

## THE PENTASTOMIDA PARASITIC IN MAN (\*)

by

A. FAIN

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*Summary* — This paper is a review of human pentastomosis. So far five species belonging to three genera of Pentastomida have been found with certainty in man. The author discusses the pathogenic role of these species and the diagnosis of the nymphal pentastomosis in man.

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KEYWORDS : Pentastomosis, human; Cancer; Review.

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### Introduction

The Pentastomida constitute a highly aberrant group of parasites. All the known species are parasitic in both adult and immature stages. Most of them are heteroxenous and have a complicated life-cycle involving two successive hosts. In the most evolved genera, such as *Armillifer* and *Linguatula*, the definitive host is a carnivorous animal, either a large snake or a carnivore, and the intermediate host a mammal. In the more primitive genus *Raillietiella*, the adults live mainly in the lung of snakes or lizards. The life cycle is not known with certainty but it seems that *Raillietiella boulengeri* a common lung parasite of African snakes utilizes small lizards as intermediate hosts (Fain, 1961 addendum, and 1964).

Recently Self (1969) has fed eggs of *Raillietiella gehyrae* to several species of lizards and recovered migrating primary larvae from the tissues.

Some pentastomids are able to perform their entire development in the same host. So far a direct development has been observed for *Sambonia lohrmanni* Noc and Giglioli, a species living in the respiratory tract of the Komodo varanus (see Fain and Mortelmans, 1960) and for *Reighardia sterna* (Diesing, 1864), living in the lungs of Laridae (Haffner and Rack, 1965). In the pulmonary tissues of the varanus we found all the intermediate forms between the embryo and the adults, including five successive larval stages. It is possible that some species of *Raillietiella* living in the lungs of lizards are also able to complete their life-cycle in these hosts.

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Lavoipierre, M.M. and Lavoipierre Michèle (1966) have reported the presence of larval pentastomids in the haemocoel of cockroaches in Singapore. They surmized that these arthropods are the intermediate hosts for a species of *Raillietiella* that infects the common house-gecko in this area. Unfortunately they did not observe the preinfective larval stages in the haemocoel of the cockroaches which could have proved that these insects were true intermediate hosts and not simply « hôtes d'attente » or paratenic hosts in which the larva had reencysted. Another point that these authors have not investigated is the possible presence of preinfective larval stages in the lung of the gecko. The discovery of such larvae would prove that the entire life cycle could take place in the tissues of the gecko.

Man is rarely infected by adult pentastomids. Nymphal parasitism on the contrary is not rare in this host.

In man the infestation results generally from the consumption of water or food infected by feces or lung mucus of snakes or carnivores, more rarely by eating infected snakes. A review of the species infecting man has been given by Fain in 1960. Since this date a number of new observations have been published and restatement of the question becomes necessary.

### **Pentastomids observed in man**

Up to now five species of Pentastomida, belonging to three genera, have been reported from man.

1. *Leiperia cincinnalis* Sambon. This species lives as an adult in the lungs of African crocodiles. The nymphs have been found encysted in the connective tissue enveloping the intestine or in the muscles of various fishes. A nymph of this species was found once in the feces of a European woman in Lubumbashi, Zaïre (Fain, 1960 and 1961). This patient has probably become infected by eating fish harbouring this larva. This case of parasitism was considered, therefore to be purely accidental.

2. The genus *Linguatula* is cosmopolitan and contains several species which live as adults in the nasal cavities of domestic and wild carnivores. Parasitism of man by the adults of this genus is very rare and has been observed only with *Linguatula serrata*, a species that lives in dogs, wolves and foxes. Nymphal pentastomosis in man has been reported on several occasions and in various parts of the world. The nymphs were recovered from mesenteric lymph nodes plus various viscera including the brain, lungs, etc. Nymphs have also been found in the anterior chamber of the eye of man at two occasions in North America (Hunter and Higgins, 1960; Rendtorff *et al.*, 1962). In the Middle East nymphs of *Linguatula serrata* have been removed from the naso-pharynx of patients suffering of halzoun or marara syndrome (Schacher *et al.*, 1969). So far the halzoun syndrome had been attributed to the presence in the naso-pharynx of flukes (*Fasciola hepatica*) or leeches.

