

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Circulation Of Zoonoses In Anthropogenic Ecosystems At Sumy Region.

TI Fotina¹, HA Fotina^{1*}, S M Nazarenko¹, OV Fotin¹, MD Chemych², NI Ilina², and VV Ilina².

¹Sumy National Agrarian University.

²Sumy State University.

ABSTRACT

In Ukraine, Sumy region, the largest endemic cell of opisthorchiasis was formed after Ob-Irtysh in Russia. The region has four types of opisthorches: *Opisthorchis felineus*, *Pseudamphistomum truncatum*, *Metorchis bilis* and *Metorchis xanthosomus*. It was established that the cells of opisthorchiasis in the conditions of the investigated area are tied primarily to small rivers. There are 5 types of carnivorous mammals in the wilderness in the natural ecosystems of Sumy region. In the anthropogenic cells, the leading role in the circulation of oppression is played by domestic cats. It is established that opisthorchity is dominant in terms of contamination and accumulation of metacercarys of 3 species of carp fish: gossip, redhead and stick. Opisthorchiasis in humans runs mainly latently. Among the manifested forms of illness most often is chronic opisthorchiasis, the decisive role in the diagnosis of which has coproscopy (100 %). The risk group consists of fishermen and members of their families (71,9 %). The main transmission factor is salt and dried fish.

Keywords: opisthorchiasis, opisthorchis, carp, bitini mollusks.

**Corresponding author*

INTRODUCTION

Opisthorchiasis is extracase naturally-focal biogelmintosis which caused by trematodes of the Opisthorchidae family and it is characterized by a polymorphism of clinical signs due to the parasitization of these helminths in the biliary ducts of the liver and ducts of the pancreas and a long course [1]. The disease is widespread in Sumy region, due to the peculiarities of the hydrological regime in the region where there is a large number of rivers in the Dnipro Basin (Desna, Psel, Vorskla, Sula, Sejm), lakes, and open water reservoirs. This is the second largest natural center in the world after the Ob-Irtys River in Western Siberia and East Kazakhstan. Opisthorchiasis refers to uncontrolled infections. According to official statistics, about two thousand people are invaded in Sumy region. There is an infection of pets, especially cats. Currently more than 30 species of defining masters, including animals, birds and humans, are registered [2, 3, 4, 5]. In Sumy region, there are 4 types of opisthorchites with significant epidemiological and epizootic significance: *Opisthorchis felineus*, *Pseudamphistomum truncatum*, *Metorchis bilis* and *Metorchis xanthosomus* [1, 2, 3]. The first two are pathogenic to humans. Taking into account the given data, opisthorchiasis is an actual and important medical, veterinary and environmental problem.

The purpose of the work is to investigate the ecological and biological features of circulation of opisthorchiasis in the conditions of the Dnipro basin (the Psel, Vorskla, Seym, Sula, Desna) in Sumy region, to find out the parameters of the epidemic process, to analyze the morbidity of the population for opisthorchiasis and to identify the main clinical and diagnostic signs of an illness.

MATERIALS AND METHODS

To determine the morbidity of Sumy region for opisthorchiasis, it is used the reporting documentation of the Duma "Sumy Regional Laboratory Center of the State Medical Service of Ukraine" and the medical cards of inpatient patients (003/o), which were treated at Sumy Regional Clinical Infectious Diseases Hospital named after Z. Krasovitsky. The criteria for diagnosis was the detection of eggs in the feces and / or duodenal contents. The degree of invasion was determined by the number of eggs found in 1 g of feces, and was distributed as follows: minimum invasion - up to 20 eggs, medium - 20-50, high - more than 50. The ELISA method was used to detect antibodies to antigens of helminths. Epidemiological history and increase in the content of eosinophils in the blood were also taken into account. It was investigated 17 heads of predatory animals (fox, stone marten, ruby of forest, mink American and domestic carnivores - dogs and cats) by the method of complete helminthic autopsy [6]. Materials for research were provided by hunters, as well as obtained by regulating the number of homeless animals in several areas of Sumy region. About 300 specimens of 5 species of carp fish have been investigated. The fish were examined by a compressor method under a microscope MBS-10 (an increase of 8-16 \times). To determine the number of indicators (infection index) counted the number of metacercarys opisthorchite in the muscle tissue of fish. It was used index of infection, intensity and extensiveness of the invasion to assess larvae and adult forms of opisthorchy. Statistical processing of data was carried out according to generally accepted methods.

