Parasitol Res
DOI 10.1007/s00436-007-0588-6

SHORT COMMUNICATION

A pilot screening of prevalence of atopic states and opisthorchosis and their relationship in people of Tomsk Oblast

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Received: 26 February 2007 / Accepted: 14 May 2007

Abstract The study was aimed to estimate the relationship between the prevalence of allergic disease and helminth invasion by the trematode *Opisthorchis felineus* in rural and urban populations of Tomsk Oblast (West Siberia, Russia). Two hundred and one people from Kargasok village of Tomsk Oblast and 196 from the city of Tomsk were screened for the presence of atopy and *O. felineus* invasion. Opisthorchosis was found in 66 participants (32.8%) from Kargasok and in 22 people (11.2%) from Tomsk. Atopic diseases were more common in the urban population than in the rural: 52.8 and 31.4%, respectively. Positive skin-prick tests were significantly higher in the urban population than in rural people: 83.2 vs 24.4%, respectively. It was found that in the city, the presence of antibodies to *O. felineus* negatively correlates with the atopic sensitization by skin-prick tests. However, in the village, opisthorchosis was positively associated with atopic diseases. The data obtained confirm the negative association of rural lifestyle and atopic diseases prevalence and indicate that *O. felineus* invasion might be a modifying factor of this relationship in Tomsk Oblast.

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Introduction

It is supposed that helminth infection can influence significantly the epidemiological portrait of atopic diseases, especially in endemic regions, modifying the prevalence of allergy because many helminthes induce Th2 immune response associated with atopy, but they can also protect against atopy due to stimulation of IL-4-dependant polyclonal IgE synthesis and the saturation of FcεRI receptors on mast cells (Godfrey and Gradidge 1976; Yazdanbakhsh and Matrikardi 2004).

Opisthorchis felineus is a parasitic worm (type *Plathyhelmintha*, class *Trematoda*, family *Opisthorchiidae*) causing opisthorchosis—primarily liver infection in endemic areas. Its major region of distribution is in the Ob-Irtisch river basin running from the south to north of West Siberia land (Russia). People in this area are being infected by the *O. felineus* through the eating of fresh or undercooked fish, the intermediate host of the helminth. The use of fresh or frozen uncooked fish is a general practice of native Siberian populations (e.g., Northern Khants) and pretty common in immigrants (e.g., Russians) especially in rural settlements. The prevalence of opisthorchosis in aboriginal Siberian people is estimated to be 75–80%, a percentage which is 100–1,000 times higher than in the European part of Russia (Bronshtein 1985; Bronshtein and Beer 1988; Bronshtein et al. 1989; Sripa 2003). However, in immigrants to Siberia, the prevalence of opisthorchosis is not determined correctly due to the absence of special screening programs.

Our recent investigations had shown that opisthorchosis invasion modifies allergic diseases course (unpublished), and we supposed that the *O. felineus* invasion can influence the epidemiological face of allergic disorders in West Siberia. Therefore, we performed the pilot study presented

herein which aimed to estimate the prevalence of this infection among the immigrated people in rural and urban areas of Siberia and to reveal the correlation between opisthorchosis and allergic diseases.

Materials and methods

The study was performed by the cross-sectional sample-based method. A total of 397 volunteers aged between 6 and 60 years were studied (Table 1).

The rural sample, comprising of 201 school children (mean age 12.1±3.4 years; 43.3%, males; 56.7%, females), was collected in Kargasok village, an endemic center of opisthorchosis located in the Ob riverbed. Officially, opisthorchosis is clinically diagnosed in 25‰ of Kargasok's citizens. The general population of Kargasok is approximately 8,500 people. River fish is a traditional foodstuff there, and fishing is a major kind of trading.

The urban population was sampled in the city of Tomsk, the capital of Tomsk Oblast. It is located on the river Tom, a confluent of the Ob. Tomsk is a contemporary city with typical European-like lifestyle and a population of approximately 510,000 people. According to official statistics, the prevalence of opisthorchosis in Tomsk is about 15‰. One hundred and ninety-six people were studied (30.2± 12.9 years; 17.3%, males; 82.7%, females).

