

RESEARCH NOTE

AN EPIDEMIOLOGICAL INVESTIGATION OF CONGENITAL *SCHISTOSOMA JAPONICUM* TRANSMISSION IN HUBEI PROVINCE, PR CHINA

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Abstract. A cohort study was conducted in Hubei Province, China, following serious flooding of the Yangtze River in the autumn of 1998 to investigate the possibility of congenital transmission of *Schistosoma japonicum* in humans. The cohort investigated was comprised of 205 women and their 208 infants born between 1 September and 30 December 1998. Blood and fecal samples from all the women and their infants were collected and examined for *S. japonicum* infection. Positive specific antibody titers were found in 14 (6.8%) of the mothers, but no fecal egg excretion was observed. All infants had negative specific antibody titers and no *S. japonicum* eggs were found in their feces. Hence, the present study could not confirm congenital *S. japonicum* transmission in humans. Further studies are highly wanted to study the impact of prenatal exposure of *S. japonicum* on the offspring.

Schistosoma japonicum primarily infects its host via the skin. However, alternative routes may exist and some researchers have suggested the likelihood of congenital *S. japonicum* infections. In Japan Narabayashi (1914) recovered young schistosomes from newborn dogs, rodents and rabbits whose mother had been experimentally infected while pregnant. In 1916, the same author found *S. japonicum* eggs in the feces of newborn children with no history of water contact, but whose mothers had a history of possible exposure to *S. japonicum* during pregnancy (Narabayashi, 1916). Decades later, Kikuchi (1957) demonstrated congenital infections in two goat kids, born by mothers experimentally infected during, late gestation. The Japanese findings have been supported by Chinese studies (Wang, 1959) in which adult schistosomes

were recovered from aborted calf fetuses and *S. japonicum* eggs were found in feces from newborn calves and water buffalos. More recently, Willingham (1999), have demonstrated congenital transmission of *S. japonicum* in Danish cross-bred pigs. They infected 3 sows with approximately 9,000 cercariae of a Chinese isolate of *S. japonicum* in mid-to late-pregnancy (10th week of gestation). All 26 piglets born to the sows were found to harbor viable adult schistosomes and *S. japonicum* eggs were recovered from both the piglets' feces and livers. Systematic human field studies addressing the issue of congenital transmission have not to our knowledge been reported. As a consequence of the serious increase in human exposure to schistosome-infested water due to the flooding of Yangtze River in the summer of 1998, it was decided to investigate the possibility of congenital transmission among pregnant women and their infants in Yanxin county, Hubei Province.

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An area of 707.41 km² around Fu River and lakes in Yangxin County, Hubei Province was chosen as the study area, as this area was severely affected by the floods in 1998. The total population of the area was 68,209 people. The schistosomiasis infection rate was 16.5% in the region based on a national wide sampling survey conducted in 1997. A total of 208 infants (136 boys and 72 girls) born between September 1 and December 31, 1998 and their mothers were investigated, as these mothers had been in mid-to late-pregnancy (6-9 months gestation) during the flooding of the Yangtze River. The mothers (205 women with 3 twin births) were between 19 and 35 years old at the time of the study. A simple questionnaire was used to obtain information about the mother's occupation, water contact during pregnancy, progression of the pregnancy and history of *S. japonicum* infection.

In May 1999, blood and fecal samples were collected from the study population. Blood samples were collected on filter paper from the heel of the infants and the ear of the mothers. Antibody detection by IHA and ELISA was performed according to the method by Bergquist (1992). For fecal examination, 5g stool samples were obtained and analyzed as described by Shi *et al* (1990).

Of the 205 women examined, 180 (88%) were farmers, 4 (2%) were fishermen and 21 (10%) had other occupations. Contact with infested water was reported by 147 (71.7%) of the pregnant women. Thirty-six women had a history of schistosomiasis for which they had been treated with praziquantel. All women were found to be negative with regard to fecal *S. japonicum* egg excretion. Positive antibody titers were found in 14 mothers (6.8%).

Of the 208 infants examined, 19 (9.1%) were delivered prematurely. No *S. japonicum* eggs were found in any of the children's stool samples. Neither did any of the children have positive antibody responses to *S. japonicum* when examined with IHA and ELISA.

The present study did not find evidence of congenital *S. japonicum* infections in in-

fants born by possibly exposed mothers. However, the negative result does not rule out the possibility of the congenital route of infection in humans. Limitations in the present study included: knowledge about the mother's actual exposure to infested water during pregnancy, infection status of each woman at the time of pregnancy and inclusion of a sensitive circulating antigen test. As pregnant women are often excluded from hard fieldwork during mid-to late-pregnancy, the chances of them being exposed are obviously reduced. Hence, it cannot be ignored that, although nearly 72% of the mothers reported to have had contact with infested water, they may not have been exposed to cercariae at all. The infection status of the mothers was not known and, although praziquantel treatment is frequently used, it can not be excluded that some of these women had a low-grade infection, which would have prevented the establishment of a challenge infection. Also, the level of resistance among the women at the time of possible exposure was unknown but it is a very important factor. The relative low number of serum positive mothers (6.8% tested in 1999 after the flooding) compared to the average for the area (16.5% tested in 1997 before the flooding) does not indicate an increased transmission of schistosomiasis among the study population during the time of flooding. None of the examined children excreted schistosome eggs. However, although 5g stool was examined, the chance of missing eggs in a single sample especially in light infections is very high (de Vlas and Gryseels, 1992). Also, the possibility of single sex infections, which have been observed in congenital rabbit and pig studies (Qian *et al*, 2000; Johansen, personal communication) would not be detected by fecal egg examination. The serological tests of the infants were also all negative. However, it cannot be precluded that the infants would develop some kind of tolerance towards *S. japonicum* by obtaining the infection *in utero*, and would thus not raise an antibody response. Hence, a sensitive antigen test would be wanted for more conclusive results.

To assess whether congenital infection

with *S. japonicum* does occur more, controlled cohort studies are needed. However, such studies would not be accepted due to ethical considerations, thus descriptive cross-sectional studies in humans supported by experimental animal studies are the only acceptable alternatives. A recent parasitological survey of Chinese children aged 0-4 years showed schistosomiasis prevalence ranging between 1.8-9.3%, which suggests that congenital transmission may occur (Xie *et al*, 1996). However, the consequence of being infected with *S. japonicum in utero* or the offspring being exposed to the parasite antigen during pregnancy are unknown parameters at present which clearly deserve further investigations as this information could be essential for developing effective control programs.

This work was partly financed by the Danish National Research Foundation. We highly appreciate the help from Hangchi Institute of Schistosomiasis Control and Yangxin Institute of Schistosomiasis Control.

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