RESULTS AND DISCUSSION

The epidemic situation with opisthorchiasis in the area is difficult. The number of patients found during the last 5 years is 64 % of the total number in Ukraine. The incidence of opisthorchiasis in Sumy region is 22-25, 6 times higher than the average in Ukraine. There is an increase in the incidence from 6,9 per 100 thousand population in 2000 to 25.1 per 100 thousand population in 2017 (in Ukraine 0,856 per 100 thousand population) (Fig. 1).

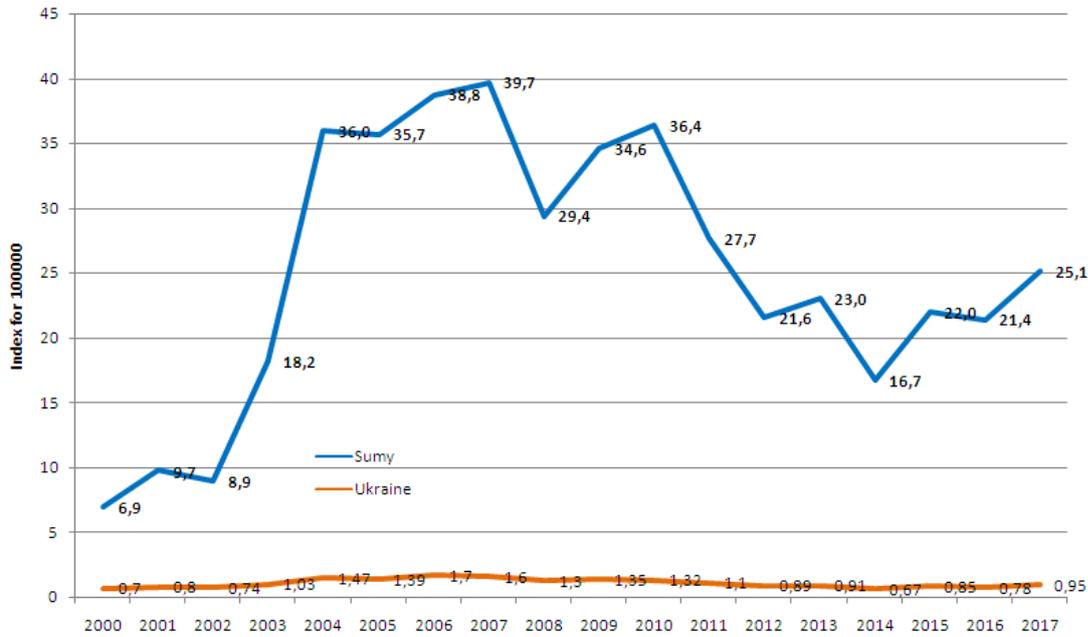


Figure 1: Index of morbidity of opisthorchiasis in 2000-2017

Opisthorchiasis is registered in 13 of 18 districts of Shostka, Romny, Konotop, Sumy region. In 2017, for the first time, 271 patients were diagnosed, including 17 children. The most invasive (77 %), as in previous years, was found in Shostka and Shostka districts. It was found the high invasiveness of the population by opisthorches in the Buryń, Yampil, V-Pysariv, Krolevets, Nedrigailivsky, S.-Budsky and Glukhiv districts. The level of morbidity in these areas is 4-7 times higher than the average oblast and approaches the most intense cells of Western Siberia in Russia. However, this statistics reflects only a part of the actual morbidity of opisthorchiasis, since indigenous people in the cells of the invasion, as well as often young