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Exploring the possible targeting strategies of liposomes against methicillin-resistant *Staphylococcus aureus* (MRSA)

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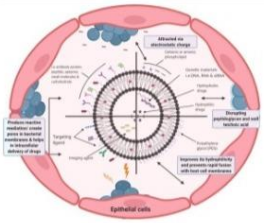
Abstract

Multi antibiotic-resistant bacterial infections are on the rise due to the overuse of antibiotics. Methicillin-resistant Staphylococcus aureus (MRSA) is one of the pathogens listed under the category of serious threats where vancomycin remains the mainstay treatment despite the availability of various antibacterial agents. Recently, decreased susceptibility to vancomycin from clinical isolates of MRSA has been reported and has drawn worldwide attention as it is often difficult to overcome and leads to increased medical costs, mortality, and longer hospital stays. Development of antibiotic delivery systems is often necessary to improve bioavailability and biodistribution, in order to reduce antibiotic resistance and increase the lifespan of antibiotics. Liposome entrapment has been used as a method to allow higher drug dosing apart from reducing toxicity associated with drugs. The surface of the liposomes can also be designed and enhanced with drug-release properties, active targeting, and stealth effects to prevent recognition by the mononuclear phagocyte system, thus enhancing its circulation time. The present review aimed to highlight the possible targeting strategies of liposomes against MRSA bacteremia systemically while investigating the magnitude of this effect on the minimum inhibitory concentration level.

Graphical abstract



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Keywords

Liposomes; Drug delivery; Targeting ligands; Surface functionalization; MRSA; Clinical trials

Abbreviations

AMR, antimicrobial resistance; MRSA, methicillin-resistant *Staphylococcus aureus*; MIC, minimal inhibitory concentration; S. aureus., *Staphylococcus aureus*; DOBAB, dioctadecyldimethylammonium bromide; PEG, polyethylene glycol; DOTAP, 1, 2-bis (oleoyl oxy)-3- (trimethylammonio) propane; DPPC, dipalmitoylphosphatidylcholine; DMPC, 1,2-dimyristoyl-*sn*-glycero-3-phosphocholine; ECGC, epigallocatechin gallate; DSAPA, di-stearoyl amino propionic acid; DOAPA, di-oleoyl amino propionic acid; DLAPA, di-linoleoyl amino propionic acid; DLLAPA, di-linolenoyl amino propionic acid; DSPC, 1,2-distearoyl-*sn*-glycero-3-phosphocholine; DSPS, 1,2-distearoyl-*sn*-glycero-3-phospho-L-serine; DSPA, 1,2-distearoyl-*sn*-glycero-3-phosphate; TSAPA, tri-stearoyl amino propionic acid; TOAPA, tri-oleoyl amino propionic acid; TLAPA, tri-linoleoyl amino propionic acid; TLLAPA, tri-linolenoyl amino propionic acid; VCM/VAM, Vancomycin; C-DLX-Lip, chitosan-coated dicloxacillin loaded liposome; CS-hydrogel, plain 2.5% chitosan hydrogel with 10% glycerol; CS-CAM-Lip, chitosan hydrogel with chloramphenicol entrapped in liposome; CAM-Sol, chloramphenicol in dH2O; VCM-OA, vancomycin oleic acid; VCM-CHT, vancomycin chitosan

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