Clinical and allergological anamnesis were collected from all participants. Skin-prick testing for 20 common domestic, animal, pollen, and food allergens was performed using standard kits by "Biomed" (Moscow, Russia) according to the manufacturer's recommendations. Stool samples were collected and analyzed microscopically in at least three replicates to reveal *O. felineus* eggs. Circulating immune complexes, IgM, and IgG antibodies to *O. felineus* in the serum of the participants were determined by the immune-enzyme assays using the following kits "D-2952 Tiatop-strip", "D-2954 Opisthorchis-IgM-strip", and "D-2956 Opisthorchis-IgG-strip" by "Vector-Best" (Novosibirsk, Russia) according to the manufacturer's recommendations. Diagnosis of opisthorchosis was stated in the case of detection of either eggs in stool or antibodies to *O. felineus* or both.

Pearson's χ^2 with Yates' correction for continuity or Fisher's exact test, when appropriate, were used to compare the prevalence of signs studied in different samples. Mann–Whitney *U* test was applied to compare quantitative measures. Spearman's rank order *R* was used to estimate correlation between atopic signs and the presence of antibodies to *O. felineus* (van Belle et al. 2004).

The protocol of the study was approved by the Ethical Committee of the Siberian State Medical University and agreed with the Health-Care Department of the Administration of Tomsk Oblast. The objective and protocol of the study were explained to all participants or parents of child participants, and informed consents were obtained. Adequate treatment and clinical recommendations of opisthorchosis and allergic diseases were offered to those patients who required it.

Table 1 Characteristics of the studied rural (Kargasok) and urban (Tomsk) populations

Characteristics		Kargasok, *n*=201	Tomsk, *n*=196	*p* value
Men/women		87/114	34/162	3.7E-8
Mean age ± SD		12.1±3.4	30.2±12.9	<0.001
Prevalence of opisthorchiasis (%)	General sample	32.8	11.2	4.1E-7
	Age before 15	31.5	17.4	0.254
	Age older 15	38.5	10.4	3.8E-5
Prevalence of atopic diseases (%)	All	31.3	52.6	2.9E-5
	Bronchial asthma	10.9	7.1	0.253
	Atopic dermatitis	12.4	16.8	0.272
	Allergic rhinitis	13.4	43.3	2.6E-10
	Urticaria, Quincke's edema	1.0	4.1	0.100
Prevalence of atopic sensitization by skin-prick testing (%)	All	24.4	83.2	1.8E-27
	Food (fish, chicken egg, cow milk)	4.5	1.0	0.062
	Dust (house dust mite, library dust)	1.0	4.6	0.034
	Epidermal (cat's and sheep's hair, horse's dandruff)	4.0	0.0	0.007
	Pollen	7.5	7.7	0.906
	Polyvalent	7.5	57.6	3.3E-26

The diagnosis of opisthorchiasis was stated by stool microscopy and immune-enzyme assays for antibodies to *Opisthorchis felineus* in serum of peripheral blood. Pearson's χ^2 test with Yates' correction for continuity or Fisher's exact test when appropriate and Mann–Whitney *U* test were used to compare qualitative and quantitative measurements, respectively.

Results and discussion

To reveal the prevalence of *O. felineus* invasion in immigrated people of Siberia, we studied Russians from urban (Tomsk) and rural (Kargasok) populations of Tomsk Oblast. As the samples of the study were different with respect to age, we compared the prevalence of the invasion between the whole groups and between the subgroups split by the age under 15 years and older.

On the whole, opisthorchosis was more common in Kargasok than in Tomsk (Table 1). The prevalence in women was 9.2% in the city and 37.7% in the village; in men, it was 20.6 and 26.4%, respectively. No significant differences in the prevalence of infection were found in subgroups of children under 15 years; however, in older people, opisthorchosis predominated in the rural population (Table 1), suggesting that the disease risk is age-dependant. Notably, the real prevalence of opisthorchosis obtained by the random screening is at least ten times higher than that according to the official data both in rural and urban populations.

Among the patients from the rural population, 43 opisthorchosis cases were found by stool sample analysis. In more than a half (25 people), the diagnosis of opisthorchosis was stated for the first time. In the city group, stool sample analysis revealed seven opisthorchosis cases (six for the first time). According to the medical records, the helminth eradication was applied previously in 27.3% of city patients and in 31.8% of village patients with current opisthorchosis; therefore, the reinvasion was found.

