Travel-related Schistosomiasis Acquired in Laos

Eyal Leshem, Eyal Meltzer, Esther Marva, and Eli Schwartz

Twelve Israeli travelers acquired schistosomiasis in Laos during 2002–2008, and 7 of them had acute schistosomiasis. The patients were probably exposed to *Schistosoma mekongi* in southern Laos, an area known to be endemic for schistosomiasis. Four possibly were infected in northern Laos, where reports of schistosomiasis are rare.

Schistosomiasis is a widely distributed intravascular trematode infection. Estimates indicate that >200 million people are infected with schistosomiasis, mainly in Africa. In Asia, 3 *Schistosoma* species cause human infection: *S. japonicum*, *S. malayensis*, and *S. mekongi*. *S. mekongi* endemicity is thought to be limited to a 200-km area of the Mekong River Basin, stretching from the southern tip of Laos to Cambodia (Figure) (1). However, this parasite’s intermediary host, freshwater snails (*Neotricula aperta*), has recently been found to be more widespread and to be advancing northwards (1,2). Attwood has suggested that *S. mekongi* may extend as far north as Khammouane Province in southern Laos (Figure) (1,3).

Acute schistosomiasis is a transient hypersensitivity reaction associated with tissue migration of *Schistosoma* spp. larvae in nonimmune persons. This syndrome is characterized by fever, cough, fatigue, myalgia, urticaria, and gastrointestinal complaints. Although acute schistosomiasis caused by *S. japonicum* was extensively studied long ago (4), we found no reports of acute schistosomiasis caused by *S. mekongi*. Moreover, current literature states that acute schistosomiasis has never been described as a feature of *S. mekongi* infection (5).

The Study

The study was conducted at the Center for Geographic Medicine at Sheba Medical Center and was approved by the institutional review board. Travel-related schistosomiasis was defined as a case of schistosomiasis confirmed by serology or ova detection in a traveler who had been exposed to freshwater in Laos. Travelers were thoroughly questioned regarding freshwater exposures during the index trip and any previous trips to schistosomiasis-endemic areas.

Serologic diagnosis conducted at the Israel Ministry of Health (MOH) Central Laboratories in Jerusalem was based on the soluble egg antigen ELISA test (IVD Research Inc., Carlsbad, CA, USA), a nonspecies-specific method. Consequently, most samples (11/12) were sent to the US Centers for Disease Control and Prevention (CDC) for species-specific serologic assays (Falcon Assay Screening Test ELISA [FAST-ELISA], CDC, Atlanta, GA, USA) (6). This method is used for *S. japonicum* serodiagnosis; specific serology for *S. mekongi* is unavailable.

Stool specimens were tested for the presence of *Schistosoma* spp. ova (merthiolate–iodine–formaldehyde technique) at the Israel MOH and Clalit Health Services laboratories. Fisher exact test was used for categoric data and the Student *t* test for continuous data. Statistical significance was set at *p*<0.05.

During 2002–2008, 12 patients (5 male, 7 female [2 children]) had travel-related schistosomiasis acquired in Laos (Table 1). No freshwater exposures in *Schistosoma*-endemic areas in Asia (excluding the index trip to Laos) were reported by patients (Table 1).
Mean patient age was 24 years (range, 6–42 years). Seven patients were exposed to freshwater in both southern and northern Laos (4,000 Islands and the town of Vang Vieng, respectively); 1 patient was exposed only in southern Laos (Figure). Notably, 4 patients reported freshwater exposure exclusively in northern Laos (Vang Vieng). Three of the 4 reported no travel in southern Laos; 1 patient (Table 1, patient 10) visited southern Laos but was not exposed to freshwater. Exposure occurred during the months of February–April for 9 of the 12 patients.

Seven patients had a diagnosis of acute schistosomiasis. Fever (86%), headache (86%), urticarial rash (71%), and cough (71%) were the most prevalent acute schistosomiasis symptoms (Table 2). Four patients reported chronic gastrointestinal symptoms (abdominal pain and discomfort, diarrhea or loose stools). One patient described a pruritic papular rash that appeared hours after exposure and resolved within a few days (suspected cercarial dermatitis). The patient was asymptomatic upon evaluation at our clinic (Table 1, patient 12).

Diagnosis was made by positive serology in all 12 patients. Eleven serum samples were sent to CDC for specification; 9 patients had positive immunoblots for *S. japonicum* (Table 1). One patient had a positive immunoblot for *S. haematobium*; this result was judged to be a cross-reaction because the patient had never visited *S. haematobium*-endemic areas.

