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Antibacterial Effects of Zinc Oxide Nanoparticles as Alternative Therapy on Drug-Resistant Group B Streptococcus Strains Isolated from Pregnant Women

Authors : Leila Fozouni, Anahita Mazandarani

Abstract : Background: Maternal infections are the most common cause of infections in infants, and the level of infection and its severity highly depends on the degree of colonization of the bacteria in the mother; so, the occurrence of aggressive diseases is not unpredictable in mothers with very high colonization. Group B Streptococcus is part of the normal flora of the gastrointestinal and genital tracts in women and is the leading cause of septicemia and meningitis in newborns. Today Zinc oxide nanoparticle is regarded as one of the most commonly used and safest nanoparticles for defeating Gram-positive and Gram-negative bacteria. This study aims to determine the antibacterial effects of Zinc oxide on the growth of drug-resistant group B Streptococcus strains isolated from pregnant women. Materials and Methods: This cross-sectional study was conducted on 150 pregnant women of 28–37 weeks admitted to seven hospitals and maternity wards in Golestan province, northeast of Iran. For bacterial identification, rectovaginal swabs were firstly inoculated to the Todd-Hewitt Broth and cultured in blood agar (containing 5% sheep blood). Then microbiologic and PCR methods were performed to detect group B Streptococci. Disk diffusion and broth microdilution tests were used to determine the bacterial susceptibility to antibiotics according to CLSI M100(2021) criteria. The antibacterial properties of Zinc oxide nanoparticles were evaluated using the agar well-diffusion method. Results: The prevalence of group B Streptococcus was 18% in pregnant women. Out of twenty-seven positive cultures, 62.96% were higher than thirty years old. Ninety percent and 45% of isolates were resistant to clindamycin and erythromycin, respectively, and susceptibility to cefazolin was 71%. In addition, susceptibility to ampicillin and penicillin were 74% and 55%, respectively. The results showed that 82% of erythromycin-resistant, 92% clindamycin-resistant, and 78% of cefazolin-resistant isolates were eliminated by zinc oxide nanoparticles at a concentration of 100 mg/L of the nanoparticle. Furthermore, ZnONPs could inhibit all drug-resistant isolates at a concentration of 200 mg/mL (MIC90 ≥ 200). Conclusion: Since the drug resistance of group B streptococci against various antibiotics is increasing, determining and investigating the drug-resistance pattern of this bacterium to different antibiotics in order to prevent arbitrary consumption of antibiotics by pregnant women and ultimately prevent Infant mortality seems necessary. Generally, ZnONPs showed a high antimicrobial effect, and it was revealed that the bactericide effect increases upon the increase in the concentration of the nanoparticle.

Keywords : group B beta-hemolytic streptococcus, pregnant women, zinc oxide nanoparticles, drug resistance
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