Effectiveness of Linezolid, $^{127}$I-Linezolid and $^{131}$I-Linezolid Against Methicillin-Susceptible Staphylococcus Aureus by Time Kill Curve Methods

Hasan Demiroğlu1, Uğur Avcıbaşı1, Serhan Sakarya2, Perihan Ünak3
1Celal Bayar University Faculty of Arts and Science, Department of Chemistry, Manisa, Turkey
2Adnan Menderes University Faculty of Medicine, Department of Infectious Diseases and Clinical Microbiology, Aydın, Turkey
3Ege University Faculty of Medicine, Institute of Nuclear Sciences, Department of Nuclear Applications, İzmir, Turkey

Abstract

Objective: Linezolid (LNZ) is one of the most effective treatments against Gram positive bacteria. However LNZ resistant intermediate strains have recently emerged in worldwide. The aim of the study was to compare the minimum inhibitory concentration (MIC), minimum bactericidal concentration (MBC) and minimum biofilm inhibitory concentration (MBIC) of LNZ, $^{127}$I-LNZ and $^{131}$I-LNZ against methicillin susceptible Staphylococcus aureus ATCC 35556 (MSSA) biofilms.

Methods: LNZ radiolabeled with $^{131}$I and cold labeling study with $^{127}$I was performed. Radiolabeling and inactive labeling quality-control studies of LNZ were carried out by using TLC (Thin Layer Radiochromatography) and HPLC (High Pressure Liquid Chromatography). LNZ, $^{127}$I-LNZ and $^{131}$I-LNZ against biofilm-forming MSSA was investigated, using a twofold serial broth microtitter method, biofilm challenge, and bacterial count recovery.

Results: The binding yield was obtained to be about 86±2% for radiolabeled LNZ. Minimal inhibitory concentration (MIC) and minimal bactericidal concentration for LNZ, $^{127}$I-LNZ and $^{131}$I-LNZ ranged from 1 to 2 µg/mL respectively. In time-kill studies LNZ, $^{127}$I-LNZ and $^{131}$I-LNZ were bactericidal against staphylococci, producing ≥ 3 Log10 decrease in viable counts (cfu/mL) within 6 h at 2xMIC. Following the biofilm formation on polystyrene U-bottom microtitter plates to investigate the minimal biofilm inhibitory concentration (MBIC) of LNZ, $^{127}$I-LNZ and $^{131}$I-LNZ was defined as the minimal concentration of antibiotic required to inhibit the biofilm. None of the LNZ, $^{127}$I-LNZ and $^{131}$I-LNZ killed 100% of biofilm associated cells. Mean cell survival in biofilms treated with 64 µg/mL LNZ, $^{127}$I-LNZ and $^{131}$I-LNZ (64 µg/mL) was 48%, 49%, and 33%, respectively.

Conclusion: Our results show that radiolabeled Linezolid demonstrated that 24 h of exposure to 64 µg/mL, promise in treating biofilm producing Staphylococcus aureus.

Key words: Biofilm, iodine-131, linezolid, radiolabeling, staphylococcus aureus

Preferred Presentation Type: Poster Presentation

DOI: 10.4274/mirt.24.01.01.12

Congress Participation and Efficiency of Education of Nuclear Medicine Technologists

Burak Sönmez, Hatice Durak, Emine Acar, Bağnu Uysal, Ebru Mendilcioğlu, Gamze Çapa Kaya
Dokuz Eylül University Faculty of Medicine, Department of Nuclear Medicine, İzmir, Turkey

Abstract

Objective: It’s aimed to reveal the areas in which technologists have inefficiency.

Methods: The questionnaire is applied to 77 (32 women, 45 men) nuclear medicine technologists with a mean age of 37 (19-59), who are working at 11 different hospitals. The education of the staff was as follows; 6 (8%) high school, 57 (74%) undergraduate, 14 (18%) bachelors degree. 70 of them was working in state hospitals (91%), 7 (9%) working in private sector. 58 technologists (75%) were working at the imaging unit, 13 (17%) working at the laboratory and 6 (8%) working both imaging and laboratory. All hospitals were equipped with gamma cameras and PET/CT. There was SPECT/CT at 4 (36%), uptake device at 6 (55%), bone mineral densitometry at 2 (19%) centers.

