The infectious diseases implications of the "Lost Boys and Girls of Sudan"

JM Conly MD[1], BL Johnston MD[2]

The "Lost Boys and Girls of Sudan" represent survivors of the longstanding Second Sudanese Civil War that occurred between 1983 and 2005 (1,2). This civil war broke out between the northern and southern regions of Sudan in 1983, and had a devastating impact on the rural population of many Sudanese who became either internally displaced or refugees (1). As the warring factions of the ruling Sudanese government and the Sudanese People's Liberation Army moved throughout Sudan, villages were raided, homes destroyed and an estimated two million people were killed. The conflict left in its wake some 26,000 displaced children (both boys and girls) and young adults who departed on an epic journey of survival and refuge across several countries. They were largely forgotten by the outside world and became known as the "Lost Boys and Girls of Sudan". Over the course of several years, these children and young adults walked throughout Sudan into Ethiopia and later to Kenya or Egypt (1,2). The journey was perilous and a human tragedy unfolded, with an estimated 10,000 of these youngsters perishing from hunger, disease or the travesties of war. Eventually, these children and young adults arrived at various refugee camps in Egypt or in western Kenya in the early 1990s (3). The United Nations High Commission for Refugees arranged to send thousands of Lost Boys and Girls overseas to start a new life, with many coming to countries such as the United States (US), Canada and Australia. The US resettled approximately 3800 Lost Boys and Girls from 2000 to 2001 and others entered the US through other resettlement channels; current estimates are that approximately 3800 to 5000 Lost Boys and Girls are currently living in the US (3). As of 2005, more than 600 Lost Boys and Girls had arrived in Canada, with almost one-half of them settling in western Canada. Winnipeg is reported to be home to over 200 of these refugees (4,5). The Lost Boys and Girls who survived have formed a mutual aid bond that transcends all ethnic, tribal and religious backgrounds. Recent epidemiological investigations have highlighted the high prevalence of certain parasitic infections that would be expected to be endemic to individuals from the horn of Africa. Given the numbers of such refugees in Canada, it was considered timely to provide an update on these studies and recommendations for the management of these individuals.

Many persons in developing countries are infected with *Schistosoma* species and *Strongyloides stercoralis*, parasitic infections that can persist for years and cause significant morbidity (6,7).

Many complications from these infections may occur, including organomegaly, portal hypertension and urinary tract dysfunction with *Schistosoma* infections; diarrhea and disseminated infection with *Strongyloides* infections; and chronic intestinal disease and anemia with either of them (6,7).

During a recent reunion in Arizona, the Centers for Disease Control and Prevention (CDC) conducted an epidemiological investigation of schistosomiasis and strongyloidiasis among the Lost Boys and Girls of Sudan cohort using serological techniques (8). The ELISA test for schistosomiasis is 99% and 90% sensitive in detecting antibodies to *Schistosoma mansoni* and *Schistosoma haematobium*, respectively, and the ELISA test for strongyloidiasis is 95% sensitive for detecting antibodies to *S stercoralis* (9,10). These serological tests are considered to have much greater sensitivity and specificity than stool tests for either schistosomiasis or strongyloidiasis and urine tests for *S haematobium*. Both these tests are available only at the CDC and no locally available serological tests for schistosomiasis or strongyloidiasis have equivalent known reliability.

A total of 462 of this cohort were tested, with 44% (n=203) testing positive for schistosomiasis and 46% (n=214) testing positive for strongyloidiasis (8). In total, 69% (n=315) were seropositive for either schistosomiasis or strongyloidiasis and 22% (n=103) of the cohort were seropositive for both schistosomiasis and strongyloidiasis. Immunoblot testing was performed on 21 randomly selected ELISA-positive persons, with 12 found to be positive for *S mansoni*, two for *S haematobium*, four positive for both and three negative for either species (8).

Given the high seroprevalence of schistosomiasis and strongyloidiasis among this cohort, and to prevent future morbidity from these diseases, the CDC recommended presumptive treatment for both (8). Additionally, all members of the Lost Boys and Girls of Sudan and other refugees from similar circumstances who have resettled in the US have been recommended to receive presumptive treatment for schistosomiasis and strongyloidiasis.

The previous policy of using presumptive treatment consisting of a single 600 mg dose of albendazole for US-bound African refugees, based on the results of previous studies of African refugees, was not considered effective and new treatment guidelines were issued (11,12).

These new treatment recommendations include both predeparture and postarrival presumptive treatment protocols, representing modifications to the previous recommendations. The primary modifications to the previous predeparture presumptive intestinal parasite treatment for Sudanese refugees include the recommendation for adequate treatment for schistosomiasis and strongyloidiasis, and the administration of postarrival presumptive treatment among Sudanese refugees who did not receive predeparture treatment (11,12).