3. The genus *Porocephalus* is represented only in Africa and in America. Up to now human parasitism by either adults or nymphs of this

genus has not been observed with certainty. All the cases reported from Africa by several authors as human porocephalosis were actually produced by nymphs of *Armillifer* (see Fain, 1960 and 1961).

Recently Prathop *et al.* (1969) have reported infestations in Malaysian aborigines by a species which they call *Porocephalus moniliformis*. Actually this species belongs to the genus *Armillifer*.

4. The genus *Armillifer* is represented in man by three species all of which are able to produce nymphal pentastomosis.

a) The most common species is *Armillifer armillatus* (Wyman), and is known only from Tropical Africa. The adults live in the lungs of the large snakes such as the pythons and vipers of the genus *Bitis*. The nymphs develop in various mammals including man and nymphal pentastomosis by *A. armillatus* has been reported frequently in man. In the earlier papers this parasite was erroneously reported under the names *Porocephalus moniliformis* or *Armillifer moniliformis*. The nymphs are generally found encysted in a thin transparent cystic membrane. In some circumstances these nymphs may escape from their envelope and become free in the host.

In man the nymphs are generally located in the peritoneal cavity or in the thorax. Most of them are encysted beneath the capsule of the liver or embedded in the superficial layers of this organ. They are also frequently found in the omentum, the mesenteries, the intestinal walls and in other abdominal organs. We found these nymphs once along the spermatic canal close to the testicle in a native of Zaïre (Fain, unpublished). Other locations for these nymphs in man are the brain (Fornara, 1923), the ocular conjunctiva (De Coster and Rodhain, 1951, Gratama and Van Thiel, 1957 and Fain, 1960) and the eyelid (Fain, 1960).

The presence of these nymphs in the peritoneal cavity is generally well tolerated and pathological complications are very rare. In two cases, however, they had produced important lesions which were followed by the death of the patients. In the fatal case described by Cannon (1942) the nymphs were extremely numerous and they had almost completely obstructed the large intestine. Bouckaert and Fain (1959) observed a similar case in Zaïre in which the nymphs were located along the hepatic angle of the large intestine and there was a distinct local peritonitis at the site of the nymphal masses.

Presently it is not known whether the nymphs of *A. armillatus* which have been ingested by man are able to cross the intestinal wall and to reencyst in the peritoneal cavity. This question is important because the passing of these relatively large nymphs through the intestinal wall could be more harmful than that of the microscopic embryos (Fain, 1960).

b) *Armillifer moniliformis* (Diesing) : This species is very common in the lung of Asiatic pythons. Nymphal parasitism in man has seldom been reported. Recently Prathap *et al.* (1969) have reported the presence of nymphs of *Armillifer moniliformis* (erroneously named *Porocephalus moniliformis*) in 45,6 per cent of a series of 30 autopsies on Malaysian aborigines. The liver and the lungs were the organs most frequently infected.

This species has been found once in the lung of an African python in Kinshasa, Zaïre, but so far nymphs have not been reported from Africa.

c) *Armillifer grandis* Hett. The adults of this species have frequently been observed in the lungs of *Bitis nasicornis*. Nymphal infestations in man have been reported in Zaïre. The nymphs are encysted in the omentum and the mesenteries in several natives living in a swampy forest area, in the Equatorial Province of Zaïre (Fain and Salvo, 1966). In this region *Bitis nasicornis*, the usual host of the adult parasite, is also very frequent. The nymphs of *A. grandis* are easily distinguished from those of *A. armillatus* by their smaller size and the greater number of circular cuticular thickenings.

Recently we found a nymph of this species encysted in the eyelid of a native from Kisangani, Zaïre (Fain, unpublished).