Results: 46 technologists (60%) haven’t participated in any congress and/or educational activity. Almost all of the 31 technologists who have participated before (97%) declared that they benefited from the activities. 22 technologists (48%)
who haven’t participated, declared that they haven’t heard about the congress or they weren’t invited to the congress/education. As a reason for their not participating, 9 technologists (20%) declared that they do not have time because of the workload and 3 technologists (7%) couldn’t participate because of economic reasons. The distribution of needs of the technologists for education are; 25 (32%) radiation safety, 14 (18%) imaging techniques and criteria, 8 (10%) up-to-date information, 7 (9%) employee rights, 3 (4%) patient-technologist relations. When we evaluated the opinions and the suggestions of the participants, it appeared that 57% wants free participation in congress and educational activities. 36% of the participants wished eliminating the shortage of staff and improvement of working conditions.

**Conclusion:** It’s thought that technologists should be informed about congresses and educational activities in due time and their participation should be encouraged. Besides, technologists should acquire up to date information about imaging techniques and criteria, radiation safety and employee rights. As a result, patient-technologist cooperation will be improved and the efficiency of nuclear medicine techniques will increase.

**Key words:** Education, nuclear medicine, technologist

**Preferred Presentation Type:** Poster Presentation

---

**In Vitro Activities of Moxifloxacin, \(^{127}\)I-Moxifloxacin and \(^{131}\)I-Moxifloxacin Against Staphylococcus Aureus Biofilms**

Hasan Demiroğlu\(^1\), Uğur Avcıbaşı\(^1\), Serhan Sakarya\(^2\), Perihan Unak\(^3\)

\(^1\)Celal Bayar University Faculty of Arts and Science, Department of Chemistry, Manisa, Turkey
\(^2\)Adnan Menderes University Faculty of Medicine, Department of Infectious Diseases and Clinical Microbiology, Aydin, Turkey
\(^3\)Ege University Faculty of Medicine, Institute of Nuclear Sciences, Department of Nuclear Applications, İzmir, Turkey

**Abstract**

**Objective:** The aim of the study was to investigate the antimicrobial effect of Moxifloxacin (MXF), radio (Na\(^{131}\)I) and cold (K\(^{127}\)I) iodinated MXF on methicillin susceptible Staphylococcus aureus ATCC 35556 (MSSA) biofilms.

**Methods:** MXF was labeled with Na\(^{131}\)I using the iodogen method. The optimum radiiodination conditions for \(^{131}\)I-MXF was determined by thin-layer radio chromatography studies. Thin-layer radio chromatography (TLRC) chromatograms were obtained by using Cyclone Plus Storage Phosphor System. The MICs of MXF, \(^{127}\)I-MXF and \(^{131}\)I-MXF were determined using the microdilution broth method according to CLSI criteria. Time kill curves were performed over 24 h using an inoculum of 2\(\times\)10\(^5\) (CFU/mL). Biofilms were grown in microtitre plates, dyed with crystal violet and the mean optical density (OD\(630\)) was used for quantification. Biofilms were incubated MXF, \(^{127}\)I-MXF and \(^{131}\)I-MXF at various concentration (0.03 to 64 \(\mu\)g/mL).

**Results:** MXF was labeled with \(^{131}\)I iodogen method. \(^{131}\)I-MXF was obtained with high a yield 95\(\pm\)3%. The MIC values for MXF, \(^{127}\)I-MXF and \(^{131}\)I-MXF was 0.06 \(\mu\)g/mL. Bactericidal activity was demonstrated at 0.25 \(\mu\)g/mL 4 hour for MXF, \(^{127}\)I-MXF and \(^{131}\)I-MXF. At MIC levels, MXF, \(^{127}\)I-MXF and \(^{131}\)I-MXF was not showed a marked reduction of metabolic activity in the S. aureus biofilm. The ODs of biofilm after incubation with an increasing antibiotic concentration were significantly lower than the ODs of biofilms without antibiotic \(p\leq0.05\). The radiolabeled MXF was most effective than MXF, \(^{127}\)I-MXF and \(^{131}\)I-MXF in reducing the number of bacteria in biofilm. After 24 h incubation Log10 CFU/mL values for 32 \(\mu\)g/mL antibiotic concentration: Control, MXF, \(^{127}\)I-MXF and \(^{131}\)I-MXF were 9.5, 4.3, 4.8 and 3.1, respectively.

