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Characterization of homologous and heterologous adaptive immune responses in porcine reproductive and respiratory syndrome virus infection

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Abstract

The present study characterized the homologous and heterologous immune response in type-I porcine reproductive and respiratory syndrome virus (PRRSV) infection. Two experiments were conducted: in experiment 1, eight pigs were inoculated with PRRSV strain 3262 and 84 days post-inoculation (dpi) they were challenged with either strain 3262 or strain 3267 and followed for the next 14 days (98 dpi). In experiment 2, eight pigs were inoculated with strain 3267 and challenged at 84 dpi as above. Clinical course, viremia, humoral response (neutralizing and non-neutralizing antibodies, NA) and virus-specific IFN-γ responses (ELISPOT) were evaluated all throughout the study. Serum levels of IL-1, IL-6, IL-8, TNF-α and TGF-β were determined (ELISA) after the second challenge. In experiment 1 primo-inoculation with strain 3262 induced viremia of ≤ 28 days, low titres of homologous NA but strong IFN-γ responses. In contrast, strain 3267 induced longer viremias (up to 56 days), higher NA titres (≤ 6 $\log_2$) and lower IFN-γ responses. Inoculation with 3267 produced higher serum IL-8 levels. After the re-challenge at 84 dpi, pigs in experiment 1 developed mostly a one week viremia regardless of the strain used. In experiment 2, neither the homologous nor the heterologous challenge resulted in detectable viremia although PRRSV was present in tonsils of some animals. Homologous re-inoculation with 3267 produced elevated TGF-β levels in serum for 7–14 days but this did not occur with the heterologous re-inoculation. In conclusion, inoculation with different PRRSV strains result in different virological and immunological outcomes and in different degrees of homologous and heterologous protection.

Introduction

One of the main obstacles for the development of new vaccines of greater efficacy against porcine reproductive and respiratory syndrome virus (PRRSV) is the limited understanding of the mechanisms involved in protection [1-4]. Up to now, most studies have focused in the development of neutralizing antibodies (NA) and to virus-specific interferon-γ secreting cells (IFN-γ-SC) as the main correlates of protection [5–10] although the precise role of these elements is not well understood. Cross neutralization experiments have shown that cross reactivity between different PRRSV strains can be low and even some PRRSV strains seem not to induce a neutralizing response at all [11,12]. Moreover, little is known about cell mediated responses in heterologous challenge models [8,10]. As a result, at present it is very difficult –or impossible- to predict the panel of strains or the characteristics of PRRSV isolates against which one pig is effectively protected after immunization. As a matter of fact, the common assumption is that immunity against a homologous strain is sterilizing –or almost complete- while immunity against other strains will depend, generically, on the degree of genetic/antigenic similarity between the immunizing and the infecting strains [1,13].

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