In 33.3% of rural opisthorchosis patients, the disease was already diagnosed in relatives, highlighting a family character of *O. felineus* infection, probably due to dietary preferences and traditions.

The majority of opisthorchosis patients from Kargasok confirmed the use of river fish for food (97.0%), infatuation with fishing (92.4%), and absence of the separate kitchen furniture for fish handling (75.8%). Mean thermal cooking time of fish was 15–25 min. In most of the families from the village area, fresh, frozen, and dried fish eating was allowed. In the Tomsk population, only 68.2% of opisthorchosis patients used river fish for food; fishing was a hobby in 32.8%. Thermal cooking time was 25–35 min, and few people ate uncooked fish.

The prevalence of allergic diseases was found to be significantly higher in the urban population than in the rural (Table 1). This difference was because of significant excess of allergic rhinitis in Tomsk as compared to Kargasok.

Specific sensitization by skin-prick testing was more common in the city than in the village (Table 1). The pattern of the cause of the sensitization was different in Tomsk and Kargasok. In people from Kargasok, isolated food and epidermal sensitization was more common, while in Tomsk, dust and polyvalent sensitization predominated. Allergic testing revealed sensitization in 22.9% of city and 10.5% of village inhabitants without any clinical manifestation of atopic diseases.

In rural patients suffering from opisthorchosis, the prevalence of allergic diseases was almost 1.6-fold higher than in non-infected people: 40.9 and 26.1%, respectively ($p=0.036$). In the city inhabitants, this discrepancy was not significant: 54.5 and 52.6%, respectively ($p=0.999$). Moreover, in the urban population, no significant correlation was found between the presence of antibodies to *O. felineus* and atopic diseases; however, in the rural sample, there was a trend of significant correlation between these parameters: Spearman's rank order R composed 0.175 ($p=0.055$). However, in Tomsk, but not in Kargasok, the presence of antibodies to *O. felineus* negatively correlated with specific atopic sensitization by skin-prick testing: Spearman's R composed -0.190 ($p=0.043$). The discrepancy in the character of association between the helminth invasion and atopic states in rural and urban populations cannot be explained at this level of study. Possibly, the dose of helminth invasion is significant because it is reasonable that its level is higher in village people. The significance of helminth invasion levels for atopy manifestation has been shown for *Ascaris lumbrocoides* infection (Mao et al. 2000).

Conclusion

This study was aimed to establish the real *O. felineus* infection rates and its relationship with atopic disease prevalence in endemic region of West Siberia. We found that this helminthiasis is more common in the rural area of Tomsk Oblast than in the urban. It was obtained that the prevalence of opisthorchosis is tenfold higher than suggested by the official statistics based upon applications of medical aid. We showed that the prevalence of atopic disease and specific sensitization prevalence is significantly higher in the rural than in the urban area of Tomsk Oblast, confirming the assumption of "hygiene hypothesis" (Strachan 1989). However, we found that *O. felineus* infection was associated with atopic disease in rural but not urban citizens. At the same time, the presence of antibodies to *O. felineus* negatively correlated with specific sensitization in urban population. This suggests that opisthorchosis can modify the risk of atopic states, but the character of its influence varies in rural and urban people probably because of the difference in the invasion levels. This hypothesis needs to be clarified further in expanded samples and with the use of more sensitive tools for *O. felineus* screening which allow precise measurement of the infection intensity. Currently, such a tool based upon real-time polymerase chain reaction is under development.

Acknowledgment This paper is supported in part by the grant of INTAS 05-1000004-7761 «Genetic links between infectious diseases and atopic disorders» and by the European Commission as part of GABRIEL (a multidisciplinary study to identify the genetic and environmental causes of asthma in the European Community), contract number 018996 under the Integrated Programe LSH-2004-1.2.5-1 "Post genomic approaches to understand the molecular basis of asthma aiming at a preventive or therapeutic control".

The protocol of the study was approved by the Ethical Committee of the Siberian State Medical University and agreed with the Health-Care Department of the Administration of Tomsk Oblast.

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