[Jpn. J. Parasitol., Vol. 40, No. 1, 102–104, February 1991]

Research Note

Development of *Paragonimus miyazakii* in Guinea Pig as an Alternative to the Human Infection

HIDEKAZU HATA, MUNEO YOKOGAWA AND SOMEI KOJIMA[1)]

(Accepted for publication; February 19, 1991)

Key words: *Paragonimus miyazakii,* unsuitable host, guinea pig

It is known that *Paragonimus miyazakii* inhabits the lung of natural host such as vessels, martens, dogs, cats, wild boars and badgers as well as of experimental hosts such as rats, rabbits and monkeys. In humans, the lung fluke is mainly found in the pleural cavity but not in the lung cysts, and the eggs were found only rarely (Yokogawa *et al.*, 1974; Kobayashi *et al.*, 1957). It has been suggested that human is not so suitable host of this parasite (Yokogawa *et al.*, 1974). However, only a few investigations have been made concerning the experimental infection of *P. miyazakii* to the unsuitable host. The present study was designed to examine the development of *P. miyazakii* in guinea pigs suspected as an unsuitable host. The worms from rats known as a suitable host or from guinea pigs were transplanted into guinea pigs or rats.

Female Hartley guinea pigs (250–300g) and female outbred Wistar rats (150–200g) were used in all experiments of *P. miyazakii. P. miyazakii* metacercariae obtained from fresh water crabs *Geothelphusa dehaani,* captured in Kawane, Shizuoka prefecture, Japan, were orally given to the animals with a capillary pipette. Transplantation of the worms was performed by killing the donor animals at various times post infection (PT), followed by washing their abdominal and pleural cavities with Hanks' BSS. The washings were pooled in a Petri dish and worms were collected under a dissecting microscope. Bleeding spots in the abdominal wall and pleural wall, the liver and lungs were examined and worms were collected from these spots. After several washings with NCTC 109 containing 100 μg/ml of streptomycin and 200 units/ml of penicillin, the worms were transplanted with a needle (3mm in inner diameter for larvae, 5mm in inner diameter for adult worms) into the abdominal cavity of recipient animals (guinea pigs or rats).

Inoculated worms were recovered from the animals by Evans-blue technique (Yokogawa *et al.*, 1979) and by the method of Habe (1978) of various intervals.

When metacercariae were orally given to guinea pigs, the majority of worms were recovered from the pleural cavity and deep muscles (muscles of extremities as well as lumbar and paravertebral muscles) even at 12 weeks PI (Table 1). However, a typical worm cyst was hardly found in the lungs of guinea pigs. Only a part of the worms found in the worm cyst or pleural cavity developed to maturity, but most of them did not develop to maturity. Yoshida (1970) also reported that, in guinea pigs inoculated with *P. miyazakii* metacercariae, immature worms might be found from the pleural cavity even on day 123 PI. On the other

Department of Parasitology, Chiba University School of Medicine, Chiba City 280, Japan

1) Present address: Department of Parasitology, Institute of Medical Science, The University of Tokyo, Tokyo 108, Japan

畑 英一　横川宗雄　小島荘明（千葉大学医学部寄生虫学教室）

Table 1. Location and average number of worms recovered from guinea pigs and rats at various intervals after oral administration of 10 metacercariae of *P. miyazakii*

Animals	Weeks after infection	No. of animals used	Average no. of worms recovered from				Average no. of worms recovered (%)
			AC	DM	PC	Lung cyst	
Guinea pig	8	3		1.0	4.0		5.0 (50)
	11	3		1.3	2.3	0.7	4.3 (43)
	12	3	0.3	1.7	2.7	0.7	5.4 (54)
Rat	8	3	0.3	1.0	0.3	4.4	6.0 (60)

AC: abdominal cavity, DM: deep muscles, PC: pleural cavity.

hand, when metacercariae were administered to rats, almost all the worms were found in worm cysts in the lungs. These worms already showed the sexual maturation even at 8 weeks PI.

