

Emerging Nanostrategies to Combat Antibiotic-Resistant Urinary Tract Infections: A Review

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Abstract

Existing preclinical and clinical evidence for nanotechnology-based therapies in the treatment of antibiotic-resistant urinary tract infections (UTIs) is reviewed in this narrative study. Antibiotic-resistant UTIs represent a growing global health concern, necessitating the development of new therapeutic approaches. This review examines the application of nanotechnology against antibiotic-resistant UTIs and the capability of nanocarrier systems to improve drug delivery, target bacterial cells, and block biofilms. Different nanocarriers, including liposomes, silver nanoparticles (AgNPs), and gold nanoparticles (AuNPs), have been investigated for their distinctive properties that improve treatment efficacy. This review also

discusses the mechanisms of action of these nanostrategies, including targeted drug delivery and enhanced penetration of antimicrobial agents. Safety considerations, including cytotoxicity and genotoxicity, as well as strategies to minimize side effects, are evaluated. Future research should focus on refining these technologies to overcome antibiotic resistance, ensuring safer and more effective clinical applications in UTI management.

Keywords: nanotechnology, antibiotic resistance, urinary tract infections, nanocarriers, drug delivery