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Skin Infection Management Using Novel Antibacterial Agents

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ABSTRACT

Pseudomonas aeruginosa and *methicillin-resistant Staphylococcus aureus* (MRSA) cause difficulties in the management of skin and soft tissue infections and have led to morbidity and mortality in hospital-acquired infections especially in susceptible individuals, those who are generally sick or immunosuppressed. Currently approaches in antibacterial agents offer opportunities to manage the trouble using novel anti-infection systems. Therefore, nanotechnology, a most promising field for generating new applications in medicine, has introduced a most prominent nanoproduct named as nanosilver that revealed excellent antimicrobial activity against some of the hazardous infections. Also cathelicidin peptides which are a part of native immune defense system in the skin and epithelia exhibit excellent antimicrobial activity against some of these perilous infections.

Introduction

In the past decade *Staphylococcus aureus methicillin resistance* (MRSA) and *P. aeruginosa* strains have become a part of epidemic level reached pathogens causing severe bacterial and resistant skin structure infections due to inadequate pharmaceutical administrations against bacterial diseases. Likely, various types of common antibiotic drugs, i.e. vancomycin, linezolid, etc were usual choices for treating MRSA, but currently reported resistances make it evident to try for new antimicrobial agents against MRSA.[1-4] Furthermore aggregations of microorganisms surrounded in a self-created matrix of extracellular materials are common examples of urinary tract, middle ear, and para-nasal sinuses infections. These bacterial accumulations, notoriously resistant to antimicrobial agents, are called biofilms. Biofilms have been concerned in the prevention of wound healing in chronic skin wounds and burn wounds due to their high potential in morbidity and mortality for patients.[5-6] The extent of the burn injury would determine the rate of infection. The control of the consequential sepsis is essential to the survival of the patients due to the emergence of methicillin resistant *Staphylococcus aureus* (MRSA) and multi-resistant *Pseudomonas aeruginosa as the major reason of morbidity and mortality for patients with burn injuries*.[7]

Silver is used widely as an antibiotic against wound infections and serious burn wounds. 1% silver nitrate solution was used as an eye solution for prevention of Gonococcal ophthalmia neonatorum. Metallic silver was reported to be a minimal health risk. Nanosilver revealed high antibacterial activity, where it is free of in vitro cytotoxicity. Nanosilver cement showed excellent antibacterial activity against *S. epidermidis, S. aureus, Escherichia coli, Staphylococcus aureus methicillin resistance strain (MRSA) and Pseudomonas aeruginosa.*, where nowadays bacterial resistance to common antibiotics is made numerous life threatening infections.[2,8-9]

Cathelicidins, effectors of native immune defense which have been identified in skin and epithelia of a number of mammals, are another family of cationic antimicrobial peptides in protection against infections. Unlike humans and mice, domesticated mammals namely pig, cow, and horse having several cathelicidin genes show better resistance to infections especially those caused by group A of *Streptococcus*, etc..[10] Cathelicidins belonging to a family of precursor proteins are gene-encoded proteins with wide-ranging antimicrobial functions by means of an extremely variable C-terminal antimicrobial area for immune defense in opposition to pathogens.[11] Also, representing an integral part of immediate responses at epithelial barriers, these peptides are active molecules in intestinal mucosal immunity and protection.[12]

Conclusion

Taken together, it would be logical to hypothesize that nanosilver particles combining to cathelicidin peptides, both with excellent antimicrobial properties, can be

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loaded and released through the intracellular environment-sensitive polymeric micelles which will make it potentially well-matched for the management of polymicrobial skin structure or wound and burn infections possibly without morphological changes to the tissue. This will improve the defensive and immunological potential of the patients against ubiquitous infections caused by skin natural microorganism namely *Pseudomonas aeruginosa*, MRSA, etc. The novel pharmaceutical dosage formulations (lotions, pomades, creams, etc. with proper concentrations) would improve bioavailability and help targeting drugs to specific sites topically where micellar formulations can be utilized systemically. Logically it could provide optimal benefits in view of more uniform release and proportionately higher uptake with a decrease in side effects due to the controlled release of the particles.[13]

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