

The First Demonstration of the Lung Fluke, *Paragonimus* from Man in Peru

ICHIRO MIYAZAKI*

Department of Parasitology, Faculty of Medicine, Kyushu University
Fukuoka, Japan

R. CELSO ARELLANO Z.

Hospital Centro de Salud, Hipólito Unanue, Lima, Perú

OSCAR GRADOS B.

Instituto de Salud Publica, Institutos Nacionales de Salud, Lima, Perú

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Introduction

About the beginning of this century, some cases of human paragonimiasis were reported in Peru by Barton (1910), Arce (1915) and Corvetto (1921), and the causative agent of the disease was presumed to be *Paragonimus westermani* (Kerbert, 1878), which had been imported by immigrants from Asia. But, little medical attention had been paid to the disease until recent years, when Grados *et al.* (1962), Morales (1963) and Miranda *et al.* (1967) reported human cases of the disease in the northern part of Peru. Subsequently, Ibáñez and Miranda (1967, 68) first found adult lung flukes different from *P. westermani* in a domestic cat and then in an opossum, *Didelphis azarae pernigra* from Department of Cajamarca, Peru, where human paragonimiasis is known to be present. Miyazaki, Ibáñez and Miranda (1969) proposed a new specific name, *Paragonimus peruvianus* for the adult lung flukes found in the above-mentioned cat, and in 1971 the same authors described the metacercaria of the new lung fluke in detail, which were collected from a crab, *Pseudothelphusa chilensis* in Cajamarca. Most recently, Miyazaki recognized *P. caliensis* Little, 1968 among adult

specimens, which were obtained by Grados *et al.* (1972) from an experimental dog infected with metacercariae collected from the same crab in the same locality (unpublished). In addition, Urteaga, Ibáñez and Miranda (1968), Grados, Rivera and Miranda (1971), and Grados *et al.* (1972) reported especially on histopathology and treatment of the disease. From epidemiological point of view and from the characteristics of eggs in the sputum of patients, it is most probable that the disease is caused chiefly by *P. peruvianus* and occasionally by *P. caliensis* in the area stated above. But, the lung fluke itself of any kind has never been demonstrated from man in Peru.

In 1970, Arellano, one of the authors surgically obtained two adult lung flukes from the right lung of a Peruvian male who had been treated for pulmonary tuberculosis for several years. Both worms were sent to Miyazaki for identification, but he had hesitation in identifying them immediately, because they were too few in number and partly abnormal in morphology. In the present paper the authors wish to show the valuable worms in detail, which were obtained from human body for the first time in Peru.

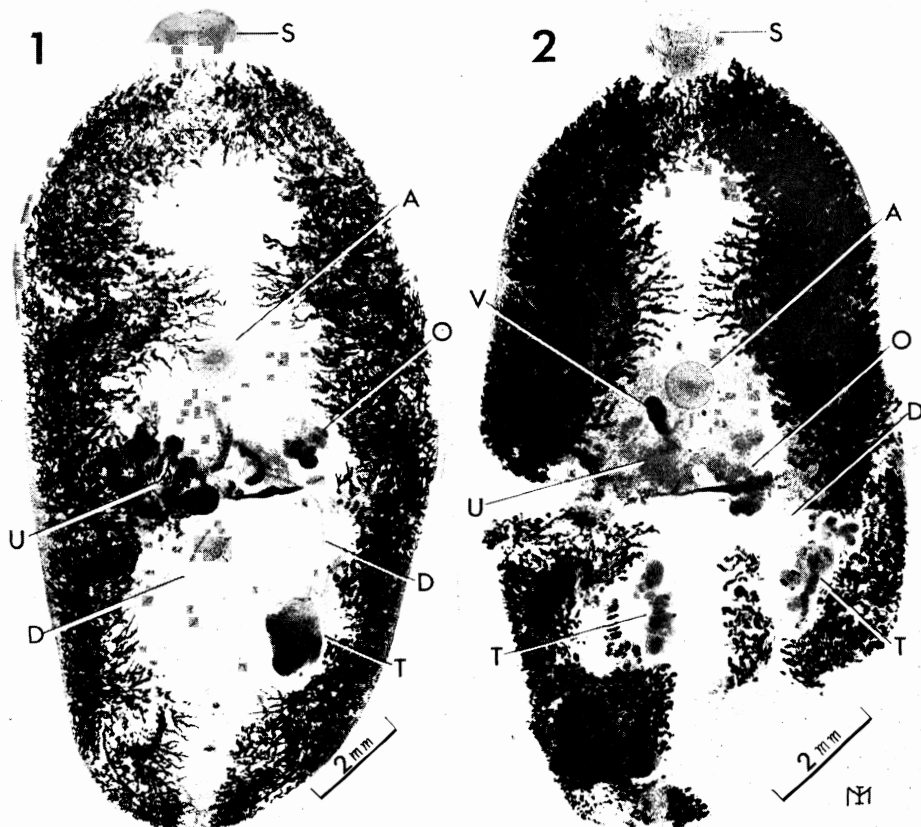
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Materials and Methods

