Table 1. Summary of data on respiratory tract infections caused by penicillin-resistant *Pasteurella multocida*.

Case no. [ref]	Age (y), sex	Underlying disease	Animal exposure	Type(s) of infection	Culture specimen(s)	Antimicrobial treatment (duration)	Outcome
1 [1]	63, M	Chronic pulmonary histoplasmosis	Swine, cattle	Lung abscess, empyema	Pleural fluid, sputum	Amp; Pen	Death (72 h after admission)
2 [2]	80, M	Pulmonary tuberculosis	Dog	Pneumopathy	Bronchial aspirate	Amox (2 d); Amox/Clv (13 d)	Death (13 d)
3 [3]	65, F	Chronic bronchitis	NS	Bronchial superinfection	Bronchial aspirate	NS	NS
4 [4]	76, M	Chronic bronchitis	None	Empyema	Pleural fluid	Gm and Cm; Pen; Amox/Clv	Recovery
5 [PR]	75, F	Chronic bronchitis	Cat	Lung abscess	BAL fluid	Amox (8 d); Amox, Mtz, and Gm (4 d); Amox/Clv, Mtz, and Gm (7 d); Amox/Clv (2 mo)	Recovery

NOTE. Amox, amoxicillin; Amp, ampicillin; BAL, bronchoalveolar lavage; Clv, clavulanate; Cm, clindamycin; Gm, gentamicin; Mtz, metronidazole; Pen, penicillin; NS, not specified; PR, present report.

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Lethal Infection Due to *Armillifer armillatus* (Porocephalida): A Snake-Related Parasitic Disease

Snake-related deaths are usually caused by bites and result from venom neurotoxicity. We report an unusual snake-related death to draw attention to the fact that other mechanisms of death caused by snakes may be overlooked.

A 26-year-old Congolese man was found dead in his family's home in Paris where he was staying. One week before his death, he came to Paris from Congo for medical advice on unexplained symptoms, including right leg paresis with abnormal movements of the 4 extremities, atypical seizures, and dysarthria. He was admitted to the hospital. Physical examination revealed no objective signs. Results of MRI, CT, electromyography, electroencephalography, CSF analysis, and other biological tests were normal. Depression was diagnosed. The patient was treated with antidepressant drugs and discharged from the hospital.

His unexpected death was considered suspicious; therefore, a medicolegal autopsy was performed. At autopsy, we found ~100 small white wormlike parasites (averaging 2 cm in length) in the lungs, liver, mesentery, and intestine (figure 1). The brain and spine were normal, as were other organs. No evidence of another disease was found during the complete autopsy. Toxicology analyses were negative.

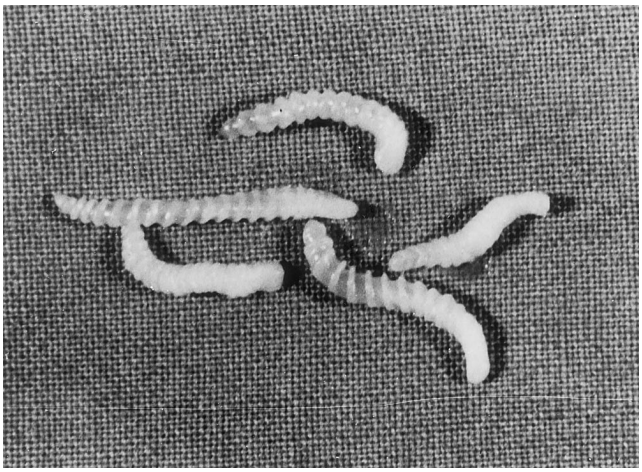

Figure 1. Nymphs of third-stage larvae of *Armillifer armillatus* with pseudoannulation that were obtained during autopsy of a man infected with these endoparasites (original size, ×2).

The parasites were identified as nymphs of third-stage larvae of *Armillifer armillatus*, an invertebrate parasite belonging to the order Porocephalida. These parasites are similar to individuals belonging to the phyla Annelida and Arthropoda, but they are now classified as Crustacea.

Two species are essentially involved in human infections [1–3]: *A. armillatus*, which is predominant in tropical Africa,

Reprints or correspondence: Dr. Véronique Lavarde, Department of Parasitology, Broussais Hospital, 96, rue Didot, 75014 Paris, France.

