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Vaccination of horses with a recombinant modified vaccinia Ankara virus (MVA) expressing African horse sickness (AHS) virus major capsid protein VP2 provides complete clinical protection against challenge

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ABSTRACT

African horse sickness virus (AHSV) is an arthropod-borne pathogen that infects all species of equidae and causes high mortality in horses. Previously, a recombinant modified vaccinia Ankara (MVA) virus expressing the protein VP2 of AHSV serotype 4 was shown to induce virus neutralising antibodies in horses and protected interferon alpha receptor gene knock-out mice (IFNAR −/−) against virulent AHSV challenge.

This study builds on the previous work, examining the protective efficacy of MVA-VP2 vaccination in the natural host of AHSV infection. A study group of 4 horses was vaccinated twice with a recombinant MVA virus expressing the major capsid protein (VP2) of AHSV serotype 9. Vaccinated animals and a control group of unvaccinated horses were then challenged with a virulent strain of AHSV-9. The vaccinated animals were completely protected against clinical disease and also against viraemia as measured by standard end-point dilution assays. In contrast, all control horses presented viraemia after challenge and succumbed to the infection.

These results demonstrate the potential of recombinant MVA viruses expressing the outer capsid VP2 of AHSV as a protective vaccine against AHSV infection in the field.

1. Introduction

African horse sickness (AHS) is a lethal arboviral disease of equids with mortality rates that can exceed 95% in susceptible populations. The disease is endemic to sub-Saharan Africa but sporadically escapes from this geographical area and extends to the North of Africa, the Middle East, the Arabian Peninsula, India and Pakistan. In the past, the disease has also spread to Europe, specifically to Spain in 1969 and Spain and Portugal in 1987 [1,2]. The latest outbreak in Western Mediterranean countries lasted 5 years [3,4].

To date no effective treatment exists for AHS and consequently control of the disease relies on preventive vaccination. AHS vaccines, based on attenuated AHS viruses, have been in use in South Africa for almost 100 years and permitted the subsistence of horses in that part of the world. There are nine different serotypes of AHS virus (AHSV) and protective immunity is long-lived against homologous serotypes. Thus, vaccination in endemic countries is normally performed by administration of combinations of representative attenuated strains of each of the virus serotypes. Serotypes 5 and 9 are normally excluded from vaccine formulations. Serotype 5 is difficult to attenuate and partially cross-reacts with serotype 8; and serotype 9 does not normally occur in South Africa (the main AHSV vaccine manufacturing country) and partially cross-reacts with serotype 6 [3,5,6].

Despite their apparent efficacy, live AHSV vaccines have a number of disadvantages [4]. These include: (a) the risk of reversion to virulence; (b) the risk of gene segment re-assortment between field and vaccine strains; (c) the risk of introducing foreign topotypes into a new geographical region, since vaccines are based on South

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