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LUNG MUCOSAL DELIVERY OF NANOCARRIER PNEUMOCOCCAL VACCINE

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There is a huge drive in the vaccine research field, pharmaceutical industry and Bill Gates Foundation for effective targeting of dendritic cells (DCs) to enhance the immune response and for needle-free vaccination. The aim of this study was to adsorb pneumococcal protein (PspA), onto poly(glycerol adipate-co-ω-pentadecalactone), PGA-co-PDL, nanoparticles (NPs) to target lung DCs. Further to formulate these NPs into dry powder nanocomposite microparticles (NCMPs) suitable for pulmonary vaccine delivery. NPs were prepared using an emulsion solvent evaporation method and PspA was adsorbed onto the surface of NPs (100:20 [NP: PspA]). The NPs were spray-dried in an aqueous suspension of leucine (1:1.5) to produce NCMPs and characterised in terms of particle size, loading, cell viability, protein stability (SDS-PAGE), integrity (circular dichroism, CD), antigenicity (ELISA), immunization and aerosolisation studies. The NPs produced were 322.83±4.25 nm in size with PspA loading 19.68±2.74 µg/mg. The NCMPs resulted in a fine particle fraction (FPF%) >75%. The NPs appear to be well tolerated by DCs cell lines ≥90% cell viability) at 19.5µg/mL after 4h exposure. SDS-PAGE, CD (α-helical decreased <13% vs. standard PspA) and the antigenicity (>95%) confirmed that PspA was stable in both formulations after spray-drying. The cfu in BALF of mice challenged with pneumococcal bacteria was signifcantly less compared to PspA alone in the lungs or via subcutaneous injection. The PspA loaded NPs were incorporated into NCMPs having excellent aerosolisation characteristics whilst maintaining protein activity. Hence, it may be feasible to use these carriers for pulmonary vaccine delivery.

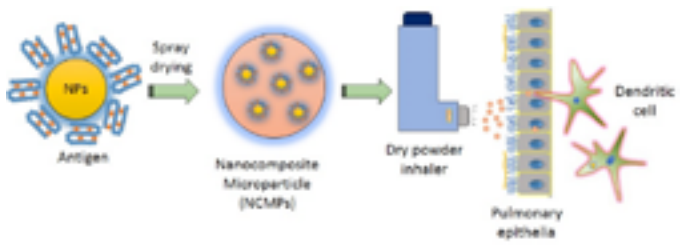

Fig.1: Lung mucosal delivery of nanocarrier pneumococcal vaccine.

BIOGRAPHY

Imran Saleem is a reader in nanomedicine within the School of Pharmacy and Biomolecular Sciences, Liverpool John Moores University, UK. His research is aimed at developing novel delivery systems for targeting therapeutic agents to their site of action, with emphasis on lung diseases via dry powder pulmonary delivery. He has over 10 years' of experience in micro/nanoparticle formulation and drug delivery systems, and has published extensively in peer-reviewed journals, conference abstracts and book chapters. His research group is focused on the design and development of nanocarriers for delivery of biomacromolecules including, genes, peptides, vaccines and drugs.

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