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Applications of nanotechnology for development of oral hepatitis B (HBV) vaccine with capability for antigen cross presentation

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Oral delivery of antigens for vaccination is an attractive proposition because of being non-invasive in nature, painless and safe for use in infants. Oral delivery of vaccines is also a cost-effective strategy. We aimed at fabricating a polymer based nano-particle with high efficiency of prolonged antigen presentation. We fabricated poly-ε-caprolactone nano-particles coated with Pluronic® F127 (PCL NPs) with average size of 60 nm, loaded with HBsAg antigen. The 60nm PCL NP were internalised through clathrin mediated endocytosis followed by endosomal escape, resulting in the cytosolic release of the antigen with enhanced antigen cross presentation through MHC-I pathway. We studied *in vitro* antigen presentation with human monocyte derived macrophages (HMoM) and their interaction with autologous T-helper cell (CD4+) and cytotoxic T-cells (CD8+) demonstrating a marked clonal expansion of cytotoxic T-cells along with a good humoral antibody response. Flow cytometry confirmed expansion of effector and central memory cytotoxic T-cells. The efficacy of this nano-adjuvant based vaccine through oral, intramuscular and intra-dermal routes were studied in mice model. High antibody titre against HBsAg was noted up to two months of single administration through oral route which was significantly higher than other routes. Fluorescent dye doped PCLNP and antigen could be demonstrated by immunofluorescence study in macrophages in intestinal villi and peripheral inguinal lymph nodes after 2 months of oral administration indicating capability of the nanocarrier for systemic antigen presentation through oral route. The present study indicated the translational potential of this nano-adjuvant based oral HBV vaccine which may have a prolonged immunity even without a booster dose.

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