people, have a latent course of the disease [7]. The presence of sources of opisthorchiasis and their territorial distribution in Sumy region are tied to fresh water bodies, primarily small rivers. The functional stability of the sources is conditioned by the presence of the necessary chains that take part in the life cycle of the opisthorchite: intermediate hosts - bivalve mollusks (first intermediate hosts) and carp species (second intermediate owner) and defining hosts. Ribs are an important epidemiological and epizootiological chain - a source of infection of the defining hosts, whose organisms develop adult forms (mariti) of the parasite. The latter are localized, usually in the biliary ducts of the liver, in the gall bladder, occasionally in the pancreas. Among the defining hosts, the key role in the circulation of opisthorchia is played by wild carnivorous animals living near the water: mink, otter, river beaver, fox (Figure 2). It has been established that the infection of mink and otter reaches the maximum values. It should be noted that in most of the infected wild animals in the liver, as a rule, two types of oppression were found: *O. felineus*, *P. truncatum*.

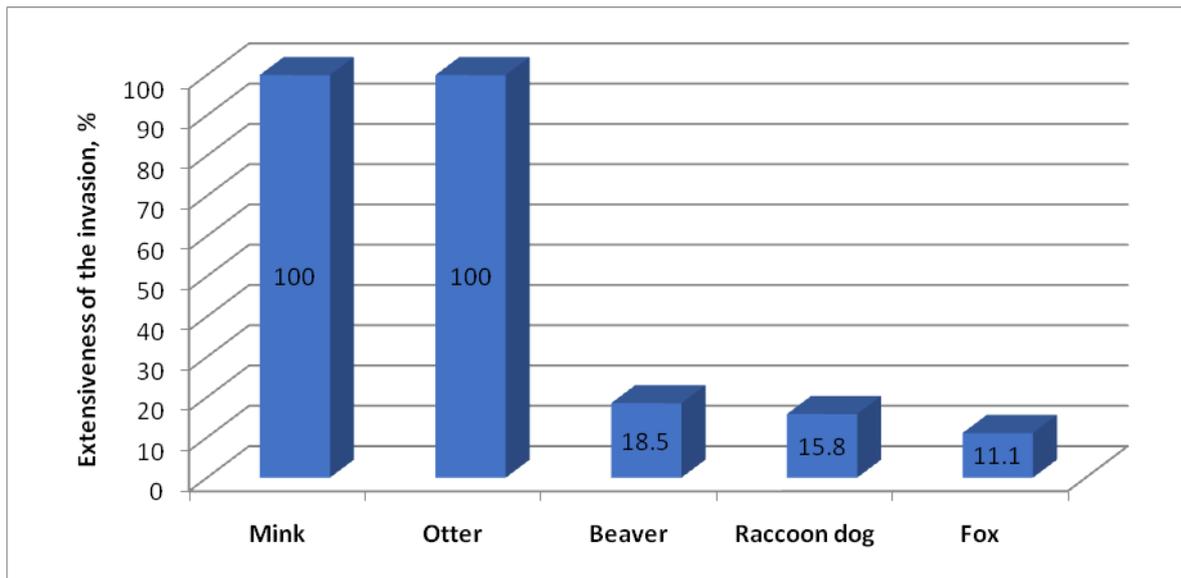


Figure 2: Infection of the defining hosts by opisthorches in the natural conditions of Sumy region

