M.D. Microbiology Senior consultant and Head of Microbiology, Max Super Speciality Hospital, Dwarka, New Delhi, India *Corresponding Author

ABSTRACT

Background: The rise in antimicrobial resistance necessitates the study of new and effective agents. **Methods:** The present study aims to assess the in-vitro antimicrobial activity of a novel antimicrobial agent, Levonadifloxacin, on Gram-positive cocci isolated from clinical samples. **Results:** Fifty Gram-positive isolates were included of which one Methicillin-sensitive Staphylococcus aureus (n=13) and two Enterococcus. faecalis (n=14) isolates showed resistance to Levonadifloxacin; all Methicillin-resistant Staphylococcus aureus (n=11), Enterococcus faecium (n=8), S. pneumoniae (n=1) and S. agalactiae (n=1) isolates were susceptible. **Conclusion:** The study highlights the high in-vitro action of levonadifloxacin against clinical isolates of Gram-positive cocci.

KEYWORDS

Levonadifloxacin, Gram-positive Cocci, Antibiotic, Antimicrobial Resistance

INTRODUCTION

The global burden of antimicrobial resistance (AMR) among Gram-positive pathogens, particularly *Staphylococcus aureus, Streptococcus pneumoniae*, and *Enterococcus spp.,* has driven the need for newer, more effective antimicrobials. Traditional therapies are increasingly compromised, resulting in treatment failures, prolonged hospital stays, and increased mortality.

Levonadifloxacin is a novel broad-spectrum benzoquinolizine fluoroquinolone, with potent bactericidal activity against Gram-positive bacteria, including strains that are resistant to quinolones [1,2]. Its enhanced affinity for DNA gyrase, biofilm penetration ability, and oral/intravenous formulations make it a promising candidate for serious infections.

Broad-spectrum activity against Gram-positive cocci sets levonadifloxacin apart as an effective agent for acute bacterial skin infection, caused by MRSA and other staphylococci [3]. Recent clinical studies and real-world data from India highlight its high clinical cure rates, excellent tissue penetration (including lungs and bone), and robust safety profile in both intravenous and oral formulations [4]. The step-down option from IV to oral administration further supports outpatient management and reduces hospital burden.

Levonadifloxacin represents an important advancement in the antimicrobial management of Gram-positive coccal infections, offering potent, broad-spectrum activity, resilience against resistance mechanisms, and favorable safety for diverse patient populations.

METHODOLOGY

The study was conducted at Max Super Speciality Hospital, Dwarka to evaluate the effect of levonadifloxacin against Gram-positive cocci. It was laboratory-based, *in-vitro* analytical study that included 50 non-duplicate Gram-positive isolates.

Clinical isolates of *Staphylococcus aureus*, *Enterococcus* spp., *Streptococcus pneumoniae*, and *Streptococcus agalactiae*, confirmed by VITEK, were included. Duplicate isolates from the same patient and those showing mixed growth of multiple organisms was excluded from the study.

Each isolate was suspended in normal saline and adjusted to a McFarland turbidity of 0.5. A lawn culture was made by using a sterile cotton swab to uniformly swab the suspension onto cation adjusted Mueller-Hinton Agar (MHA) plates. After allowing the surface to dry, antibiotics discs were placed aseptically on the agar. Of note, the standard disc concentration for Levonadifloxacin is 10µg[5]. Agar plates were incubated at 37°C overnight (18-24 hours) under aerobic conditions. The zone of inhibition was then measured, the data recorded as an excel sheet and interpreted as per the Clinical and Laboratory Standards Institute (CLSI) guidelines [5].

All categorical data was entered into Microsoft Excel and analyzed using SPSSv25. All data was expressed in percentages for susceptibility and resistance.

RESULT

In the present study, a total of 50 Gram positive cocci strains were isolated from different clinical samples. The most common clinical isolates were Methicillin-sensitive *Staphylococcus aureus* (MSSA), Methicillin-resistant *Staphylococcus aureus* (MRSA), and *Enterococcus faecalis*. The sensitivity pattern of the Gram-positive cocci is depicted in the tables (Table 1 and 2).