The patient who harbored the present lung flukes was a 36-year-old Peruvian male peasant. He was born at Cañete, Department of Lima, and has never been outside Peru. In early 1965, while he was hunting, he ate raw crabs in the jungle of Aguaytia, Department of Loreto, and in July 1965 he began to have weakness, slight fever, cough, and pain in the lower part of the thorax. In July 1966 he began to expectorate the sputum, which became bloody in the middle of 1967. In every hospital he visited, he was treated for pulmonary tuberculosis, but he had never felt better until July 1970, when he was finally diagnosed as

paragonimiasis. The patient was treated with bithionol in the hospital "Hipólito Unanue" in Lima, but *Paragonimus* eggs never became negative in his sputum. Accordingly, a part of lung tissue involving a worm cyst was surgically removed from the inferior lobe of his right lung. After the operation the patient has rapidly recovered from his long illness.

The cyst harbored two adult lung flukes, one of which was damaged during the operation. The worms were fixed with 70% alcohol under pressure, and the unbroken worm(A) was sent to Miyazaki, which was then stained with carmine and mounted in balsam. The other worm(B) was likewise



Figs. 1 and 2. Adults of *Paragonimus* sp. from man in Peru. 1. Worm A, dorsal view. 2. Worm B, ventral view. A: ventral sucker, D: vas deferens, O: ovary, S: oral sucker, T: testis, U: uterus, V: seminal vesicle.

made up to a mounted specimen in Peru, and was later sent to Japan. But the latter specimen was broken in transit; therefore, it was remounted by Miyazaki after small parts of cuticles and vitelline glands were removed to show the ovary and testes clearly. The sputum of the patient before treatment with bithionol was sent to Japan in 10% formalin.

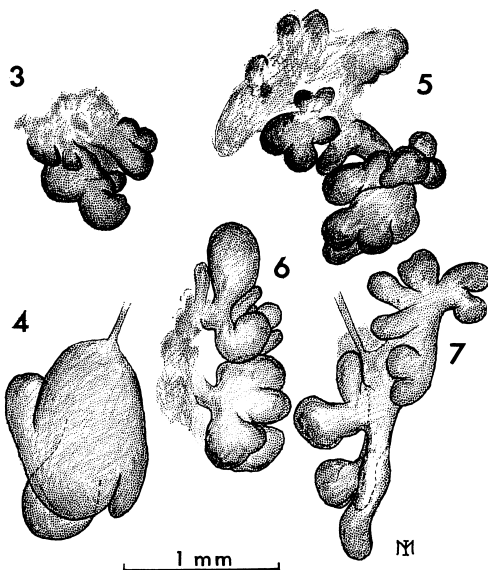
Description

Measurements in millimeters unless otherwise noted. *Worm A* (figs. 1, 3, 4): Body slightly damaged on the tip and right side, measuring 15.9 long by 7.8 wide. Oral sucker 1.55 wide by 0.94 long; ventral sucker 1.02 wide by 0.97 long. Ovary (fig. 3) situated in right side and partly obscure in contour, measuring about 1.1 by 0.9 in size, which contains minute particles only with no egg cells. Uterus filled with debris and a number of eggs which are highly variable in size and shape. Vitelline ducts filled with degenerate vitelline cells. Right testis (fig. 4)

compact in shape and 1.5 by 1.2 in size, containing minute particles without sperm; left testis invisible. Both seminal vesicle and vas deferens contain minute particles but no sperms. Cuticular spines lost in every part of body except in a small area on dorso-anterior part, where some spines are single and some are splitted into two or three. *Worm B* (figs. 2, 5-7): Body broken in posterior half, measuring 13.8 long by 7.2 wide. Oral sucker 1.12 wide by 0.82 long; ventral sucker 0.82 wide by 0.80 long. Ovary (fig. 5) situated in left side measures about 1.7 by 1.4, contour of anterior part being indistinct. Uterus contains some debris without eggs. Right testis (fig. 6) approximately 1.6 by 1.0 and left one (fig. 7) 2.0 by 0.8, both showing some branching. Sperms, egg cells and vitelline cells invisible in reproductive organs, just the same as worm A. Cuticular spines entirely lost from the body. Twenty eggs in formalin-preserved sputum of the patient measure 73 to 92 by 47 to 53 μ , averaging 84 by 50. Egg-shell thin and irregularly undulated.

