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In vitro antimicrobial photodynamic inactivation of multidrug-resistant *Acinetobacter baumannii* biofilm using Protoporphyrin IX and Methylene blue

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Highlights

- Clinical, abattoir, and aquatic MDR A. baumanii were used with ATCC 19606 biofilm producing reference as positive control.
- Methylene blue and Protoporphyrin IX were used as the antibacterial photodynamic therapy photosensitizer.
- A convenient non-coherent light source equipped with a tungsten halogen GE Quartzline lamp with wavelengths from 560–780 nm was used.
- Photosensitisers were visualized in the cells using epifluorescence microscopy of cells attached to glass surfaces.

Abstract

Background

Acinetobacter baumannii is a challenging pathogen due to the rapid development of antimicrobial resistance and biofilm formation. The objective of this study was to evaluate the effect of antimicrobial photodynamic inactivation against biofilms of multidrug-resistant *A. baumannii* isolated from clinical, abattoir and aquatic sources.

Methods

The isolates were tested for susceptibility to imipenem, meropenem, tigecycline and colistin using autoSCAN-4 automated system and rechecked by the E-test. Methylene blue, Protoporphyrin IX, and a halogen lamp were used in the *in vitro* assay against biofilms of the isolates. The antimicrobial photodynamic inactivation was assessed by counting colony-forming units (CFU).

Results

The isolates from abattoir and aquatic sources were resistant to carbapenems (>64 μg/mL) but susceptible to tigecycline (2 μg/mL) and colistin (Abattoir, 0.35 μg/mL and Aquatic, 0.24 μg/mL), whereas the clinical isolate was susceptible to only colistin (0.5 μg/mL) using the E-test. The log survival percentages of the control group at a concentration of 20 μM were 5×10^{-6} % for Protoporphyrin IX and 2×10^{-6} % for Methylene blue. Therefore, Methylene blue showed higher bacterial reduction of 7.0 $\log_{10}$ colony forming units than 6.0 $\log_{10}$ for Protoporphyrin IX. No significant difference was observed with respect to the origin of isolates and the minimum inhibitory concentrations.

Conclusion

The results indicate that antimicrobial photodynamic inactivation could be an alternative strategy for the control of infections caused by multi-drug resistant *A. baumannii* by significantly reducing biofilm growth at a sub-lethal concentrations.

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Keywords

Antimicrobial photodynamic inactivation; Methylene blue; Protoporphyrin IX; Biofilm; *A. baumannii*; Multidrug-resistant; Halogen lamp

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