Of the 13 MSSA isolates, one showed resistance to levonadifloxacin, while all 11 MRSA isolates were sensitive. Among 14 *Enterococcus faecalis* isolates, two were resistant to levonadifloxacin. All isolates of *S. pneumoniae* (n=3*)*, and *S. agalactiae* (n=1), were sensitive to levonadifloxacin.

Among 13 isolates of MSSA, five were resistant to erythromycin, while all were sensitive to linezolid and vancomycin. Of the 11 MRSA isolates, seven were resistant to erythromycin, with none resistant to linezolid and vancomycin. All 14 isolates of *E. faecalis* were resistant to erythromycin, none to linezolid, and two were resistant to vancomycin.

DISCUSSION

The levonadifloxacin susceptibility profile observed in the 50 Gram-positive isolates studied demonstrates markedly superior activity compared with older fluoroquinolones. All MRSA, *E. faecalis* and *E. faecium* isolates were fully susceptible to levonadifloxacin, and it retained activity against the majority of ciprofloxacin- and levofloxacin-resistant *S. aureus* strains. These results are consistent with several larger surveillance data. A multicenter disc-diffusion study of 664 isolates from six Indian hospitals likewise reported 100% levonadifloxacin susceptibility across all Gram-positive species [6].

MRSA-specific investigations also corroborate the study. A recent study on 456 MRSA isolates demonstrated 100% susceptibility by disc diffusion and low $MIC_{50/90}$ values (0.38/0.5µg ml^{-1}) by E-test and broth-microdilution[7]. Prospective blood-stream data from Mumbai (31 isolates) showed potent activity with $MIC_{50/90}$ of 0.5/1 µg mL^{-1}, which has markedly lower than levofloxacin ($MIC_{50/90}$ 8/32mg/L) [8]. Earlier

phase-III and post-marketing studies reported ≥95% MRSA susceptibility and similar potency against quinolone-resistant strains of *S. aureus*, reinforcing advantage of using levonadifloxacin over older fluoroquinolones, such as ciprofloxacin and levofloxacin, which often exceed 50% resistance in the same settings [9,10].

Collectively, the current data aligns with other studies indicating that levonadifloxacin retains high *in-vitro* activity against contemporary MRSA and vancomycin-resistant *Enterococcus* isolates, even when conventional fluoroquinolones fail. Limitations of the present series include its modest size (n=50) and lack of standardized breakpoints for *E. faecium*, suggesting the need for larger, multi-center studies to confirm these trends.

Table 1: Antibiotic susceptibility profile (% sensitivity) of the clinical isolates.

Antimicrobial agents	MSSA (n=13)	MRSA (n=11)	*E. faecalis* (n=14)	*E. faecium* (n=8)	*S. pneumoniae* (n=3)	*S. agalactiae* (n=1)
LND	92.3 %	100 %	85.7 %	100 %	100 %	100 %
BNZ	15.38 %	0	100 %	0	NA	100 %
CF	30.7 %	18.2 %	21.4 %	0	NA	NA
CDM	92.3 %	54.4 %	NA	NA	33.34 %	NA
DPT	100 %	100 %	92.8 %	NA	NA	NA
ETM	61.5 %	36.4 %	0	0	0	NA
GNT	92.3 %	90.9 %	NA	NA	NA	NA
GNT-HL	NA	NA	28.5 %	0	NA	NA
LFX	46.1 %	18.2 %	21.4 %	0	NA	100 %
LN	100 %	100 %	100 %	100%	100%	100 %
NTF	100 %	100 %	100 %	0	NA	100 %
OXL	84.6 %	0	NA	NA	NA	NA
RFP	100 %	90.9 %	NA	NA	100 %	NA
TCP	100 %	100 %	100 %	50 %	NA	NA
TCL	100 %	100 %	0	12.5 %	0	0 %
TGC	100 %	100 %	100 %	100 %	66.67 %	100 %
T/S	69.23 %	100 %	NA	NA	33.34 %	NA
VNC	100 %	100%	85.7 %	50 %	33.34 %	100 %

MSSA: Methicillin sensitive *Staphylococcus aureus*, MRSA: Methicillin resistant *Staphylococcus aureus*, LND:

Table 2: Comparative susceptibility of MSSA, MRSA and *E. faecalis* to fluoroquinolones and other key antibiotics.