Discussion

Though the present worms show a little morphological difference in their testes, they are most probably the same species, because they lived together in a single worm-cyst of the lung. Degenerative changes in the male and female reproductive organs were apparently due to bithionol. The similar degeneration of lung flukes by the same remedy had already been reported by Yokogawa *et al.* (1961) in animal experiments with *P. westermanni* and *P. ohirai* Miyazaki, 1939. Although the present worms are not entirely normal in morphology of the ovary and testes, they were compared with some related species of *Paragonimus*. In Peru, only a single species, *P. peruvianus* is known at present, and *P. caliensis*, which was originally found in Colombia, has recently been recognized by Miyazaki in the northern part of the country (unpublished). Worm A of the present material is a little similar to *P.*



Figs. 3-7. Details of ovaries (3, 5) and testes (4, 6, 7) under the same magnification. 3 & 4: Worm A, dorsal view. 5-7: Worm B, ventral view.

caliensis in the character of ovary and testis as well as in the arrangement of cuticular spines. But, the ratio of oral and ventral suckers is different between them; i.e. in worm A the oral sucker is apparently larger than the ventral, while in *P. caliensis* both suckers are almost the same size. Uterine eggs are too variable in size and shape to be compared with those of other species, but the eggs in the sputum of the patient are very similar to those of *P. peruvianus* and *P. caliensis*. Worm A is also similar to *P. harinasutai* Miyazaki et Vajrasthira, 1968 in the character of the ovary, testis and cuticular spines, but this species found in Thailand has slightly larger ventral sucker than the oral and its egg-shell is not undulated but frequently thickened at the non-operculated end. The testes of worm B are somewhat similar to those of *P. peruvianus* in their branching, but they are much smaller than those of the latter as compared with respective body size. Worm B is also close to *P. mexicanus* Miyazaki et Ishii, 1968 in the ratio of two suckers and branching of testes, which was found in Mexico and is probably occurring in other Central American countries. But they differ from each other in size of the testes and branching of the ovary. As compared with *P. kellicotti* Ward, 1908, the North American species, the present worms are quite different in the ratio of two suckers and character of eggs.

Ultimately, it seems that the present worms are an undescribed species, and this probability is increased by the fact that the authors found in 1971 an undescribed metacercaria in Tingo Maria located about 60 kilometers from Aguaytia, where the patient is suspected to have been infected with the present worms (unpublished). Anyhow, these valuable worms obtained from the human lung should be definitely identified after more materials of both adults and metacercariae are available from the above-mentioned region.

Summary

Two adult lung flukes, *Paragonimus* sp. were demonstrated from man for the first time in Peru. They were surgically obtained from the right lung of a 36-year-old Peruvian male, who was suspected to have been infected in the district of Aguaytia, Department of Loreto. The worms showed degenerative changes especially in reproductive organs, which were due to bithionol administered before the operation. They were described and compared with related species of *Paragonimus*, but agreed with none of them in morphology, suggesting that they might belong to an undescribed species. However, the definite identification of the present worms was postponed until more materials are available in the future.

Acknowledgement

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ペルーで人から初めてえられた肺吸虫 [特別掲載]

宮崎 一郎

(九州大学医学部寄生虫学教室内)

R. Celso Arellano Z.

(ペルー, リマ, Hipólito Unanue 病院)

Oscar Grados B.

(ペルー, リマ, 公衆衛生研究所)

この国では、今世紀初頭から、人の肺吸虫症が知られていたが、ほとんど問題にされなかつた。10年位前、ペルー北部カハマルカ州に流行地がみつき、急に関心がたかまつてきたが、1967年には、ペルーで初めて肺吸虫成虫が流行地のネコからえられ、ついでフクロネズミからもとりだされた。これらは従来病原虫と考えられてきたウェステルマン肺吸虫とは全く異なる種類であることがわかり、69年に、ペルー肺吸虫という名が与えられた(本誌, 18, 123-130)。さらに昨年は、上記流行地で、実験的にイヌからえられた成虫のなかに、コロンビア原産のカリ肺吸虫が混在していることを明らかにした(未発表)。したがって、同地方の病原虫は、主としてペルー肺吸虫、ときにカリ肺吸虫もなりうる事が考えられる。(卵で両種を区別することは不可能)。とにかく、患

者は、かなり発生しているが、虫をとりだした例は、この国には全くなかつた。ところが、70年に上記流行地から遠いペルー中央部(ロレト州南部)で感染したと思われる36歳の男の右肺から2成虫がとりだされた。この患者は65年以来、肺結核と誤診され、70年に肺吸虫症と判明して、ピチオノールを服用したが、喀痰中の卵がなくなるという理由で、手術された例である。虫体は2つとも薬のために変性がみられ、本当の形態を知ることができなかつたが、既知種のどれとも一致しなかつた。したがって、未知種と思われるが、同じ場所で、さらに多くの材料がえられるまで、同定をさしひかえた。しかし、この患者が感染したと思われる所から約60 km離れた地域で、昨年10月、未記録のメタセルカリアを認めたことは、この推測を裏付けるものであろう。