

Development and Evaluation of Surgical Sutures Coated with Antibiotic Loaded Gold Nanoparticles

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Abstract : Surgical site infections (SSIs) are the most common nosocomial infections localized at the incision site. With an estimated 27 million surgical procedures each year in USA, approximately 2-5% rate of SSIs are predicted to occur annually. SSIs are treated with antibiotic medication. Current trend suggest that the direct drug delivery from the suture to the scared tissue can improve patient comfort and wound recovery. For that reason coating the surface of the medical device such as suture and catguts with broad spectrum antibiotics can prevent the formation of bacterial colonies with out compromising the mechanical properties of the sutures. Hence, the present study was aimed to develop and evaluate a surgical suture coated with an antibiotic Ciprofloxacin hydrochloride loaded on gold nanoparticles. Gold nanoparticles were synthesized by chemical reduction method and conjugated with ciprofloxacin using Polyvinylpyrrolidone as stabilizer and gold as carrier. Ciprofloxacin conjugated gold nanoparticles were coated over an absorbable surgical suture made of Polyglactan using sodium alginate as an immobilising agent by slurry dipping technique. The average particle size and Polydispersity Index of drug conjugated gold NPs were found to be 129 ± 2.35 nm and 0.243 ± 0.36 respectively. Gold nanoparticles are characterized by UV-Vis absorption spectroscopy, Fourier Transform Infrared Spectroscopy (FT-IR), Scanning electron microscopy and Transmission electron microscopy. FT-IR revealed that there is no chemical interaction between drug and polymer. Antimicrobial activity for coated sutures was evaluated by disc diffusion method on culture plates of both gram negative (E-coli) and gram positive bacteria (Staphylococcus aureus) and results found to be satisfactory. In vivo studies for coated sutures was performed on Swiss albino mice and histological evaluation of intestinal wound healing parameters such as wound edges in mucosa, muscularis, presence of necrosis, exudates, granulation tissue, granulocytes, macrophages, restoration, and repair of mucosal epithelium and muscularis propria on day 7 after surgery were studied. The control animal group, sutured with plain suture (uncoated suture) showed signs of restoration and repair, but presence of necrosis, haemorrhagic infiltration and granulation tissue was still noticed. Whereas the animal group treated with ciprofloxacin and ciprofloxacin gold nanoparticle coated sutures has shown promising decrease in terms of haemorrhagic infiltration, granulation tissue, necrosis and better repaired muscularis layers on comparison with plain coated sutures indicating faster rate of repair and less chance of sepsis. Hence coating of sutures with broad spectrum antibiotics can be an alternate technique to reduce SSIs.

Keywords : ciprofloxacin hydrochloride, gold nanoparticles, surgical site infections, sutures

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