It was unexpected the discovery of *O. felinus* in a river beaver, which for the first time in Sumy region was registered as a new definitive owner of this parasite. The extraordinary nature of this fact lies that beaver is considered to be an exclusively herbivorous animal. And the infection of the defining host *sopisthorchidah* occurs during eating carp fish which is having a viable metacercary. It can be assumed that in certain periods of life (seasons of year) beavers can eat fish. According to the results of research, relatively high indicators (at 18,5%) of *O. felinus* beans infection in the *P. p.* System were detected, indicating the important role of the beaver in maintaining the circulation of opisthorchia in the natural environment. Infestation of foxes by opisthorches in natural conditions is small (11.1%). But the ecological value of fox in the circulation of this parasite must be associated with its relatively high numbers in Sumy region. In anthropogenic ecosystems (settlements near reservoirs), cats and humans play a leading role in the circulation of opisthorchiosis. In settlements near the reservoirs - small and medium-sized rivers, where cats constantly ate fish caught in local water bodies (Vorskla, Sejm, Desna, Psel, Sula), the invasiveness of their marits oppression ranged from 44% to 95.7%. According to the results of this study, 3 types of opisthorchia were found in cats: *P. truncatum*, *O. felinus*, *M. bilis*. Frequently *P.*

Truncatum was registered - 66.7%, at least two other species: *O. felinus* and *M. bilis* – 33,3 %. The intensity of invasion by three types of oppression was 48,6, including *P. truncatum* – 29,1, *O. felinus* – 17,3 and *M. bilis* – 2,3. So, the results of researches of the definitive owners prove that in the natural conditions of Sumy region, the key role in the circulation of oppression is played by wild predatory animals living near the reservoirs, among which the mink is dominant. But in some reservoirs of the Dnipro basin in the region, the beaver has a significant role in the circulation of these parasites. In anthropogenic ecosystems a leading role in the circulation of opisthorchitis is played by the domestic cat. The first intermediate hosts of opisthorchity are mollusks of bithynia, which have a large number in the rivers of Sumy region. Their invasion of the partners is optimism from 2 % to 10 %. Carp species of fish - the second intermediate (additional) owner and obligatory chain link in the life cycle opisthorchity. More than 30 species of carp are the source of contamination by the opisthorids of the definitive masters, especially human [3, 4]. According to our data, in the territory of Sumy region, 9 species of carp fish are registered as the second intermediate owner: gossip, redhead, stick, yaz, guster, bream, head, line and podust. According to the indicators of infection, the dominant place is occupied by the sticks (79,5 % extensiveness, 79,9 % invasion), and gossip (65,7 %); the next level forms the other four types of fish: redhead (59,1 %), bream 51,1 %, chocolate (46,2 %), guster (40,4 %), minimum infection rates were determined in line (33,3 %) and basal (16,7 %).

The highest indexes of infection with metacercaria are socketed (21,6 %), redhead (18,0 %) and gossip (17,6 %). Consequently, these three species of carp fish play an important role in the accumulation of invasive elements and the circulation of parasitic systems oppression. The role of other species of carp fish in the functioning of sources of opisthorchitis is less significant, which is due, in the first place, to relatively low

numbers [2, 3]. The stability of the endemic cell of opisthorchiasis in the region is due not only to natural but also to social factors: the spread of amateur fishing, a large proportion of fish in the diet of the population, the habit of eating cheese or slightly salty fish. Studies conducted in relation to the biology of development of opisthorchis, ecological peculiarities of their circulation, and the invasiveness of intermediate hosts indicate a high risk of human infection at an early age. Among the manifest forms of disease in humans, chronic opisthorchiasis prevails, clinical signs of which are nonspecific, polymorphic and do not fit into any one syndrome. Often, patients turn to doctors of other specialties and the disease remains unrecognized due to insufficient knowledge of doctors of this pathology. The analysis of the clinical course of opisthorchiasis in patients treated in Sumy Regional Clinical Infectious Diseases Hospital named after Z. Krasovitsky prevailed (62,5 %), which can be related to the high percentage of women belonging to a decreed group, which is regularly inspected on helminthiasis, the average age of invasive patients was $37,09 \pm 1,44$ years. Persons over 40 were prevalent: up to 18 years old were 11,6 %, 19-26 – 23,2 %, 30-40 – 18,8 %, older than 40 – 46,4 % ($p < 0,05$). In 98,5 % of cases, the diagnosis was confirmed by the detection of eggs in feces and duodenal contents, in the remaining (1,5 %) by the ELISA method. From an epidemiological history it was found out that in 59,8 % of patients the transmission factor was dried or salted fish. The infection of people living near the reservoirs, opisthorches contributed to the traditional habits of eating raw fish. Such food traditions are part of a deeply rooted culture and therefore difficult to change. The risk group (fishermen and their family members) was 71,9 %.

