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Drug delivery by tattooing to treat cutaneous leishmaniasis

Background: Leishmaniasis is a vector-borne disease that is caused by obligate intra-macrophage protozoa of the Leishmania species. Leishmaniasis can cause different clinical syndromes, including cutaneous leishmaniasis (CL), in which the patient generally presents with one or several ulcer(s) or nodule(s) on the skin, resulting from the infection of phagocytic cells located in the dermis. It often results into severe scar tissue in the skin. Most of the twelve million people infected with Leishmania worldwide are CL cases, a 1.5 million new cases occur annually.

Objective: WHO has a program to develop new treatments for cutaneous leishmaniasis. This study establishes a proof-of-concept that a tattoo device can target intra-dermal drug delivery against cutaneous leishmaniasis (CL).

Methods: The selected drug is oleylphosphocholine (OlPC) formulated as liposomes, particles known to be prone to macrophage ingestion. First is shown that treatment of cultured Leishmania-infected macrophages with OlPC-liposomes results in a direct dose-dependent killing of intracellular parasites. Based on this, *in vivo* efficacy is demonstrated using a 10-day tattooing-mediated treatment in mice infected with L. major and L. mexicana. In both models this regimen results in rapid clinical recovery with complete regression of skin lesions by Day 28. Parasite counts and histopathology examination confirm high treatment efficacy at the parasitic level. Low amount of drug required for tattooing combined with fast clinical recovery may have a positive impact on CL patient management.

Results: This first example of tattoo-mediated drug delivery could open to new therapeutic interventions in the treatment of skin diseases. This study demonstrates that the use of a tattoo instrument for drug delivery is possible in the treatment of cutaneous leishmaniasis, and that this method can successfully eliminate intracellular parasites at the site of infection. After showing that the selected drug oleylphosphocholine (OlPC) formulated as liposomes could efficiently reach intracellular.

Recent Publications

1. Shio, M.T. et al. Drug Delivery by Tattooing to Treat Cutaneous Leishmaniasis. Nature Sci. Rep. 4, 4156; DOI:10.1038/srep04156 (2014).
2. Stienstra S. et al. Drug Delivery by Tattooing with a PMU machine to treat Cutaneous Leishmaniasis. Abstr Book 23th World Congress of Dermatology, Vancouver (2015).

Biography

Stef Stienstra works internationally for several medical and biotech companies as scientific advisory board member and is also an active reserve-officer of the Royal Dutch Navy in his rank as Commander (OF4). For the Dutch Armed Forces he is CBRNe specialist with focus on (micro)biological and chemical threats and medical- and environmental functional specialist within the 1st CMI (Civil Military Interaction) Battalion of the Dutch Armed Forces. For Expertise France he is now managing an EU CBRN CoE public health project in West Africa. He is visiting professor for the University of Rome Tor Vergata in Italy for the CBRN Masters Course and lecturer for the NATO School in Oberammergau in Germany and the Joint NATO CBRN-Defense Center of Excellence in Vyskov in the Czech Republic. In his civilian position he is at this moment developing with MT-Derm in Berlin (Germany) a novel interdermal vaccination technology as well as a new therapy for cutaneous leishmaniasis for which he has won a Canadian 'Grand Challenge' grant. With Hemanua in Dublin (Ireland) he has developed an innovative blood separation unit, which is also suitable to produce convalescent plasma for Ebola Virus Disease therapy. He has finished both his studies in Medicine and in Biochemistry in The Netherlands with a doctorate and has extensive practical experience in cell biology, immuno-haematology, infectous diseaases, biodefense and transfusion medicine. His natural business acumen and negotiation competence helps to initiate new successful businesses, often generated from unexpected combinations of technologies.

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