*S. mekongi/japonicum* ova were detected in stool samples of 1 of 7 patients who submitted such samples for ova detection (Table 1). Issues of technical proficiency and expertise precluded a definitive conclusion regarding speciation according to egg size. Laboratory findings in 5 patients with acute schistosomiasis were significant for marked eosinophilia (Table 2).

All infected patients were treated with praziquantel at ≥12 weeks postexposure to avoid treatment failure (8). Of the acute schistosomiasis patients, 3 of the 7 required corticosteroid treatment during the acute illness.

**Conclusions**

Acute schistosomiasis, which is considered to be a hypersensitivity reaction that usually develops a few weeks after *Schistosoma* infection, is best studied in nonimmune travelers rather than in continuously exposed local popula-

### Table 1. Demographic, epidemiologic, and clinical characteristics of travelers with schistosomiasis acquired in Laos*

| Patient no. | Age, y/sex | Clinical features | Countries visited during index trip | Places of water exposure in Laos | Date of exposure | Date of clinic visit | Possible past exposure to schistosomiasis | Serology, genus-specific/immunoblot | Stool ova |
|-------------|------------|-------------------|-------------------------------------|----------------------------------|-----------------|---------------------|------------------------------------------|-------------------------------------|----------|
| 1           | 27/F       | AS                | China, Laos, Cambodia, Thailand     | 4,000 Islands                    | 2003 Apr        | 2003 Sep            | 1997, Malawi               | Pos/S. japonicum            | Neg      |
| 2           | 22/F       | AS                | Thailand, Laos, Cambodia, Vietnam   | Vang Vieng, 4,000 Islands        | 2007 Jun        | 2007 Aug            | No                         | Pos/S. japonicum            | Neg      |
| 3           | 23/M       | AS                | Thailand, Nepal, Laos, Vietnam, Cambodia | Vang Vieng, 4,000 Islands | 2006 Apr        | 2006 Jun            | No                         | Pos/S. japonicum            | ND       |
| 4           | 38/F       | AS                | India, Thailand, Laos, Cambodia     | Vang Vieng, 4,000 Islands        | 2008 Apr        | 2008 May            | No                         | Pos/S. japonicum            | Neg      |
| 5           | 9/F        | AS                | India, Thailand, Laos, Cambodia     | Vang Vieng, 4,000 Islands        | 2008 Apr        | 2008 May            | No                         | Pos/S. japonicum            | Pos      |
| 6           | 42/M       | AS                | India, Thailand, Laos, Cambodia     | Vang Vieng, 4,000 Islands        | 2008 Apr        | 2008 May            | No                         | Pos/S. japonicum            | ND       |
| 7           | 6/M        | AS                | India, Thailand, Laos, Cambodia     | Vang Vieng, 4,000 Islands        | 2008 Apr        | 2008 May            | No                         | Pos/S. japonicum            | ND       |
| 8           | 24/F       | CS                | Thailand, Laos, India              | Vang Vieng, 4000 Islands         | 2003 Nov        | 2006 May            | No                         | Pos/Neg               | Neg      |
| 9           | 36/F       | CS                | India, Thailand, Vietnam, Cambodia, Laos | Vang Vieng | 2004 Mar        | 2005 May            | No                         | Pos/S. japonicum            | ND       |
| 10          | 26/F       | CS                | Thailand, Laos, Australia, New Zealand | Vang Vieng | 2003 Nov        | 2004 Nov            | No                         | Pos/S. haematobium†          | Neg      |
| 11          | 22/M       | CS                | Thailand, Laos, China, Nepal        | Vang Vieng                       | 2007 Feb        | 2007 Dec            | No                         | Pos/ND               | Neg      |
| 12          | 23/M       | CDA               | Thailand, Laos, Vietnam, Cambodia, China | Vang Vieng | 2007 Mar        | 2007 Aug            | No                         | Pos/S. japonicum            | ND       |

*AS, acute schistosomiasis; CS, chronic schistosomiasis; pos, positive; neg, negative; ND, not done; S. japonicum, Schistosoma japonicum; S. haematobium, Schistosoma haematobium; CDA, cercarial dermatitis, asymptomatic.*

†Patient tested positive on *S. haematobium* immunoblot.
Travel-Related Schistosomiasis Acquired in Laos