[1]*Departments of Medicine, Pathology and Laboratory Medicine, and Microbiology and Infectious Diseases, University of Calgary, Calgary, Alberta;* [2]*Queen Elizabeth II Health Sciences Centre and Dalhousie University, Halifax, Nova Scotia*

Correspondence: Dr JM Conly, Departments of Medicine, Pathology and Laboratory Medicine, and Microbiology and Infectious Diseases, University of Calgary, Calgary, Alberta. Telephone 403-944-8222, fax 403-944-1095, e-mail John.Conly@CalgaryHealthRegion.ca

Received and accepted for publication May 20, 2008

Current recommendations include the treatment for schistosomiasis with praziquantel (40 mg/kg divided in two doses administered 6 h to 8 h apart) for the Lost Boys and Girls of Sudan and also the Somali Bantu refugee group. Strongyloidiasis in the Lost Boys and Girls of Sudan should be treated with albendazole (400 mg twice per day for seven days) whereas in the Somali Bantu refugees, it should be treated with ivermectin (200 mg/kg per day on two consecutive days). Ivermectin is considered the drug of choice for treatment of strongyloidiasis, but the CDC did not recommend this drug for for strongyloidiasis in Sudanese refugees because of concerns about potential concurrent Loa loa infection (11,12). Persons with high levels of Loa loa microfilaremia may have a life-threatening encephalopathic reaction if treated with ivermectin and, consequently, the CDC recommended that ivermectin should not be given to Sudanese refugees unless Loa loa microfilaremia was ruled out.

There is no reason these recommendations should not apply to the Canadian setting. Infectious diseases physicians need to be reminded of the importance of screening for both schistosomiasis and strongyloidiasis and their subsequent treatment in newly arrived immigrants, especially as the number of refugees emigrating to Canada from the horn of Africa increases (13).

REFERENCES

1. Lost Boys of Sudan. <www.lostboysfilm.com> (Version current at May 12, 2008).
2. American Red Cross. Lost and Found: Orphaned Sudanese Refugees Come to America. <www.redcross.org/news/in/africa/0108lostboyspage.html> (Version current at May 12, 2008).
3. Centres for Disease Control and Prevention. Recommendations for presumptive treatment of schistosomiasis and strongyloidiasis among the Lost Boys and Girls of Sudan. <www.cdc.gov/ncidod/dq/refugee/lostboysandgirlssudan/presumptive_tx_recc.htm> (Version current at May 12, 2008).
4. CBC.ca Manitoba. Sudan's Lost Boys. <www.cbc.ca/manitoba/features/sudan/> (Version current at May 12, 2008).
5. Lost Boys and Girls of Sudan in Calgary – updates 11/27/2007. <www.ourstory.com/thread.html?t=296237> (Version current at May 12, 2008).
6. Ross AG, Bartley PB, Sleigh AC, et al. Schistosomiasis. N Engl J Med 2002;346:1212-20.
7. Siddiqui AA, Berk SL. Diagnosis of *Strongyloides stercoralis* infection. Clin Infect Dis 2001;33:1040-7
8. Posey DL, Blackburn BG ,Weinberg M, et al. High prevalence and presumptive treatment of schistosomiasis and strongyloidiasis among African refugees Clin Infect Dis 2007;45:1310-5
9. Tsang VC, Wilkins PP. Immunodiagnosis of schistosomiasis. Immunol Invest 1997;26:175-88.
10. Loutfy MR, Wilson M, Keystone JS, Kain KC. Serology and eosinophil count in the diagnosis and management of strongyloidiasis in a non-endemic area. Am J Trop Med Hyg 2002;66:749-52.
11. Centers for Disease Control and Prevention. Division of Global Migration and Quarantine, 2005. Recommendations for presumptive treatment of schistosomiasis and strongyloidiasis among the Lost Boys and Girls of Sudan. <www.cdc.gov/ncidod/dq/lostboysandgirlssudan/updated_presumptive_tx_recc_061305.htm> (Version current at May 12, 2008).
12. Centers for Disease Control and Prevention. Division of Global Migration and Quarantine, 2005. Recommendations for presumptive treatment of schistosomiasis and strongyloidiasis among the Somali Bantu refugees. <www.cdc.gov/ncidod/dq/somali_bantu/presumptive_tx_reccs_061305.htm> (Version current at May 12, 2008).
13. Keystone JS. Can one afford not to screen for parasites in high-risk immigrant populations? Clin Infect Dis 2007;45:1316-8.