Nashwa Khadr, J Microb Biochem Technol 2015, 5:4
http://dx.doi.org/10.4172/1948-5948.S1.014

OMICS International
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World Congress and Expo on
Applied Microbiology
August 18-20, 2015 Frankfurt, Germany

Can penicillin-bound nanoparticles restore the activity of ß-lactam antibiotics against methicillin-resistant *Staphylococcus aureus*?

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Loss of effectiveness of commonly used antibiotics such as penicillin and other β-lactam drugs against MRSA lead to calling for immediate need for improvement in drug design, discovery, and delivery. The application of nanotechnology to drug delivery system is widely expected to change the landscape of pharmaceutical and biotechnology industries for foreseeable future, where nanoparticles represent a very promising approach to this aim. The aim of this work was to assess whether penicillin-bound nanoparticles will display antibacterial activity against MRSA and to determine the bioactivity of penicillin-bound nanoparticles. *Staphylococcus aureus* isolates were subjected to oxacillin and cefoxitin disc diffusion method, and PCR for detection of *mecA* gene for identification of MRSA and MSSA isolates. Fifty MRSA and 30 MSSA were selected and further tested. Determination of Penicillin and Penicillin-bound nanoparticles MIC by broth microdilution method was performed. All MRSA isolates were resistant to penicillin using both methods. As for the MSSA isolates, using penicillin-bound nanoparticles, none displayed resistance at a dilution of ≥ 512 µg/ml (0.0%), 10 (33%) revealed an MIC of ≥16 µg/ml, whereas 7 revealed an MIC of 16 µg/ml. It was observed that 3 isolates (10%) of MSSA turned sensitive to penicillin when performing the MIC broth microdilution test, using penicillin-bound nanoparticles. Though 27 MSSA isolate remained resistant; yet the MIC of penicillin-bound nanoparticles was significantly reduced. In conclusion, penicillin-bound nanoparticles was effective only with MSSA producing penicillinase in reducing MIC of penicillin or even making MSSA sensitive to penicillin. But with MRSA, penicillin-bound nanoparticles gave no effect.

Notes: