CLINICAL STUDY

A Sewage Disposal failure as a Cause of Ascariasis and Giardiasis Epidemic in a Family

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Abstract

In monitoring the incidence of intestinal parasites in children and employees of a nursery the authors examined 31 children with 8 (25.81 %) and 16 employees with 3 (18.75 %) positive results.
The authors wanted to examine also the family members of 8 positive children and 3 positive employees but except from the cleaner's family, (Ascaris lumburicoides, Enterobius vermicularis and Entamoeba coli) nobody accepted the offer. All 8 members of a large family except for Patient 1 (a cleaner) and her grandson were without clinical and laboratory findings. They constitute 3 independent families who lived in 1st category flats.
On August 31 there was an extensive sewage disposal failure in the ground floor flat of Family II and the flat was flooded by sewage. All family members worked solidarily on cleaning and also the members of Family IV who are friends of Family II. As shown by clinical symptoms of ‚virosis', during the pre-patent period and after an outbreak within 73–78 days, laboratory findings of the family members demonstrated a severe family infection equal to a epidemic of intestinal parasitosis. Ascaris lumbricoides was diagnosed in 8 family members (61.54 %) and Giardia intestinalis in 7 family members (53.85 %) involved in cleaning. Enterobius vermicularis was found in 2 and Etamoeba coli in 1 family member.
In monitored persons, in extreme hygienic conditions during the failure and later, a mass contraction arose on the basis of infection. The fact, that family epidemic arose subsequently, proved, in contrast to sporadic findings in children and adults, a 6.4 and 3.3 times higher incidence of Ascaris lumbricoides and a 5.6 and 8.6 times higher incidence of Giardia intestinalis.
The authors discus the reasons of incidence and also preventive measures in population. ***(Tab. 3, Ref. 29.)***
Key words: children, employees, sewage disposal failure, family, epidemic, ascariasis, giardiasis.

A small interest in epidemiological situation of some intestinal parasitologic diseases and neglecting of their monitoring on the basis of focused laboratory examinations led to a decrease of interest in incidence and to an underestimation of past professional precautions. Since some time, the evaluation of health harmlessness of environment regarding the level of bioindicators was discontinued. In this case there are different stages of intestinal parasites, namely protozoa cysts and helmints ova. Their excretion by hosts into environment is equal to negative effects of other abiotic and biotic agents (Lonc and Okulewicz, 1996).

Fluctuation in monitoring allowed to record changes in prevalence of infection sources and also to determine a degree of environmental contamination. It seems that an excellent situation in prevalence of geohelminths in 1947 and in children in Bratislava in 80s: Ascaris lumbricoides 2/0.10 %, Trichuris trichiura 11/0.56 %, led to satisfaction with the situation and underestimating of its development. Findings of 85 strains of Giardia intestinalis despite repeated precautions still reached 4.37 %. The similar results were demonstrated by Lengyelova (1988), Jedlicka et al (1990), Cunta et al (1989) in the same period. According to Straka and Skracikova (1989), prevalence of geohelminths in children in pre-school and school institutions is very similar to the mentioned trend in 80ties. Geohelminths in nurseries and kindergartens were not found. In primary schools 13/0.2 % out

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of 6780 children have T. trichiura and 1/0.1 % A. lumbricoides. Among total 1763 secondary school students Straka and Skracikova (1989) found T. trichiura in 7/0.4 % and A. lumbricoides in 5/0.3 % cases.

In the light of these facts it seemed that a growing risk of population over-contamination by geohelminths does not loom, and this fact was generally accepted. It was resigned from a conception that the ban on fertilization by human faeces will be kept for ever. The well-known ability of A. lumbricoides ova to survive in contaminated soil for 1–2 years minimally and 10–12 years maximally, when the contamination of persons and repeated outbreaks of epidemiological process can appear, was also underestimated (Krasnonos, 1978). The long-proved low prevalence of geohelminthiasis led to judgement that A. lumbricoides and T. trichiura are from epidemiological view intestinal parasites of low importance from epidemiological point of view.

Material and methods

To evaluate the epidemiological situation in prevalence of intestinal parasites we examined children and employees of nursery in street B in Bratislava in 1998.

Among 36 registered children, the stool of 31 (86.11 %) was tested for intestinal parasites. Among 16 employees there were 11 (68.75 %) nurses or nannies, two kitchen workers (12.50 %) and 3 cleaners (18.75 %) (Tab. 2). Among parasite positive employees was our offer to examine also family members accepted just by 1 cleaner. On a proposal of the positive cleaner Patient 1 (1946), we examined 8 members of her family who live separately in 3 families in direct relationship. Family I comprises Patient 1 (1946) – mother and her daughters Patient 2 (1978) and Patient 3 (1985). The Family II comprises Patient 4 (1970), her daughter in 6th month of gravidity, son-in-law Patient 5 (1965) and their son Patient 6 (1996), who is a grandson of Patient 1. In the Family III, there live Patient 7 (1966) son, and Patient 8 (1978), daughter-in-law of Patient 1 and Patient 9 (1990) their daughter and granddaughter of Patient 1 The granddaughter Patient 9 (1990) lived alternatively also with her grandmother Patient 1 Family I–III lived in 1st category flats. Patient 1 together with the members of Family II were tested on parasite in May and her grandson was examined in July. He suffered from diarrhoea at that time, and a pediatrician treated him with Entizol. Except from Patient 1 (1946) and her grandson (1996), other family members were negative.

On August 31 there was an extensive technical failure of sewage pipeline in ground floor flat of Family II. The whole flat was flooded by sewage to the height of 50 cm and more. All furniture, carpets, and walls were foul, wet and devastated. The 1st category flat suddenly sunk into hygienic category D and became uninhabitable. After technical repairs the flat-dwellers started to work on repair immediately. Later also other relatives and even four members of Family IV, who are friends of Family II, helped them with cleaning and they sanitated the flat together.

Patient 4 (1970), mother of 2.5-year-old son Patient 6 (1996) approached the area health centre because her son was ill. A pediatrician prescribed Zinat, Ambrobene and Augmentin because of cough, bronchitis and cold. The problems had just decreased. The abdominal pain was intermittent and cough was present. The pediatrician suggests an allergic influence of the flat environment after the failure. He prescribed Bronchovaxin. The boy had very smelly, foamy and large stool. His mother was not satisfied with his health status and asked us to examine him for parasites again at the beginning of November 1998. In the mean time, a mother, Patient 4 (1970), shortly after her son's health problems, developed clinical symptoms of a ‚virosis' (pain in her throat, dry cough and irregular stool). She did not check her temperature. She referred that the same symptoms and temperature slightly over 37 °C had also her husband. The Patient 9's granddaughter (1990) had the same symptoms at the same time but with a temperature over 38 °C.

Similar symptoms in several members of Patient 1's (1946) large family led to examination for parasites in all family members and 4 members of Family IV, in some cases for the second time. The first examination for parasites in all 13 persons after the failure was done on November 12–17, 1998 at the end of the mentioned clinical manifestation and at the end of pre-patent time. The examination was repeated on November, 18–24 1998 and on December, 1–9 1998.

The stool specimens and perianal PVC tapes were examined consecutively three days in children and employees and in one case in members of the cleaner's family. The family members of positive children and two positive employees did not accept the offer.

The stools were examined by thick smear method by Katoh (1970), by Jirovec et al (1977), modified by Faust's method (1938), by Jirovec et al (1977) and by concentrated MIFC method (merthiolat-iodone-formaldehyde) (Sapero and Lawless, 1953), in valid cases for protozoa we loaded the specimens by Heidenhein hematoxylin except from the specimens coloured by Lugol's solution and also by Giemsa–Romanovsky, all by Jirovec et al (1977). We loaded oocysts of cryptosporidia by Henriksen and Pohlenz (1981) and by Ziehl-Neelsen method.

The specimens taken by sticky PVC tapes were modified by the Graham–Brumpt method (Brumpt, 1936; Graham, 1941) and all other specimens were microscoped (Amplival Zeiss Jena) at satisfactory magnification. The microscopic examination and evaluation was done by the same experienced persons who checked their findings reciprocally.

Results

The parasite findings in children are described in Table 1 and the findings in personnel of creches in Table 2. In one of three cleaners, Patient 1, (1946) we diagnosed A. lumbricoides, E. vermicularis and Entamoeba coli.

As proposed by Patient 1 (1946), who was afraid due to her pregnant daughter, Patient 4 (1970), we examined also members of the Family II in May 1998, but we did not detect any parasite. A repeated examination of the grandson Patient 6 (1996) in June was also negative. After the failure at the beginnig of November

Tab. 1. Intestinal Parasites Findings in Examined Children in Nursery B in Bratislava.

	n		%	
recorded	36			
examined	31			
	stool		perianal PVC tape examination	
examined	31	(86.1)	27	(75.00)
parasitologic finding				
negative	7	(22.6)	24	(88.9)
Ascaris lumbricoides	*3	(9.7)		
Giardia intestinalis	*3	(9.7)		
Enterobius vermicularis	-		2	(7.4)
Hymenolepis nana	-		1	(3.7)
positive	5	(16.1)	3	(11.1)
positive total	8	(25.8)		

* one case is double infection of *Ascaris lumricoides* and *Giardia intestinalis*

we diagnosed cysts of Giardia intestinalis together with ova of Ascaris lumbricoides in his specimens (Tab. 3). We sent him to a pediatrician and recommended a therapy. The laboratory control after the failure was satisfactory. In his mother' s, Patient 4 (1970), specimens we diagnosed Ascaris lumbricoides and Giardia intestinalis at the same time. The father, Patient 5 (1965), and also Patient 1's son-in-law were infected by helminth Ascaris lumbricoides and protozoa Giardia intestinalis and Entamoeba coli. The most frequented intestinal parasites were A. lumbricoides and G. intestinalis (Tab. 3). We sent all family members with positive parasite findings to a general practitioner with a proposal for recommended treatment.