As shown in Table 2, when the larval (2 and 5 weeks PI) or adult worms (8 weeks PI) recovered from the permissive host (rat) were transplanted into the abdominal cavity of guinea pigs, most of the worms migrated into the pleural cavity and the deep muscles, but they seldom formed worm cysts in the lung. When adult worms were transplanted into guinea pigs, recovered worms from the recipients showed degeneration of their reproductive organs. In

Table 2. Transfer of larval *P. miyazakii* removed from donor animals into the abdominal cavity of recipient animals

Donor			Recipient						
Animals	Autopsied at (week)	Recovered from	Animals	No. of animals used	Weeks after transfer	Average no. of worms recovered from			Average no. of worms recovered (%)
						AC	PC	Lung cyst	
Rat	2	AC, Liver	Guinea pig	4	10–12		2.8	0.5	3.3 (66)
	5	AC, PC, Liver		3	10		3.0		3.0 (60)
	8	Lung cyst		5	4	0.2	1.8	0.4	2.4 (48)
Guinea pig	5	AC, AW	Rat	2	7			5.0	5.0 (100)
	11	PC, DM		3	4	1.0	0.3	3.7	5.0 (100)
Rat	2	AW, AC, Liver	Rat	2	6			4.5	4.5 (90)
	5	AC, PC, Liver		2	8		0.5	4.0	4.5 (90)
	8	Lung cyst		4	4		0.5	2.5	3.0 (60)

Five worms were transferred to each recipient.
AC: abdominal cavity, AW: abdominal wall, PC: pleural cavity, DM: deep muscles.

contrast, when larvae recovered from guinea pigs at 5 and 11 weeks PI were transplanted into rats, respectively, most of the worms penetrated into the lung, formed worm cysts and developed to fully mature worms. Furthermore, when the larval (2 and 5 weeks PI) and adult *P. miyazakii* (8 weeks PI) from rats were transplanted into rats, the majority of the worms easily migrated into the lung, formed worm cysts, and in the case of larvae, they developed to fully mature worms. Hamajima and Habe (1971, 1972) reported that, when the larvae of *P. westermani* developed to a certain degree (15 days) in dogs were transplanted into rats, these worms could develop to maturity in rats suspected as an unsuitable host. In the present study, though various developmental stages, from early to late, of *P. miyazakii* from rats were transplanted to guinea pigs, the ratios of worm cyst formation and maturation of the worms did not increase. The maturation and worm cyst formation of *P. miyazakii* in guinea pigs were always suppressed. However, if these worms were transplanted to the suitable host (rat), they continued to develop normally. Thus, the suppression was found to be transient for the development of *P. miyazakii.*

Though it is known that the pleural effusion is one of typical symptoms of human paragonimiasis miyazakii, there has been very few report on such a symptom in experimental animals. In the present study, however, pleural effusion and adhesion between the lung and pleural wall were found in most of guinea pigs when they harboured worms in the pleural cavity. This is quite similar to human infections in that most of the worms inhabit the pleural cavity (Yokogawa *et al.*, 1974). Thus guinea pigs may be used as an animal model for research in human paragonimiasis miyazakii.

References

1) Kobayashi, A., Suzuki, S., Horiuchi, K., Yokogawa, M. and Araki, K. (1975): Four human cases of paragonimiasis miyazakii. Jikeikai Med. J., 22, 127–135.
2) Habe, S. (1978): Experimental studies on the mode of infection with the lung-fluke, *Paragonimus westermani* (Kerbert, 1878). Jpn. J. Parasitol., 27, 261–292.
3) Hamajima, F. and Habe, S. (1971): Experimental transplantation of the immature worms of *Paragonimus westermani* from dogs into the peritoneal cavities of rats. Jpn. J. Parasitol., 20, 263–264.
4) Hamajima, F. and Habe, S. (1972): Experimental transplantation of the immature worms of *Paragonimus westermani* from dogs into the peritoneal cavities of rats (2). Jpn. J. Parasitol., 21 (Supple), 90.
5) Yokogawa, M., Araki, K., Saito, K., Momose, T., Kimura, M., Suzuki, S. and Chiba, N. (1974): *Paragonimus miyazakii* infections in man first found in Kanto district, Japan – especially, on the methods of immunosero-diagnosis for paragonimiasis –. Jpn. J. Parasitol., 23, 167–179.
6) Yokogawa, M., Cabrera, B.D., Kobayashi, M., Hata, H., Tazaki, T. and Araki, K. (1979): Comparative studies on Philippine *Paragonimus westermani* and Japanese *Paragonimus westermani.* Acta Med. Philippina., 15, 119–131.
7) Yoshida, T. (1970): Studies on experimental infection with *Paragonimus miyazakii* to small laboratory animals. Jpn. J. Parasitol., 19, 76–91.