From clinical forms it was prevailing chronic opisthorchiasis. Acute opisthorchiasis for the indigenous population of the cell is exceptional, during the period of observation, only 2 cases of acute opisthorchiasis were discovered (the father and son were ill who consumed slightly salty fish). As with other helminthiasis, in the clinical course of opisthorchiasis there are acute and chronic phases. The leading pathogenetic factors of the acute phase are allergic reactions of the immediate and delayed type, which arise due to the sensitization of the organism by products of metabolism and the disintegration of opisthorchis, as well as due to autosensitization of damaged own tissues (epithelium of the bile ducts). In future, immunopathogenetic reactions develop with cell proliferation and secretion of inflammatory factors in the skin, mucous membranes of the respiratory tract, the gastrointestinal tract with a violation of the microcirculation and the formation of a granule. In this process, the possibility of mutations is extremely high, which combined with the immunosuppressive effect of opisthorchians significantly increases the risk of carcinogenesis [8]. Helminths carry out a damaging mechanical action in relation to bile duct epithelium, causing multiple erosion and stimulation of regenerative-hyperplastic reactions of the epithelium, which creates an obstacle to the outflow of bile and pancreatic secretion. Significant importance in the pathogenesis of opisthorchiasis has a secondary infection [9]. Taking into account the pathogenesis of invasion for the clinical picture of chronic opisthorchiasis, there are typical symptoms of lesions of the hepatopancreatic [10, 11, 12, 13]. Analysis of the results of the study allowed identifying a number of syndromes that encountered a different frequency: cholangiocholecystitis, dyskinesia biliary tract, gastrointestinal symptoms, allergic, pancreatopathy, vegetative-vascular dystonia. In most patients, the disease has a latent course. This is evidenced by the occasional discovery of opisthorchis eggs in fecal examinations of a deceased population (58,2 %), while seeking medical care for other diseases (17,7 %), and only one in four (24,1 %) patients had signs of manifestation illnesses. The main clinical signs of the disease were dyspeptic and pain syndromes: 56,3 % of the patients complained about the severity in the right hypochondrium, 30,4 % to the pain in the right hypochondrium, 26,8 % to bitterness in the mouth, 24,1 % - nausea, 17 % - abdominal distension, 10,7 % - vaginal discharge, loss of appetite – 11,6 %, oral dryness – 8,9 %, vomiting – 3,6 %, itching – 1,5 %. There were no complaints in 14,3 % of the people. In an objective examination, liver enlargement was observed in each second patient (55,4 %) at $(1,96 \pm 0,28)$ cm. The most patients had an average degree of severity (86,0 %). The degree of invasion in 76,9 % was minimal, 21,5 % - moderate, 1,6 % - high. Determining the diagnostic significance of clinical and laboratory symptoms in patients with opisthorchiasis, it has been established that the most diagnostic value among the clinical data is the signs of cholangitis, cholecystitis, gastritis, hepatomegaly, feeling of heaviness in the epigastrium; from the laboratory - the detection of opisthorchis in the feces; from the epidemiological - belonging to the risk group and the use of thermally untreated fish (Figure 3).

