Animal models for intestinal Echinococcus infections and for Alveolar Echinococcosis (AE) in aberrant hosts

Summary / Zusammenfassung

To provide comparative data on the reproduction of E. multilocularis in different definitive hosts, foxes, raccoon dogs, dogs and cats were experimentally infected. Worms were recovered from all foxes and racoon dogs, and from most of the dogs. The highest worm burdens in foxes were found at 35 dpi. These declined to low levels by day 63. In dogs, there was no significant difference between worm burdens recovered at days 35 and day 90, respectively. Egg excretion dynamics suggested that the mean biotic potential per infected animal was high in foxes, racoon dogs and dogs. Therefore, it is concluded that these species are good hosts of E. multilocularis with subtle differences in the biotic potential and egg excretion during the patent period. In contrast, few worms established in cats, and the few eggs that were excreted had a low infectivity (Kapel et al., 2006; Thompson et al., 2006; Al-Sabi et al., 2007). This strongly indicates that cats play an insignificant role in parasite transmission. The established animal model for the isolation of intestinal E. multilocularis stages resulted in the successful collaboration with the Sanger Institute, Cambridge UK, establishing the genome of E. multilocularis and other zoonotic cestodes (see Tsai et al., 2013, published in Nature).

Extended studies in murine models for metacestode infections have provided important information on immunological mechanisms viability model. However, due to the rapid parasite development in these hosts compared to human patients, they might not be the most appropriate model for the study of clinical and immunological aspects of human alveolar echinococcosis (AE). Therefore, there is a need for alternative models, and other models are being investigated. Experimental AE in pigs was studied in order to evaluate the potential use of this animal model for human AE. We succeeded in demonstrating two types of development of E. multilocularis larval stages in pigs. Animals with predominantly small lesions had pronounced antibody reactions (“high responders”) whereas animals with larger, sharply demarcated ovoid nodules were associated with reduced humoral reactions (“low responders”). In both types of lesions, viability of the parasite could not be demonstrated, and histological examinations revealed fractured laminated layers and the absence of germinative cells in the lesions, implying that the parasites were dead. In conclusion, this preliminary study suggests that the pig could provide a new clinical model for imaging techniques, surgical interventions and chemotherapy of human AE (Deplazes et al., 2005).

Highly progressive and lethal metacestode infections have been recorded in dogs and several monkey species. Therefore, clinical and serological studies of 25 dogs with naturally acquired hepatic AE were initiated (Staebler et al., 2007; Scharf et al., 2004). Experimental metacestode infections of dogs with intraperitoneal or intrahepatic injections of metacestodes were not successful.

A new project is investigating a rat model for the establishment of E. multilocularis egg infections and AE in an animal host with low susceptibility revealed promising results, this project will be further developed.

In 2011 a new EU-Project "Paravac" was initiated aiming to investigate intestinal protective immunological mechanism against Echinococcus granulosus, in collaboration with the Institute of Virology of the Vetsuisse Faculty with the project title: Vaccines against helminth parasites of livestock of economic and/or public health significance.

Publications / Publikationen

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