### **Pentastomosis and cancer**

Galli-Valerio (1921) described a human case of fibrosarcoma of the nasal cavities invaded by an adult of *Linguatula serrata*.

Tobie *et al.* (1957) reported a tongue worm (*Linguatula serrata*) infestation in a patient with acute leukemia.

We have observed a bronchial carcinoma in a Komodo *varanus* which was infected with *Sambonia lohmanni*. This cancer had apparently originated from a villouspapilloma of the bronchial mucosa. Several young larvae of this pentastomid were found inside the villi. Other larvae or nymphs were embedded in the tracheal mucosa. This host was also infected by the adult form of the same pentastomid (Fain and Mortelmans, 1960).

Although these three observations are not sufficient to prove the carcinogenetic action of larval pentastomids, we think that they are interesting because they draw the attention to the possibility of this action in man. The high frequency of the primitive cancer of the liver, in the Africans, could be in relation with the great prevalence of the nymphal pentastomosis of the human liver in Central Africa. We think that experimental work should be performed in order to study the carcinogenetic actions of *Armillifer armillatus* in the liver. It should be necessary to select for that purpose animals that are especially susceptible to this kind of cancer.

### **Diagnosis of nymphal pentastomosis in man**

Nymphal pentastomosis in man by *Armillifer armillatus* is generally discovered during surgical intervention or at necropsies.

As long as the nymphs are alive they are not visible by X-rays. After death they may calcify and become visible by X-rays. Their ring or horse-shoe form (10-14 mm in diameter) and their location in the abdominal or thoracic cavity are characteristic. As a matter of fact the calcification of these nymphs is probably not a general phenomenon for in countries such as Zaïre where nymphal pentastomosis by *Armillifer armillatus* is very common the discovery of calcified nymphs, during routine X-rays examinations is exceptional. Van Wymeersch and Wanson (1954) working in Kinshasa,

Zaire, have found only three cases of calcified nymphal pentastomosis in man, from a total of 70.000 routine X-rays examinations.

Recently immunological techniques have been proposed for the detection of nymphal pentastomosis. They will probably provide a more accurate diagnosis (Amy, 1973).

**Résumé — Les Pentastomidés parasitaires chez l'homme.**

Ce travail est une mise au point de nos connaissances sur la pentastomose humaine. Cinq espèces, appartenant à trois genres de Pentastomida ont été rencontrées avec certitude chez l'homme. Le rôle pathogène de ces diverses espèces et le diagnostic de la pentastomose nymphale chez l'homme sont passés en revue.

**Samenvatting — De Pentastomida parasitair voor de mens.**

Dit werk geeft een overzicht inzake de menselijke pentastomosis. Tot heden werden vijf species, behorend tot drie soorten Pentastomida, met zekerheid bij de mens gevonden. De auteur bespreekt de pathogenische rol van deze soorten en de diagnose van nymfale pentastomosis bij de mens.

A. Fain : Department of Medical Zoology, Prince Leopold Institute of Tropical Medicine, Nationalestraat 155, B-2000 Antwerpen, Belgium.