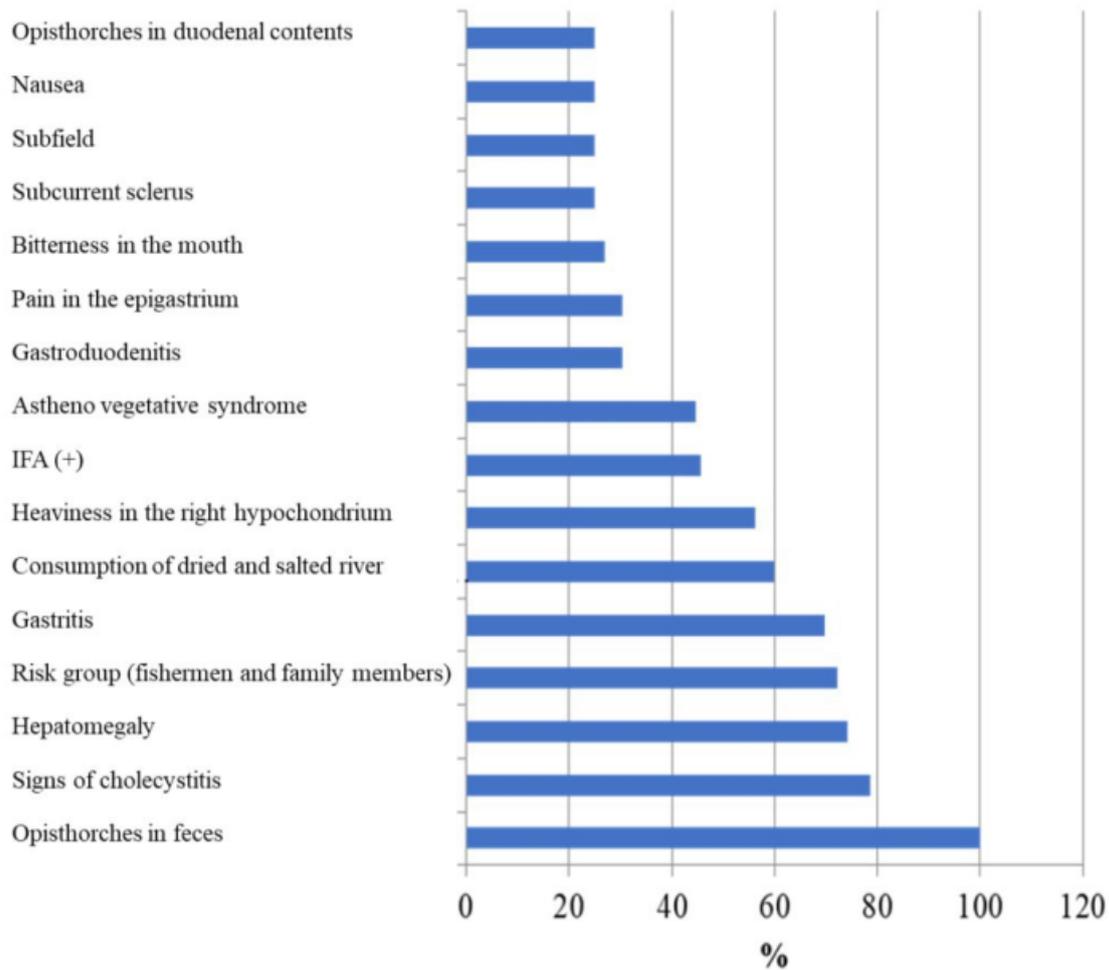


Figure 3: Diagnostic significance of clinical and laboratory symptoms in patients with opisthorchiasis

In spite of the predominance of the latent course of the disease, the disease significantly affects the health of the population, causing a high percentage of chronic, development of bile duct and liver cancer, which determines the social and medical significance of this invasion.

CONCLUSIONS

In Sumy region, a stable endemic cell of opisthorchiasis has been formed, the incidence of this disease is 22-25.6 times higher than in Ukraine.

In Sumy region sources of opisthorchistes are tied to the systems of tributaries of Psel, Desna and Vorskla. Nowadays, taking into account the specifics of environmental conditions in the region, the anthropogenic sources of this trematodase dominate.

Maritopisthorchia on the territory of Sumy region in natural ecosystems are registered in 6 species of animals: mink, otter, river beaver, foxes and raccoon dogs. Among them, the key role in the circulation of opisthorchia is played by wild predatory animals living near the water.

In anthropogenic ecosystems, domestic animals, mainly cats and humans, play an important role in the circulation of oppressions.