Clinical Infectious Diseases 1999; 29:1346–7

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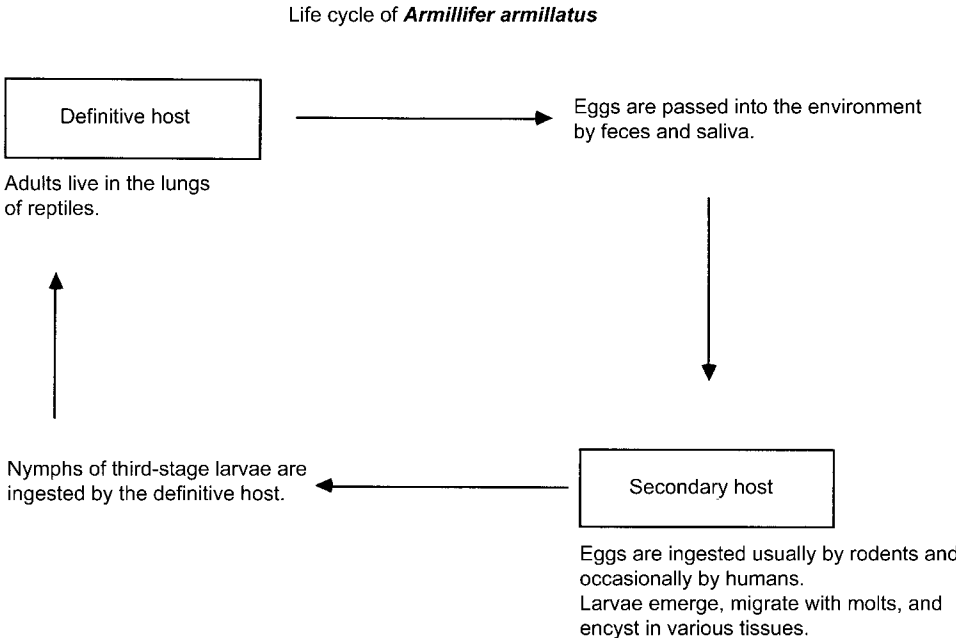

Figure 2. Life cycle of *Armillifer armillatus*

and *Linguatula serrata*, which is predominant in the Middle East. Male and female adults of *A. armillatus* live in the respiratory tract of reptiles, where they become attached by means of their hooks and suck blood and other tissues. Eggs are thrown out into the environment and infect the intermediate host (rodents); after a series of molts, third-stage larvae are encapsulated and then ingested by the definitive host, in whom they migrate to the respiratory tract to develop. Humans are dead-end hosts (figure 2).

Most reports of human porocephaliasis are from West Africa and Congo, but some cases have also been reported in Asia; risk factors for humans are consumption of food or drink contaminated by eggs of reptiles and contact with snake flesh or skin. In North America, where the incidence of porocephaliasis among crotalid snakes is high, human infections by these parasites are very rare. Only one case has been described in an emigrant from Nigeria [2].

The incidence of this parasitic disease is likely to be underestimated, because *Armillifer* is a usually well-tolerated parasite and most patients are asymptomatic. Patients are infected only by 1–12 nymphs. The main sites of involvement are the lungs, liver, and mesentery. Parasites are discovered during autopsy or surgery or are evidenced during radiological examination as calcified C-shaped nymphs. Some clinical symptoms can arise when encysted larvae pressure or perforate organs during larval migration. The diagnosis of the disease is then made during surgical operation. Larvae can cause intestinal occlusion, peritonitis, pericarditis, pneumonia, or meningitis.

Death is exceptional, resulting from massive infection following ingestion of a female full of eggs. Hypersensitivity or toxin release by parasites might be suggested as a possible mechanism for neurological signs and death, as in our patient, when destruction of multiple disseminated larvae occurs. Only 3 lethal cases, including our case, have been reported in the literature [4]. No medical treatment is available. Surgery is often necessary when complications occur. In areas where *A. armillatus* is endemic, precautions are washing food and cautious handling of snakes.

Véronique Lavarde[1] and Paul Fornes[2]
[1]Department of Parasitology, Broussais Hospital, and [2]Institute of Forensic Medicine and Department of Forensic Sciences, College of Medicine Cochin Port-Royal, University of Paris (V), Paris, France

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