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**REFERENCES**

- Amy, D. (1973) : La Pentastomose à *Armillifer armillatus*. Etude biologique, immunologique et radiologique. Thèse, Faculté de Médecine, Marseille.
- Bouckaert, L. and Fain, A. (1959) : Een geval van nymfale porocephalose met dodelijk verloop. Ann. Soc. belge Méd. trop., **39**, 793.
- Cannon, D. A. (1942) : Linguatulid infestation of man. Ann. Trop. Med. Parasitol. **36**, 160-166.
- Fain, A. (1960) : La pentastomose chez l'homme. Bull. Acad. Roy. Méd. Belg., Série VIe, **25** 7, 516-532.
- Fain, A. (1961) : Les Pentastomidés de l'Afrique Centrale. Ann. Mus. Roy. Afr. Centr., Série 8 Sci. Zool. **92**, 1-115.
- Fain, A. (1964) : Observations sur le cycle évolutif du genre *Raillietiella* (Pentastomida). Acad. Roy. Belg. Bull. Classe de Sciences, Série 5 L **9**, 1036-1060.
- Fain, A. (1966) : Pentastomida of Snakes — Their Parasitological Role in Man and Animals. Mem. Inst. Butantan, Simp. Internac., **33** 1, 167-174.
- Fain, A. (1973) : In Flynn, R. J. : Parasites of Laboratory Animals : Chap. 16 — Pentastomida, by Fain. Ames Iowa State University Press, p. 493-503.
- Fain, A. (1974) : Human Infestation by Pentastomids. Proc. Third International Congress of Parasitology München, 25-31 August, 1974 Vol. 2. Section c 14 (12) : 1028-1029.
- Fain, A. and Mortelmans, J. (1960) : Observations sur le cycle évolutif de *Sambonia lohrmanni* chez le Varan. Preuve d'un développement direct chez les Pentastomida. Bull. Acad. Sci. Belg. 5<sup>e</sup> Sér., **46** 6, 518-531.
- Fain, A. and Salvo, G. (1966) : Pentastomose humaine produite par des Nymphes d'*Armillifer grandis* (Hett) en République Démocratique du Congo. Ann. Soc. belge Méd. trop., **46**, 6, 675-682.
- Faust, E. C., Russel, P. F. and Jung, R. C. (1970) : Graig and Faust's Clinical Parasitology, 8th Ed. Philadelphia, Lea and Febiger.
- Galli-Valerio, B. (1921) : Parasitologische Untersuchungen und Beiträge zur parasitologische Technik. Centralbl. Bakt., I Abt. **86**, 349.
- Gratama, S. and Van Thiel, P. H. (1957) : Ocular localization of *Armillifer armillatus*. Doc. Med. Geogr. Trop. **9**, 374.
- Haffner, K. von and Rack, G. (1965) : Neues ueber die entwicklung der Pentastomide *Reighardia sterna*. Jahrb. Anat. **72**, 419-444.
- Hunter, W. S. and Higgins, R. P. (1960) : An unusual case of human porocephaliasis. J. Parasitol. **46**, 68.
- Khalil, G. M. and Schacher, J. F. (1965) : *Linguatula serrata* in relation to Halzoun and the Marrara syndrome. Amer. J. Trop. Med. Hyg. **14** 5, 736-746.
- Lavoipierre, M. M. J. and Lavoipierre, Michèle (1966) : An arthropod intermediate host of a Pentastomid. Nature **210** (5038), 845-846.

- Prathap, K., Lau, K.S. and Bolton, J.M. (1969) : Pentastomiasis : a Common finding at Autopsy among Malaysian Aborigines. Amer. J. Trop. Med. Hyg. **18**, 20-27.
- Rendtorff, R. C. Deweese, M. W. and Murrell, W. (1962) : The occurrence of *Linguatula serrata*, a Pentastomid within the human eye. Amer. J. Trop. Med. Hyg., **11**, 762-764.
- Schacher, J. F., Saab, S., Germanos, R. and Boustany, N. (1969) : The aetiology of halzoun in Lebanon : recovery of *Linguatula serrata* nymphs from two patients. Trans. Roy. Soc. Trop. Med. Hyg. **63**, 854-58.
- Self, J. J. (1969) : Biological relationships of the Pentastomida : a bibliography on the Pentastomida. Exp. Parasitol. **24**, 63-119.
- Sweatman, G. K. (1971) : Mites and Pentastomids. In Parasitic Diseases of Wild Mammals. John W. Davis and Roy C. Anderson, Ames, The Iowa State University Press, 1-64.
- Tobie, J. E., Edgcomb, J. H. and Freireich, E. J. (1957) : Tongue worm (*Linguatula serrata*) infestation in a patient with acute leukemia. Amer. J. Clin. Path. **28**, 628-633.
- Van Wymeersch, H. and Wanson, M. (1954) : La porocéphalose nymphale et son image radiologique. Ann. Soc. belge Méd. trop., **34**, 517.
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