As opposed to the second intermediate hostage in the Dnipro basin, in Sumy region, there were 9 species of carp fish: gossip, redhead, stick, yaz, guster, bream, beef, lynx and podust. The leading role in the accumulation and circulation of metacercaryopisthorchity in the studied territories are three types of carp fish: gossip, stick and redhead.

The risk group consists of fishermen and members of their families (71,9 %). The main transmission factor is salt and dried fish.

The disease has a latent course predominantly. Of manifestations of the disease, cholecystitis is most common (78,6 %). Coproscopy (100 %) plays a decisive role in the diagnosis of chronic opisthorchiasis.

REFERENCES

- [1] Parasitology and invasive animal diseases / V.F Galat, A.V Berezovsky, N. M. Soroka, M. P. Prus. - Kyiv: Harvest, 2009. - 368 p.
- [2] Chemych M.D Ecological-biological, epidemiological and clinical aspects of the endemic cell of opisthorchiasis in the Sumy region / M. D. Chemych, T. I. Fotina, G. A. Fotina, N. I. Ilyina, S. M. Nazarenko, V.V. Ilyina, L.S. Frolova // Infectious diseases. - 2016. - No. 2. - P. 48-53.
- [3] Vlasenko V.V. Diseases of fishes / V.V. Vlasenko, Yu.D. Temnikhanov. - Vinnytsya, 2012 – 676 p.
- [4] Paltsev A. I. Epidemiology of Opisthorchiasis / AI Paltzev, S. V. Yakhin // Therapeutic Archive. - 2008. - No. 2. - P.89-92.
- [5] Zaslavskaya A.A Top most dangerous food parasites / A.A Zaslavskaya, I. B. Ershova, E. I. Abilova, I. A A. Lochmatova // Actual infectology. - 2016 - No. 4 (13). - P. 85-92.
- [6] Dakhno I. S. Ecological Helminthology / I. S. Dakhno, Yu. I. Dakhno. - Sumy, 2010. - 220 p.
- [7] Parfenov S.B, Comparative characteristic of clinical and immunological parameters of different contingents of patients with opisthorchiasis in the outbreak. Indigenous population / S. B. Parfenov, N. N. Ozeretskovskaya, V. A. Zolotukhin // Medical parasitology and parasitic diseases. - 2009. - No. 2. - P. 42-45.
- [8] Bouvard V. A review of human carcinogens - Part B: biological agents / V. Bouvard, R. Baan, K. Straif et al., WHO International Agency for Research on Cancer Monograph Working Group // Lancet Oncol. - 2009. - No. 10. - P. 321-322.
- [9] Carpenter H. A. Bacterial and parasitic cholera / Carpenter H.A. // Mayo Clin Proc. - 2008. - No. 5. - P. 473-478.
- [10] Kuznetsova V.G Opisthorchiasis in the clinical practice of the infectious disease physician / V.G. Kuznetsova, E.I. Krasnov, N.G. Paturin // Treatment physician. - 2013. - №6. - P. 74-79.
- [11] Dubinskaya G. M. Clinico-epidemiological characteristic of acute opisthorchiasis in the Poltava region / G. M. Dubinskaya, A. M. Izyumskaya, A. M. Minak, V. A. Korshenko, L. L. Kryvenko, N. P. Sviridenko // Modern infections. - 2009. - No. 1. - P. 54-58.
- [12] Gubergrits N.B. Pancreatic defeat at opisthorchiasis / N. B. Gubergrits, N. V. Shirinskaya, Yu. A. Zagorenko // Clinical immunology. Allergology. Infectology. - 2008. - No. 3. - P. 11-18.
- [13] Beloborodova E. I. The course of gastroesophageal reflux disease on the background of chronic opisthorchiasis / E. I. Beloborodova, I. A. Svitenko, E. V. Beloborodova // Clinical Prospects of Gastroenterology, Hepatology. - 2011. - No. 4. - P. 26-30.