Trematode Infections

Liver and Lung Flukes

Thomas Fürst, MA[a,b], Urs Duthaler, PhD[a,c], Banchop Sripa, PhD[d], Jürg Utzinger, PhD[a,b], Jennifer Keiser, PhD[a,c,*]

KEYWORDS

• Trematode • *Clonorchis sinensis* • *Opisthorchis viverrini* • *Fasciola hepatica* • *Fasciola gigantica* • *Paragonimus* spp

KEY POINTS

- Liver and lung fluke infections belong to the food-borne trematodiases that are transmitted through the consumption of contaminated undercooked aquatic food.
- Infections are most prevalent in Southeast Asia and Latin America, but might occur in North America due to international travel, human migration, and food trade.
- Clinical manifestations of liver and lung fluke infections are unspecific and, according to the parasites' location in the human host, comprise hepatobiliary and pleuropulmonary symptoms.
- Timely diagnosis and treatment are essential to avoid severe sequelae such as cholangiocarcinoma and ectopic complications as infections progress.
- Prevention and integrated control measures are essential to avoid transmission and include improved sanitation, food processing and inspection, ICE campaigns, and access to treatment.

Funding statement: Thomas Fürst is associated to the National Centre of Competence in Research (NCCR) North-South and received financial support through a Pro*Doc Research Module from the Swiss National Science Foundation (SNSF; project number PDFMP3-123185) and from the Freiwillige Akademische Gesellschaft (FAG) Basel. Jennifer Keiser acknowledges a personal career development grant from SNSF (projects no. PPOOA3–114941 and PPOOP3_135170).
Conflict of interests: The authors have nothing to disclose.
[a] University of Basel, Petersplatz 1, CH-4003 Basel, Switzerland; [b] Department of Epidemiology and Public Health, Swiss Tropical and Public Health Institute, P.O. Box, CH–4002 Basel, Switzerland; [c] Department of Medical Parasitology and Infection Biology, Swiss Tropical and Public Health Institute, P.O. Box, CH–4051 Basel, Switzerland; [d] Tropical Disease Research Laboratory, Department of Pathology, Khon Kaen University, Khon Kaen 40002, Thailand
* Department of Medical Parasitology and Infection Biology, Swiss Tropical and Public Health Institute, P.O. Box, CH–4002 Basel, Switzerland.
E-mail address: jennifer.keiser@unibas.ch

Infect Dis Clin N Am 26 (2012) 399–419
doi:10.1016/j.idc.2012.03.008 **id.theclinics.com**
0891-5520/12/$ – see front matter

INTRODUCTION

Food-borne trematodiases are a cluster of mainly chronic diseases caused by parasitic worms of the class Trematoda.[1,2] Recent data suggest that food-borne trematodiases are an emerging public health problem, partially explained by the exponential growth of aquaculture (inland fish production) in Southeast Asia as well as intensified transport and trade of aquatic foodstuffs.[3] According to the final organs parasitized in the human host, food-borne trematodiases are grouped into liver, lung, and intestinal fluke infections.

This article focuses on the liver and lung flukes, the most prominent of which are *Clonorchis sinensis*, *Fasciola gigantica*, *Fasciola hepatica*, *Opisthorchis felineus*, and *Opisthorchis viverrini* (liver flukes), and *Paragonimus* spp (lung flukes).[1,2] These fluke infections together cause more than 85% of the global burden due to food-borne trematodiases.[4] The authors describe the epidemiology, including current distribution, global burden estimates, life cycle, and transmission; clinical signs and symptoms; diagnostic approaches for detecting infection and disease; and the present armamentarium for treatment and morbidity control. Measures for prevention and integrated control of the infections are discussed, and research needs are also emphasized.

EPIDEMIOLOGY

The epidemiology of liver and lung fluke infections, as well as other trematode and nematode infections, is governed by social-ecological contexts.[5–7] Nutrition-related behavior (ie, consumption of undercooked aquatic products such as freshwater fish, crabs, and water plants) and distribution networks of aquatic foodstuffs that are contaminated with metacercariae play important roles in liver and lung fluke infections.[1] The key risk factor for infection is the consumption of raw, undercooked, or pickled fish, crabs, and other aquatic products that are contaminated with the infectious stages of the parasites (ie, metacercariae). In Southeast Asia and the Americas, aquatic food dishes are often rooted in local traditions with high ethnic, cultural, and nutritional values. For example, culinary dishes that cause lung fluke infection in the people of the Republic of Korea include raw crab meat spiced with soy sauce (*kejang*). Liver fluke infections in the People's Republic of China (P.R. China) have been linked to the consumption of raw grass carp dishes and in Thailand and Lao People's Democratic Republic (Lao PDR) to the consumption of freshly prepared uncooked or fermented fish (*lab pla*, *koi pla*, *pla som*, and *pla ra*).[1,8] In Peru, *alfalfa* juice is consumed as a popular herbal medicine, but this habit has also been identified as a risk factor for *F hepatica* infection.[9] Food-borne trematodiases, in general, and liver and lung fluke infections, in particular, are rarely found in Africa, mainly explained by the tradition of cooking fish and other foodstuffs completely.[10]

Although eating habits are deeply rooted in local traditions and thus difficult to influence, the social-ecological systems in many endemic regions have changed over the past decades, which, in turn, also modified the epidemiologic patterns of food-borne trematodiases. For instance, in Asia, the changing demographic and economic situation and modified agricultural production systems and ecosystems, sometimes coupled with disease control and education efforts, resulted in a remarkable shift in the prevalence of paragonimiasis. Children living in poor rural setting who catch and eat raw crustaceans while playing or helping their parents in the fields are still at high risk for infection. However, an increasing number of better off, middle-aged, and usually male city dwellers enjoying delicacies such as freshwater crabs or undercooked meat of wild boars (*Sus scrofa leucomystax*), which may act as paratenic host for *Paragonimus westermani*, are at risk of infection during their participation at parties, festivals, and recreational visits to the countryside.[11] Similarly,