BIOCHEMICAL EVALUATION OF MICE, EXPERIMENTALLY INFECTED WITH ECHINOCOCCUS GRANULOSUS METACESTODES

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ABSTRACT: BALB/c mice were infected intraperitoneally with protoscoleces of Echinococcus granulosus. After 15 months of infection, several biochemical parameters in the serum of the mice were compared with those of age-matched controls. Measurements of serum glutamate-oxaloacetate transaminase, glutamate-pyruvate transaminase, alkaline phosphatase, α-amylase, lactate dehydrogenase, creatine kinase, and separated serum proteins, suggested that the infection with hydatid cysts was associated with muscular and possibly hepatic damage.

KEY WORDS: Echinococcus granulosus, hydatidosis, transaminase, lactate dehydrogenase, creatine kinase, amylase, serum globulins.

INTRODUCTION

Hydatidosis is a zoonosis caused world-wide by the larva of the cestode Echinococcus granulosus. The unicellular metacestode, or hydatid cyst, parasitizes many mammals, including horses, sheep, cattle and man, in various anatomical sites, such as lungs, liver, heart, and brains. In man, the pressure of isolated cysts growing in organs usually causes the first clinical signs. Depending on the location of the cysts, these complaints are expressed as pains or heaviness in abdomen and liver, cough, fatigue or anaemia, and are often accompanied by hepatomegaly (BARROS, 1978; TODOROV et al., 1991). Hydatidosis can also result in acute complications such as anaphylactoid responses as a consequence of cyst rupture. Many laboratory studies on the biology and chemotherapy of larval echinococcosis make use of the experimental infection of E. granulosus in mice, e.g. PENNOIT-DE COOMAN & DE RYCKE (1970) and ECKERT (1986). However, from a clinical point of view, data on biochemical analyses of serum of infected mice are virtually absent in the literature. In the present paper, laboratory mice suffering a 15-month infection of hydatidosis were compared with age-matched controls. The extent of the disease was estimated by comparing values of certain serum enzymes and other biochemical parameters.

MATERIAL AND METHODS

Female Balb/c (H-2b) mice were obtained from the Servicio de Animales de Laboratorio of the University of Granada. At six weeks of age, one group of mice was injected intraperitoneally with 2000 protoscoleces (from hydatid cysts obtained from sheep), while an uninfected group served as age-matched controls. The animals were quarantined for 15 months after infection, when 7 infected and 5 control mice were bled. Approximately 500 µl of blood was collected and clotted for a biochemical serum analysis. The total protein content was determined using the Boehringer Mannheim HiCo Total Protein test. A HITE SYSTEM 300 (Olympus) was used to separate the proteins on cellulose-acetate strips, to stain them with red Ponceau and to quantify them by transmission densitometry. Serum glutamate-oxaloacetate transaminase (GOT), glutamate-pyruvate transaminase (GPT), alkaline phosphatase (AP), α-amylase, and creatine kinase (CK) were measured on a COBAS MIRA S auto-analyser (Roche), and lactate dehydrogenase (LDH) and total serum proteins on a HITACHI 717 auto-analysers. Data are expressed as the mean ± s.e.m. and the significance of differences between infected and control mice was determined by the Student’s t-test.

RESULTS

The number of cysts collected from the BALB/c mice after 15 months of infection ranged from 2 to more than 50 per mouse, and sizes varied from less than 1.5 mm to 25 mm. All mice had cysts occurring freely in the peritoneal cavity, and most also had cysts embedded in liver tissue. Three out of seven mice displayed splenomegaly, the expression of which was not to be correlated with the parasitic burden or with other biochemical features of the infected mice. An analysis of a series of serological parameters showed that infected mice had significantly higher values for CK, GPT, AP and total serum proteins, whereas levels of LDH, serum amylase and GOT did not differ from those of control (Table 1). The higher total serum-protein contents were due to a greater amount of gamma-globulins, as was revealed by a quantitative analysis of the serum proteins by cellulose-acetate electrophoresis (Table 2). In the infected mice, no relationship was found between the parasitic burden and the values of serum proteins and serum enzyme activities.
The hydatid cyst produced by *E. granulosus* is a slow-growing lesion which is usually asymptomatic until it mechanically causes dysfunction in adjacent organs. Biochemical data on infected intermediate animal hosts are few and mainly restricted to sheep, where the parasite disrupts normal liver functions (reviewed in ARME, 1978). Our results for serum-enzyme activities in mice suffering hydatidosis (Table 1) showed normal values for serum amylase (suggesting that there was no effect on pancreatic functions) and higher values for GPT and GOT (although the latter lacked statistical significance), which could confirm liver damage. Serum-AP (another indicator of liver disease) was also raised in infected animals. Comparing it with other parasites, however, offers no evidence of an active penetration by the hydatid cysts. It should be remembered that our experimental model involves intraperitoneal infection of mice with protoscoleces, and as such, could not be expected to have effects identical to those of natural infections with *Echinococcus* eggs. Likewise, the results appear to confirm those obtained in an *in vitro* model of larval echinococcosis, where the invasion of the parasite into host tissue leads to a «co-habitation» of host and parasite tissue, instead of an «infection» (JANSSSEN, DE RYCKE & DE RIDDER, 1990). Together with the fact that AP, GOT and GPT are not the only parameters of liver disease, the raised serum CK activity and the generally higher serum-LDH activity could point to an additional source of cell damage. Hydatid cysts in the peritoneal cavity exerting pressure against the abdominal muscle, for instance, could also cause such cell damage. The hypothesis that liver functions are not seriously affected may be confirmed by the concentrations of albumin, α1-, α2-, and β-globulins (all liver-derived serum proteins), which were similar in infected and control mice (Table 2). Only the gamma-globulin concentrations were significantly higher in mice with hydatidosis, a fact also observed by MATOSSIAN et al. (1976), who found a significant increase in serum IgG in all humans with hydatidosis, and significant IgA and IgM in patients with pulmonary hydatidosis.

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**REFERENCES**


Pathology of hydatidosis in mice