Table 2. Clinical characteristics of patients with acute schistosomiasis acquired in Laos compared with those of case-patients from Tanzania*

| Clinical characteristic | Infections acquired in Laos, n = 7 | Infections among case-patients in Tanzania, n = 19 |
|-------------------------|----------------------------------|-----------------------------------------------|
| Fever                   | 6 (86)                           | 13 (68)                                      |
| Headache                | 6 (86)†                          | 2 (10)                                       |
| Urticaria               | 5 (71)                           | 7 (37)                                       |
| Cough                   | 5 (71)                           | 15 (78)                                      |
| Fatigue                 | 4 (57)                           | 11 (58)                                      |
| Angioedema              | 3 (42)                           | 2 (10)                                       |
| Abdominal pain          | 3 (42)                           | 5 (26)                                       |
| Diarrhea                | 2 (28)                           | 7 (37)                                       |
| Myalgia                 | 2 (28)                           | 7 (37)                                       |
| Cerebral dermatitis     | 1 (14)                           | 3 (16)                                       |
| Time from exposure to seeking medical care, d (±SD) | 27 (±4) | 38 (±22) |
| Eosinophil count, cells/mm (±SD) | 3,595 (±3,218) | 3,535 (±2,394) |

*Patients with cases suspected to be caused by Schistosoma mekongi infection compared with patients infected with S. mansoni and/or S. haematobium in Tanzania (7). All values are no. (%) except as indicated. †p<0.001.

We report 7 cases of acute schistosomiasis presumably caused by S. mekongi infection acquired in Laos. Acute schistosomiasis is reportedly not a species-specific phenomenon but may develop after infection with any Schistosoma spp. (8), a view strengthened by this report.

Symptoms of acute schistosomiasis caused by S. mekongi, although a small number of cases, appear similar to symptoms of acute schistosomiasis caused by S. mansoni or S. haematobium (7) (Table 2). The only symptom significantly more prevalent in acute schistosomiasis caused by S. mekongi was headache.

Most Schistosoma infections in travelers are acquired in Africa (8,9). In our clinic, travel-related schistosomiasis acquired outside Africa was diagnosed only in travelers exposed in Laos (8). This exposure is probably due to the popularity of water-related adventure activities among travelers to Laos.

S. mekongi–endemic areas in Laos have presumably included only the southern reaches of the Mekong River (Figure) (1,2,5). However, this assumption may reflect a serendipitous effect because schistosomiasis in Laos was first diagnosed in immigrants originating from this region. These early schistosomiasis cases led early epidemiologic surveys to the region of Khong, where most subsequent studies were performed (5,10). Since these epidemiologic surveys were conducted, S. mekongi infections acquired in northern Laos have been described only anecdotally (11–13).

In this report, we describe 4 patients with schistosomiasis apparently acquired in northern Laos (Figure) after exposure to freshwater exclusively in Vang Vieng; that is, they reported no other freshwater exposure during their visit to Laos. However, because of lack of species-specific serology and the inability to find Schistosoma ova in these patients’ stool samples, we can not determine which Schistosoma spp. caused their infection.

Most of these patients were infected during February–April, Mekong’s early low-water period, indicating a seasonal infection pattern similar to that of local populations (5). The increased risk of schistosomiasis during the late dry season should be conveyed to travelers during pretravel consultations.

Our observation of Schistosoma infection in the 4 travelers exposed exclusively in Vang Vieng has several limitations. First, the diagnosis was based on positive serology and not on ova detection. Cross-reactivity of nonhuman Schistosoma spp. with S. japonicum in serologic studies (e.g., S. sinensis or S. ovuncatum) could have caused seropositivity in our patients. Second, these 4 travelers (Table 1, patients 9–12) have visited other areas in Asia known to be Schistosoma endemic (China) or suspected to be (Vietnam, Nepal). Although travelers were thoroughly questioned regarding possible freshwater exposures, they may not have recalled minor exposures. Finally, we found no published malacologic surveys of the Vang Vieng area, and most experts regard this area as free from N. aperta, the intermediate host of S. mekongi.

In other world regions (e.g., Lake Malawi in Africa), Schistosoma-infected travelers have served as sentinels alerting local authorities to previously unsuspected foci of transmission (14). The cases of schistosomiasis in travelers thought to be exposed only in northern Laos, an area where dam building may have changed local conditions, mandates a systematic reevaluation of S. mekongi distribution in Laos.

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Dr Leshem is a fellow in infectious diseases at The Chaim Sheba Medical Center. His interests include travel and tropical medicine.

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Address for correspondent: Eli Schwartz, Center of Geographic Medicine, The Chaim Sheba Medical Center, Tel Hashomer 52621, Israel; email: elischwa@post.tau.ac.il

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