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GROWTH AND DEVELOPMENT OF *ECHINOCOCCUS MULTILOCULARIS* IN EXPERIMENTALLY INFECTED CATS

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Cats which were experimentally infected with the Alaskan strain of *Echinococcus multilocularis* showed a sudden decrease in the recovery rate after day 10 postinfection. The growth rate of the cestode in the intestine of cat is very much retarded as is evidenced by the slow increase in the length as well as the late formation of the posterior proglottid as compared to those recovered from dogs which were similarly infected to serve as controls. The ability of *E. multilocularis* to develop normally to maturity in the definitive host even after about three decades of passage in rodents in the form of secondary echinococcosis was also observed.

Key words: *E. multilocularis*, experimental infection, development, cats, dogs

INTRODUCTION

Until the report by AMBO et al. (1954) on the spontaneous occurrence of the adult cestode of *Echinococcus multilocularis* in a domestic cat in Rebun Island, north-west of Hokkaido, Japan, *E. multilocularis* infection in cats was either unknown or not investigated. However, since then, natural infection of *E. multilocularis* in cats was reported in Saskatoon, Canada (WOBESER, 1972), North Dakota, U. S. A. (LEIBY & KRITSKY, 1972), Baden-Württemburg, W. Germany (ECKERT et al., 1974), Amman, Jordan (MORSY et al., 1980), Saubian Alb, W. Germany (ZEYHLE, 1982) and Nemuro, Japan (YAGI et al., 1984).

LEIBY and KRITSKY (1972) stressed that the domestic cat may be a source of *E. multilocularis* infections in humans. Despite this emphasis, the actual role played by cats in the epidemiology of *E. multilocularis* remains to be clarified because of the limited studies on the growth and development of the cestode in the feline host.

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MATERIALS AND METHODS

Seven helminth-free cats, 5–7 months old, were each orally inoculated with 70,000 protoscolices of the Alaskan strain of *E. multilocularis* which had been maintained by intraperitoneal passage of larval tissue or protoscolices in rodents since 1955. Either one or two cats were necropsied on days 7, 10, 15, 25 and 30 postinoculation (PI). Recovery and growth rates of the cestode in the digestive tract were examined. The recovered worms were fixed in 10% formalin and stained with acetocarmine for microscopic observation.

As control, seven dogs were also simultaneously infected and the procedure was carried out as described for the cats.

RESULTS

The recovery rate of *E. multilocularis* from the intestinal tracts of the infected animals is shown in Fig. 1. On day 7 PI, the recovery rate of the worms from both

FIGURE 1 *Recovery rate of Echinococcus multilocularis in dogs* (□——□) *and cats* (●------●)

the dog and the cat examined was around 5% of the infective dose, but on day 10 PI, there was a sudden decrease in the recovery rate from the cat, and the percentage recovered was 0.12. Furthermore, the percentages of worms recovered from the cats on day 15 PI were 0 and 0.17; on days 25 and 30 were 0.09 and 0 respectively.

On the contrary, the recovery rate from the dogs was around 5% of the infective dose throughout the duration of the experiment. The majority of the worms were recovered from the lower part of the small intestines in both dogs and cats. No worm was recovered from the stomachs of the infected animals.

The growth in length of *E. multilocularis* in the intestines of cats and dogs is shown in Fig. 2. The growth rate as well as the development of the worms in the dogs were significantly faster than in the cats as evidenced by the majority of the worms having 2–3 proglottids in the former and only 1 proglottid in the latter on day 25 PI (Table 1).

FIGURE 2 *Development of Echinococcus multilocularis in dogs (■) and cats (□)*

TABLE 1 *Development of Echinococcus multilocularis in dogs and cats*

DAYS AFTER INFECTION	HOST	PERCENTAGE OF WORMS AT DIFFERENT STAGES OF SEGMENTATION					
		S	S+B	S+B+1#	S+2	S+B+2	S+3
7	cat	78	22				
	(dog)	(72)	(28)				
15	cat	56	31	13			
	(dog)	(3)	(24)	(58)	(15)		
25	cat			63	37		
	(dog)				(10)	(58)	(32)
30	(dog)						(100)

S : Scolex and neck
B : Band
: Integer refers to the number of segments

DISCUSSION

Experimental infection of *E. multilocularis* in cats had been reported by VOGEL (1957), RAUSCH and RICHARDS (1971), EASTMAN and WORLEY (1979), ANDERSEN et al. (1981), CRELLIN et al. (1981), ZEYHLE and BOSCH (1982), and THOMPSON and ECKERT (1983). However, the emphases of all these reports were on the susceptibiltiy rather than the growth or devlopment of *E. multilocularis* in cats. Our results concurred with these reports that the cat was an unsuitable host for *E. multilocularis* because of poor recovery rate. In the present study, we also showed that the growth of *E. multilocularis* in the cat intestines was retarded and slow as compared to in their natural definitive host, the dog. However, it is well known that *E. multilocularis* can develop to the stage having ovigerous strobilae in the cat.

Laboratory maintenance of *E. multilocularis* in rodents by vegetative transfer of larval tissue is the standard procedure used in many laboratories nowadays. The ecchinococcal materials used in the present study had been maintained in our laboratory since 1955. We showed that after nearly three decades of passage in the form of secondary ecchinococcosis, the protoscolices were still normal, and could mature in the intestine of the definitive host. In fact, gravid proglottids were observed in the cestodes recovered from the dog on day 30 PI.

The finding of spontaneous infection of *E. multilocularis* in cats in Hokkaido (AMBO et al., 1954 ; YAGI et al., 1984) indicates that this host can not be disregarded in an epidemiological survey of the parasite. Since we used the Alaskan strain of *E. multilocularis* in the present study, it is difficult to extrapolate our results to the

present situation in Hokkaido, which is an endemic area for this cestode. In order to elucidate role of cats in the epidemiology of *E. multilocularis* in the local situation here in Hokkaido, experimental infection on the susceptibility of cats to the Hokkaido strain of *E. multilocularis* is now in progress in our department.

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