

Exploratory Characterization of Antibacterial Efficacy of Synthesized Nanoparticles on Staphylococcus Isolates from Hospital Specimens in Saudi Arabia

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Abstract : Staphylococci spp are ubiquitous gram-positive bacteria is often associated with infections, especially nosocomial infections, and antibiotic resistance. Study pathogenic bacteria and its use as a tool in the technology of Nano biology and molecular genetics research of the latest research trends of modern characterization and definition of different multiresistant of bacteria including Staphylococci. The Staphylococci are widespread all over the world and particularly in Saudi Arabia. The present work study was conducted to evaluate the effect of five different types of nanoparticles (biosynthesized zinc oxide, Spherical and rod of each silver and gold nanoparticles) and their antibacterial impact on the Staphylococcus species. Ninety-six isolates of Staphylococcus species. Staphylococcus aureus, Staphylococcus epidermidis, MRSA were collected from different sources during the period between March 2011G to June 2011G. All isolates were isolated from inpatients and outpatients departments at Royal Commission Hospital in Yanbu Industrial, Saudi Arabia. High percentage isolation from males (55%) than females (45%). Staphylococcus epidermidis from males was (47%), (28%), and (25%). For Staphylococcus aureus and Methicillin-resistant Staphylococcus aureus (MRSA). Isolates from females were Staphylococcus aureus with higher percent of (47%), (30%), and (23%) for MRSA, Staphylococcus epidermidis. Staphylococcus aureus from wound swab were the highest percent (51.42%) followed by vaginal swab (25.71%). Staphylococcus epidermidis were founded with higher percentage in blood (37.14%) and wound swab (34.21%) respectively related to other. The highest percentage of methicillin-resistant Staphylococcus aureus (MRSA) (80.77%) were isolated from wound swab, while those from nostrils were (19.23%). Staphylococcus species were isolates in highest percentage from hospital Emergency department with Staphylococcus aureus (59.37%), Methicillin-resistant Staphylococcus aureus (MRSA) (28.13%) and Staphylococcus epidermidis (12.5%) respectively. Evaluate the antibacterial property of Zinc oxide, Silver, and Gold nanoparticles as an alternative to conventional antibacterial agents. Staphylococci isolates from hospital sources we screened them. Gold and Silver rods Nanoparticles to be sensitive to all isolates of Staphylococcus species. Zinc oxide Nanoparticles gave sensitivity impact range (52%) and (48%). The Gold and Silver spherical nanoparticles did not showed any effect on Staphylococci species. Zinc Oxide Nanoparticles gave bactericidal impact (25%) and bacteriostatic impact (75%) for of Staphylococci species. Detecting the association of nanoparticles with Staphylococci isolates imaging by scanning electron microscope (SEM) of some bacteriostatic isolates for Zinc Oxide nanoparticles on Staphylococcus aureus, Staphylococcus epidermidis and Methicillin resistant Staphylococcus aureus (MRSA), showed some overlapping bacterial cells with lower their number and appearing some appendages with deformities in external shape. Molecular analysis was applied by Multiplex polymerase chain reaction (PCR) used for the identification of genes within Staphylococcal pathogens. A multiplex polymerase chain reaction (PCR) method has been developed using six primer pairs to detect different genes using 50bp and 100bp DNA ladder marker. The range of Molecular gene typing ranging between 93 bp to 326 bp for Staphylococcus aureus and Methicillin resistant Staphylococcus aureus by TSST-1, mecA, femA and eta, while the bands border were from 546 bp to 682 bp for Staphylococcus epidermidis using icaAB and atlE. Sixteen isolation of Staphylococcus aureus and Methicillin resistant Staphylococcus aureus were positive for the femA gene at 132bp, this allowed the using of this gene as an internal positive control, fifteen isolates of Staphylococcus aureus and Methicillin resistant Staphylococcus aureus were positive for mecA gene at 163bp. This gene was responsible for antibiotic resistant Methicillin, Two isolates of Staphylococcus aureus and Methicillin resistant Staphylococcus aureus were positive for the TSST-1 gene at 326bp which is responsible for toxic shock syndrome in some Staphylococcus species, None were positive for eta gene at 102bp that was responsible for Exfoliative toxins. Six isolates of Staphylococcus epidermidis were positive for atlE gene at 682 bp which is responsible for the initial adherence, three isolates of Staphylococcus epidermidis were positive for icaAB gene at 546bp that are responsible for mediates the formation of the biofilm. In conclusion, this study demonstrates the ability of the detection of the genes to discriminate between infecting Staphylococcus strains and considered biological tests, they may potentiate the clinical criteria used for the diagnosis of septicemia or catheter-related infections.

Keywords : multiplex polymerase chain reaction, toxic shock syndrome, Staphylococcus aureus, nosocomial infections

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