QUATERNARY AMMONIUM POLYETHYLENEIMINE NANOPARTICLES: ANTIMICROBIAL EVALUATION AGAINST BACTERIA FROM PERITONEAL DIALYSIS RELATED PERITONITIS

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OBJECTIVES

Pathogenic bacteria associated with peritonitis in Peritoneal Dialysis (PD) patients are becoming increasingly resistant to many commonly used antibiotics. The development of alternative therapeutic compounds with antimicrobial activity, as Nanoparticles (NPs), is the focus of extensive research. The objective of this study is to determine the antibacterial effect of quaternary ammonium polyethyleneimine NPs (QA-PEI NPs) against multirresistant bacteria causing PD-related peritonitis.

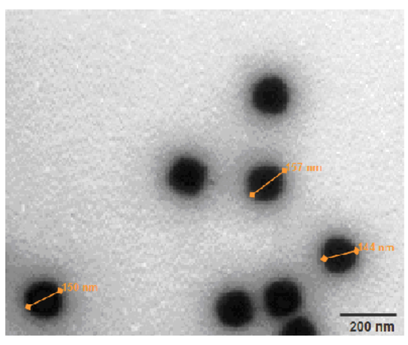
METHODS

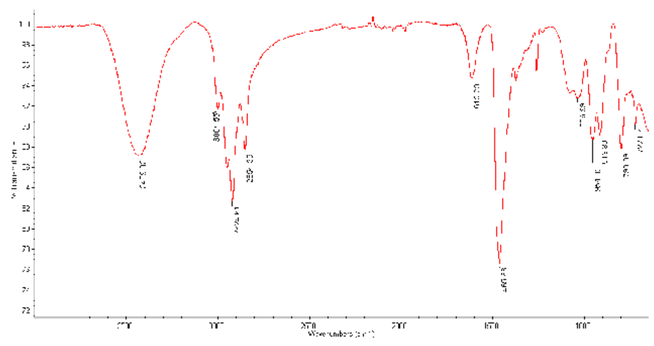
Bacteria were collected from infected peritoneal dwell from PD patients. To appraise the antibacterial activity, minimal inhibitory concentration (MIC), minimal bactericidal concentration (MBC) and bactericidal killing assays were performed using different concentrations of QA-PEI NPs (0.2-100 µg/ml) for each bacteria.

Values are mean ± standard deviation of three triplicates. Statistical significance was evaluated by nonparametric variance analysis (Kruskal-Wallis) followed by Dunn's test, with $p < 0.05$ considered statistically significant.

RESULTS

3 multiresistant pathogens were isolated ex-vivo: *Streptococcus viridans, Stenotrophomonas maltophilia* and *Escherichia coli*. MICs of *S. maltophilia* and *E. coli* isolates, were 12.5 and 25 µg/ml, respectively, whereas the MIC of *S. viridians* was 100 µg/ml. MBC was 100 µg/ml for *S. maltophilia (A)*, and 50 µg/ml for both *E. coli (B)* and *S. viridians (C).* Furthermore, the time kill assays revealed that, for the three isolates studied, bacterial growth was inhibited at 12.5 µg/ml NP after 1 h.



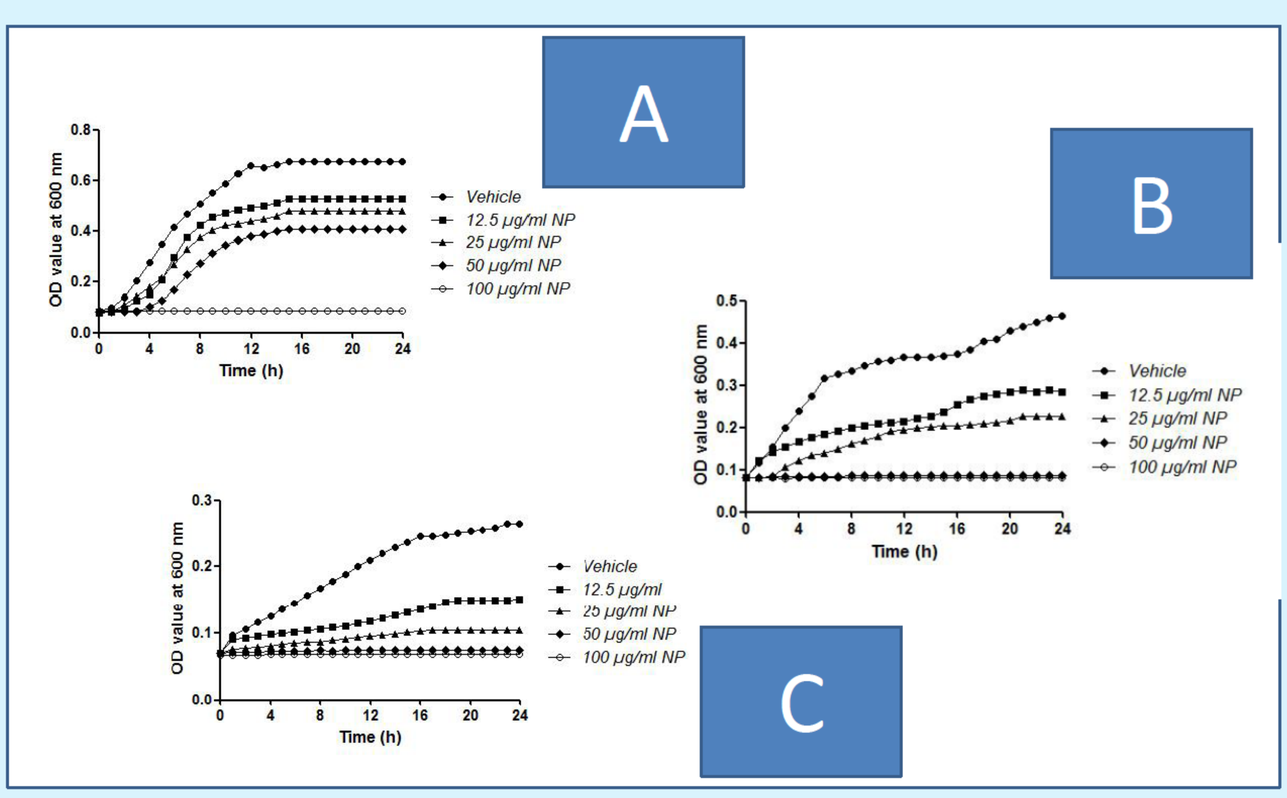


CONCLUSION

These QA-PEI NPs have antibacterial activity on peritoneal solutions infected by both Gram-positive and Gram-negative bacteria. This effect may be used for the prevention and treatment of peritonitis in patients on PD, avoiding the development of angiogenesis, fibrosis and membrane failure.

Further studies should investigate the antimicrobial activity of QA-PEI NPs on other types of bacteria and the toxicity on peritoneal mesothelial cells for potentially widening such antibacterial applications.

The present findings reveal that the QA-PEI NPs could be used as an alternative antibacterial agent after completing successful toxicity studies.



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