	MSSA (n=13)	MRSA (n=11)	*E. faecalis* (n=14)
Ciprofloxacin resistant	8	9	10
Ciprofloxacin sensitive	5	2	3
Levofloxacin resistant	7	9	10
Levofloxacin sensitive	6	2	3
Levonadifloxacin resistant	1	0	2
Levonadifloxacin sensitive	12	11	12
Erythromycin resistant	5	7	14
Linezolid resistant	0	0	0
Vancomycin resistant	0	0	2

REFERENCES

1. Jacobs MR, Bajaksouzian S, Windau A, Appelbaum PC, Patel MV, Gupte SV, et al. In vitro activity of the new quinolone WCK 771 against staphylococci. Antimicrob Agents Chemother. 2004 Sep;48(9):3338-42.
2. Appelbaum PC, Pankuch GA, Bozdogan B, Lin G, Jacobs MR, Patel MV, et al. Activity of the new quinolone WCK 771 against pneumococci. Clin Microbiol Infect. 2005 Jan 1;11(1):9-14.
3. Mehta Y, Mishra KC, Paliwal Y, Rangappa P, Sinha S, Bhapkar S. Meeting the Unmet Need in the Management of MDR Gram-Positive Infections with Oral Bactericidal Agent Levonadifloxacin. Crit Care Res Pract. 2022;2022(1):2668199.
4. Veeraraghavan B, Bakthavatchalam YD, Manesh A, Lal B, Swaminathan S, Ansari A, et al. India-discovered levonadifloxacin & alalevonadifloxacin: A review on susceptibility testing methods, CLSI quality control and breakpoints along with a brief account of their emerging therapeutic profile as a novel standard-of-care. Indian J Med Microbiol. 2023 Jan 1;41:71-80.
5. Clinical and Laboratory Standards Institute (CLSI). Performance Standards for Antimicrobial Susceptibility Testing. 34th ed. CLSI supplement M100. Wayne, PA: CLSI; 2024.
6. Baliga S, Mamtora DK, Gupta V, Shanmugam P, Biswas S, Mukherjee DN, et al. Assessment of antibacterial activity of levonadifloxacin against contemporary gram-positive clinical isolates collected from various Indian hospitals using disk-diffusion assay. Indian J Med Microbiol. 2020 Jul 1;38(3-4):307-12.
7. Vinayan S, Sistla S, Manoharan M, Sugumar M. In vitro efficacy of levonadifloxacin against methicillin-resistant Staphylococcus aureus (MRSA) including hVISA isolates collected across India. Indian J Med Microbiol. 2025 Jan 1;53:100788.
8. Mamtora D, Saseedharan S, Rampal R, Joshi P, Bhalekar P, Ahdal J, et al. In vitro activity of a novel benzoquinolizine antibiotic, levonadifloxacin (WCK 771) against blood stream gram-positive isolates from a tertiary care hospital. J Lab Physicians. 2020 Dec;12(03):230-2.
9. Mehta Y, Sutar AR, Zirpe K, Kothari JN, Alapati C, Pathak M, et al. Prescription-Event monitoring study on safety and efficacy of levonadifloxacin (oral and IV) in management of bacterial infections: findings of real-world observational study. Int J Appl Basic Med Res. 2022 Jan 1;12(1):30-6.
10. Kongre V, Bhagwat S, Bharadwaj RS. Resistance pattern among contemporary Gram positive clinical isolates and in vitro activity of novel antibiotic, Levonadifloxacin (WCK 771). Int J Infect Dis. 2020 Dec 1;101:30.