OPEN ACCESS Freely available online

Journal of Antivirals & Antiretrovirals

Short Communication

Measles as a Vector for the Malaria Vaccine Development

Narayana Penta*, Gaurav Gupta, Reinhard Glueck

Vaccine Research and Development Division, Zydus Cadila Healthcare Limited, Ahmedabad, India

ABSTRACT

Classical viral vectors have been successfully used to deliver Malaria, HPV antigens. Emerging viral vector technologies such as Measles virus (MV) are useful for vaccine development. Studies in animal models suggest that each viral vector is unique in its ability to induce humoral and cellular responses. Measles virus is a member of Mononegavirales thus the genomic RNA is not translated either *in vivo* or *in vitro*. MV replicates exclusively in the cytoplasm, ruling out the possibility of integration into host DNA. Live attenuated Measles (MeV) are thus inducing long lived immunity after a single immunization dose. MeV vector allows insertion and stable expression over multiple replications round of various genes from different genome positions, allowing comparable immunity against MeV proteins and vectored antigens. Hence in the present study we identified the novel target for Malaria vaccine development, N-terminal region of Merozite surface protein 1 (MSP-1). The present invention relates to a combined Measles Malaria vaccine containing different attenuated recombinant measles malaria vectors comprising a heterologus nucleic acid encoding several *Plasmodium falciparum* antigens. Preferably it relates to a viral vector that comprise nucleic acids encoding the circumsporozoite (CS) protein of *P. falciparum*, the merozoite surface protein 1 (MSP-1) of *P. falciparum* and its derivatives (P-42) in its glycosylated and secreted forms.

Keywords: *Plasmodium*; Measles; Malaria; Vaccine; Viral vectors

DESCRIPTION

The pace of development and licensure of vaccines accelerated during the 20th century and early part of the 21st, with approximately one novel vaccine licensed per year 1 during the past decade. In general, these new products employed proven vaccine technologies, such as glycoconjugates (meningococcus and pneumococcus vaccines), recombinant or purified proteins (hepatitis B and human papilloma virus vaccines) or replication-competent but empirically attenuated versions of the pathogen (rotavirus vaccine). In some cases, novel vaccines targeted diseases for which vaccines already existed, but where improvements in delivery, potency or safety were needed (e.g. nasally delivered influenza vaccine, acellular pertussis vaccine). In other cases, novel vaccines marked the first success against a particular pathogen (eg. human papilloma virus, *Borrelia burgdorferi*). From this perspective, it would appear that vaccinology has emerged as a mature translational enterprise, characterized by well-developed tool kits and proven development pathways. Contrasting starkly with this claim, however, is the fact that important vaccine targets have resisted the efforts of vaccine developers, including parasites, retroviruses and malignancies [1]. Although the barriers to developing vaccines against these difficult diseases are numerous, a major issue has been that traditional technologies have not worked.

Malaria is a significant cause of morbidity and mortality, affecting billions of people worldwide. It is estimated that malaria is responsible for the annual deaths of more than one million people, mostly children under the age of five [2]. An effective malaria vaccine is urgently needed to control the disease. Major obstacles to developing an effective malaria vaccine include the complex life cycle and antigenic diversity of the parasite. Despite the challenges, encouraging results have been reported recently for RTS,S, a pre-erythrocytic, circumsporozoite protein (CSP)-based vaccine. This leading candidate has demonstrated protection against clinical malaria in malaria-na¨ıve adults in Phase 2a experimental challenge studies [3] and in African children in a Phase 2b field trial [4]. The traditional approach for malaria vaccine development is based on recombinant proteins. However, one of the main challenges for a recombinant protein-based vaccine is that the protein itself is poorly immunogenic. As such, many recombinant protein-based vaccines require the addition of an adjuvant to boost immune responses, especially when a Th1-biased immune response is desired. Most of the experimental malaria vaccines are currently using adjuvants that have yet to be used in licensed vaccines.

Correspondence to: Narayana Penta, Vaccine Research and Development Division, Zydus Cadila Healthcare Limited, Ahmedabad, India, E-mail: vslnaidu@gmail.com

Received: January 15, 2021; **Accepted:** January 29, 2021; **Published:** February 05, 2021

Citation: Penta N, Gupta G, Glueck R (2021) Measles as a Vector for the Malaria Vaccine Development. J Antivir Antiretrovir.13:212.

In addition, many antigenic targets are highly structured and proper conformation seems to be required to generate a functional immune response. This leads to challenges in developing the purification process where refolding and isolation of proper conformers often results in complex manufacturing processes and low yields. Another challenge is the long-term stability of recombinant proteins when they are formulated in adjuvants at ambient temperatures. Viral vectors, on the other hand, appear to be capable of inducing both antibody and T-cell-mediated immunity in the absence of an adjuvant. Furthermore, complex process development may not be required for viral-vectored vaccines, which usually have a consistent purification process, irrespective of the transgene they express. As these vaccines use the eukaryotic cellular machinery to generate the antigenic targets, it may be possible to generate antigens with native conformation. Finally, some of the viral vectors have the capacity to deliver more than one gene. Thus, a single viral vectored construct may contain multiple antigens from the different parasite life stages and would have the potential to induce a broad protective immunity. Significant manufacturing cost savings could also be realized [4]. Viral vectors have been used in vaccine development for decades. Although earlier studies have generated mixed results, recently there have been substantial advances in applying viral vectors towards malaria vaccine development, and such vaccines have progressed to through Phase 2b efficacy testing in African children. Viral-vectored vaccines have shown some efficacy in malaria vaccine trials in humans but not so far in other diseases. At the same time, significant progress has been made in developing new viral-vector technologies, and some of them are being used for the development of HIV vaccines. To facilitate the application of viral vectors for malaria vaccine development, the PATH Malaria Vaccine Initiative (MVI) organized a workshop on "Viral Vectors for Malaria Vaccine Development." The purpose of the workshop was to share experience in vector technologies and in malaria vaccine development, which could be very valuable in designing the next generation of effective viral vectored malaria vaccines.

REFERENCES

1. Richardson JS, Dekker JD, Croyle MA, Kobinger GP. Recent advances in Ebola virus vaccine development. Hum Vaccin. 2010; 6:439-449.
2. Roca-Feltrer A, Carneiro I, Armstrong-Schellenberg JR. Estimates of the burden of malaria morbidity in Africa in children under the age of 5 years. Trop Med Int Health. 2008; 13:771-783.
3. Schwartz L, Brown GV, Genton B, Moorthy VS. A review of malaria vaccine clinical projects based on the WHO rainbow table. Malar J. 2012;11:11.
4. Thompson FM, Porter DW, Okitsu SL, Westerfeld N, Vogel D, Todryk S, et al. Evidence of blood stage efficacy with a virosomal malaria vaccine in a phase IIa clinical trial. PLOSOne. 2008; 3:e1493.