**Conclusion:** \(^{131}\)I and \(^{127}\)I were used alone there was no penetration of the S. aureus biofilm and no damage. In contrast our results demonstrate that the radiolabeled Moxifloxacin (\(^{131}\)I-MXF) have potent anti-biofilm activity against S. aureus compare to MXF, \(^{127}\)I-MXF and media control. This is suggested that, \(^{131}\)I labeled antibiotic may have harmful effect on biofilm structure.

**Key words:** Biofilm, moxifloxacin, radioiodination, staphylococcus aureus ATCC 35556

**Preferred Presentation Type:** Poster Presentation

---

**In Vitro Activities of Moxifloxacin, \(^{127}\)I-Moxifloxacin and \(^{131}\)I-Moxifloxacin Against Staphylococcus Aureus Biofilms**

Hasan Demiroğlu\(^1\), Uğur Avcıbaşı\(^1\), Serhan Sakarya\(^2\), Perihan Unak\(^3\)

\(^1\)Celal Bayar University Faculty of Arts and Science, Department of Chemistry, Manisa, Turkey
\(^2\)Adnan Menderes University Faculty of Medicine, Department of Infectious Diseases and Clinical Microbiology, Aydin, Turkey
\(^3\)Ege University Faculty of Medicine, Institute of Nuclear Sciences, Department of Nuclear Applications, İzmir, Turkey

**Abstract**

**Objective:** The aim of the study was to investigate the antimicrobial effect of Moxifloxacin (MXF), radio (Na\(^{131}\)I) and cold (K\(^{127}\)I) iodinated MXF on methicillin susceptible Staphylococcus aureus ATCC 35556 (MSSA) biofilms.

**Methods:** MXF was labeled with Na\(^{131}\)I using the iodogen method. The optimum radiiodination conditions for \(^{131}\)I-MXF was determined by thin-layer radio chromatography studies. Thin-layer radio chromatography (TLRC) chromatograms were obtained by using Cyclone Plus Storage Phosphor System. The MICs of MXF, \(^{127}\)I-MXF and \(^{131}\)I-MXF were determined using the microdilution broth method according to CLSI criteria. Time kill curves were performed over 24 h using an inoculum of 2\(\times\)10\(^5\) (CFU/mL). Biofilms were grown in microtitre plates, dyed with crystal violet and the mean optical density (OD\(630\)) was used for quantification. Biofilms were incubated MXF, \(^{127}\)I-MXF and \(^{131}\)I-MXF at various concentration (0.03 to 64 \(\mu\)g/mL).

**Results:** MXF was labeled with \(^{131}\)I iodogen method. \(^{131}\)I-MXF was obtained with high a yield 95\(\pm\)3%. The MIC values for MXF, \(^{127}\)I-MXF and \(^{131}\)I-MXF was 0.06 \(\mu\)g/mL. Bactericidal activity was demonstrated at 0.25 \(\mu\)g/mL 4 hour for MXF, \(^{127}\)I-MXF and \(^{131}\)I-MXF. At MIC levels, MXF, \(^{127}\)I-MXF and \(^{131}\)I-MXF was not showed a marked reduction of metabolic activity in the S. aureus biofilm. The ODs of biofilm after incubation with an increasing antibiotic concentration were significantly lower than the ODs of biofilms without antibiotic \(p\leq0.05\). The radiolabeled MXF was most effective than MXF, \(^{127}\)I-MXF and \(^{131}\)I-MXF in reducing the number of bacteria in biofilm. After 24 h incubation Log10 CFU/mL values for 32 \(\mu\)g/mL antibiotic concentration: Control, MXF, \(^{127}\)I-MXF and \(^{131}\)I-MXF were 9.5, 4.3, 4.8 and 3.1, respectively.

**Conclusion:** \(^{131}\)I and \(^{127}\)I were used alone there was no penetration of the S. aureus biofilm and no damage. In contrast our results demonstrate that the radiolabeled Moxifloxacin (\(^{131}\)I-MXF) have potent anti-biofilm activity against S. aureus compare to MXF, \(^{127}\)I-MXF and media control. This is suggested that, \(^{131}\)I labeled antibiotic may have harmful effect on biofilm structure.

**Key words:** Biofilm, moxifloxacin, radioiodination, staphylococcus aureus ATCC 35556

**Preferred Presentation Type:** Poster Presentation