



## ABSTRACT

**Objectives:** To compare *in vitro* activity of ciprofloxacin (CIP), levofloxacin (LEV) and moxifloxacin (MOX) against nosocomial strains of *Staphylococcus aureus* isolated in different regions of Russia.

**Methods:** A total of 879 *S. aureus* isolates obtained from patients hospitalised in 17 medical institutions in different regions of Russia: 4 in Central region (Moscow, Ryazan, Smolensk), 2 in North-Western region (St.-Petersburg), 3 in Southern region (Krasnodar, Stavropol), 2 in Volga region (N. Novgorod, Kazan), 3 in Ural region (Ekaterinburg, Ufa) and 3 in Siberia (Krasnoyarsk, Novosibirsk, Tomsk) were included in the study. Antimicrobial susceptibility testing was performed by agar dilution method in accordance with the NCCLS recommendations (2002). Intermediately resistant and resistant strains were considered as non-susceptible. The *S. aureus* ATCC 29213 was used as a control strain.

**Results:** Against all strains MOX was the most active agent with MIC<sub>90</sub>=0.25 mg/l compare to 4 mg/l for CIP and 1 mg/l for LEV. The MIC<sub>50</sub>, MIC<sub>90</sub> and MICs ranges are shown in the table 1. Against ciprofloxacin-susceptible MRSA (N=199) the following MIC<sub>90</sub> were found: 0.5 mg/l for CIP, 0.25 mg/l for LEV and 0.06 mg/l for MOX. Against non-susceptible to CIP MRSA strains (N=96) MIC<sub>90</sub> were: 16 mg/l for LEV and 2 mg/l for MOX.

**Conclusions:** According to the above data MOX is more active than CIP and LEV against both MSSA and MRSA strains. However, MOX and LEV have a reduced activity against non-susceptible to CIP MRSA isolates.

## OBJECTIVES

Methicillin-resistant nosocomial *S. aureus* strains are known to be one of the problem nosocomial pathogen in term of its resistance to beta-lactams and other antimicrobials. We performed this study to determine if new quinolones (levofloxacin and moxifloxacin) have sufficient *in vitro* activity against this pathogen.

## METHODS

**Strains:** A total of 879 *S. aureus* isolates obtained from patients hospitalised in 17 medical institutions in different regions of Russia: 4 in Central region (Moscow, Ryazan, Smolensk), 2 in North-Western region (St.-Petersburg), 3 in Southern region (Krasnodar, Stavropol), 2 in Volga region (N. Novgorod, Kazan), 3 in Ural region (Ekaterinburg, Ufa) and 3 in Siberia (Krasnoyarsk, Novosibirsk, Tomsk) were included in the study (Fig. 1). The strains were identified using cultural growth test on mannitol-salt agar and tube coagulase test. All strains were shipped to a reference laboratory of Institute of Antimicrobial Chemotherapy (Smolensk, Russia) and re-identified there by standard biochemical methods and stored at -70°C in glycerol broth.

**Susceptibility testing:** Oxacillin-resistance was identified by agar-screening test.

Minimal inhibitory concentrations (MICs) of ciprofloxacin (CIP), levofloxacin (LEV) and moxifloxacin (MOX) were determined by agar dilution method in Mueller-Hinton II agar (BBL, USA). Interpretation of results for oxacillin (OXA), CIP and LEV were performed according to the NCCLS recommendations (2002). Intermediately resistant and resistant strains were considered as non-susceptible.

**Quality control:** *S. aureus* ATCC 29213 was used as the reference strain.

Figure 1. Centers participated in the study



## RESULTS

Against all strains moxifloxacin was the most active agent with MIC<sub>90</sub>=0.25 mg/l compare to 4 mg/l for ciprofloxacin and 1 mg/l for levofloxacin. The MIC<sub>50</sub>, MIC<sub>90</sub> and MICs ranges are shown in the table 1. Against ciprofloxacin-susceptible MRSA (N=199) the following MIC<sub>90</sub> were found: 0.5 mg/l for ciprofloxacin, 0.25 mg/l for levofloxacin and 0.06 mg/l for moxifloxacin. Against non-susceptible to ciprofloxacin MRSA strains (N=96) MIC<sub>90</sub> were: 16 mg/l for levofloxacin and 2 mg/l for moxifloxacin.

Table 1. *In vitro* activity of CIP, LEV and MOX against *S. aureus*

Antimicrobials	MIC <sub>50</sub> (mg/l)	MIC <sub>90</sub> (mg/l)	MIC range (mg/l)
MSSA (N=584)			
Ciprofloxacin	0.5	1	0.125-32
Levofloxacin	0.25	0.5	0.06-16
Moxifloxacin	0.06	0.125	0.015-4
MRSA (N=295)			
Ciprofloxacin	0.5	32	0.125-64
Levofloxacin	0.25	8	0.125-16
Moxifloxacin	0.06	2	0.015-8

Table 2. *In vitro* activity of CIP, LEV and MOX against MRSA

Antimicrobials	MIC <sub>50</sub> (mg/l)	MIC <sub>90</sub> (mg/l)	MIC range (mg/l)
Ciprofloxacin-susceptible (N=199)			
Ciprofloxacin	0.5	0.5	0.125-1
Levofloxacin	0.25	0.25	0.125-1
Moxifloxacin	0.06	0.06	0.015-0.5
Ciprofloxacin-non-susceptible (N=96)			
Levofloxacin	8	16	0.5-16
Moxifloxacin	2	2	0.06-64

## CONCLUSIONS

- > Moxifloxacin was significantly more potent against both methicillin-susceptible and methicillin-resistant *S. aureus* than ciprofloxacin and levofloxacin.
- > Moxifloxacin and levofloxacin have a reduced activity against non-susceptible to ciprofloxacin MRSA isolates, so further investigations are needed to estimate their clinical potential in staphylococcal infections, caused by these strains.