A. lumbricoides and E. vermicularis in the Family I, in specimens of Patient 1 (1946), was found for the second time. Her daughter, Patient 2 (1978), was excreting ova of A. lumbricoides and cysts of G. intestinalis. The granddaughter, Patient 9 (1990), also visited this family very often and A. lumbricoides and G. intestinalis was detected in her specimens. At the control of the treatment results was G. intestinalis detected in her stool again. From the third Family, Patient 7 (1966), a son of Patient 1, and the father of daughter Patient 9 (1990), who visited the Family I very often, had negative results. His wife, Patient 8 (1978), daughter-in-law of Patient 1, was invaded by E. vermicularis.

Besides them we examined mother (1920) of Patient 1 who visited her daughter's flat nearly everyday. Her parasitologic finding was negative.

In Family IV we examined 4 members. In the specimens of a father, Patient 10 (1967) we found A. lumbricoides and mother Patient 11 (1971) had cysts of G. intestinalis in the stool. Their son, Patient 12 (1991), was infected by both of intestinal parasites, A. lumbricoides and G. intestinalis. In the specimens of his sister, Patient 13 (1996), we did not find any parasite (Tab. 3).

Altogether we tested 13 persons, 8 adults and 5 children, in 4 families for parasites. Two children and 1 adult man were without parasitologic finding. In species we diagnosed most often A. lumbricoides (8/61.5 %) and G. intestinalis (7/53.9 %). Twice we detected E. vermicularis (15.48 %) and in one case Entamoeba coli (Tab. 3).

Discussion

The presented study had an original aim to investigate the prevalence of intestinal parasites in children collective in day care–centers in Bratislava, their families and employees of those centers.

The incidence of intestinal parasites in day nursery, especially A. lumbricoides, were much higher than previously stated by Lengyelova (1988), Skracikova et al (1988, 1991), Klobusicky et al (1990) and others. It was supposed that the ban on dunging by human faeces brought a radical turn in the incidence of geohelminths with a long-lasting effect. At the end of 80s and beginning of 90s professionals considered the problem of geohel-

Tab. 2. Intestinal Parasites Findings in Examined Children in Nursery B in Bratislava.

Parasitologic findings	children nurse, nanny		cook, helping cook		cleaner		total	
	n	%	n	%	n	%	n	%
negative	5	31.3	1	6.3		-	6	37.5
Ascaris lumbricoides	-		1	6.3		-	1	6.3
Ascaris lumbricoides and *Giardia intestinalis*	1	6.3	-			-	1	6.3
Ascaris lumbricoides and *Enterobius vermicularis*	-		-		1	6.3	1	6.3
Entamoeba coli	-		-		1	6.3	1	6.3
examined	11	68.8	2	12.5	3	18.8	16	100.0
positive for parasites	1	9.1	1	50.0	1	33.3	3	18.8

Tab. 3. A view of positive findings in family members of positively diagnosed cleaner after the sewage disposal failure in Family II.

Family members	A.l.	E.v.	G.i.	E.c.
	n %	n %	n %	n %
Family I				
Patient 1 (1946) mother	+	+	-	-
Patient 2 (1978) daughter Patient 1	+	-	+	-
Patient 3 (1985) daughter Patient 1	-	-	-	-
∑ 3	2/1	1/2	1/2	-
Family II				
Patient 4 (1970) daughter Patient 1	+	-	+	-
Patient 5 (1965) son-in-law Patient 1	+	-	+	+
Patient 6 (1996) son&grandson Patient 1	+	-	+	-
∑ 3	3/0	-	3/0	1/2
Family III				
Patient 7 (1966) son Patient 1	-	-	-	-
Patient 8 (1978) daughter-in-law Pt 1	-	+	-	-
Patient 9 (1990) daughter&grangdaughter Patient 1	+	-	+	-
∑ 3	1/2	1/2	1/2	-
Family IV, friends				
Patient 10 (1967) father	+	-	-	-
Patient 11 (1971) mother	-	-	+	-
Patient 12 (1991) son	+	-	+	-
Patient 13 (1996) daughter	-	-	-	-
∑ 4	2/2	-	2/2	-
∑ 13	8	2	7	1
%	61.5	15.4	53.9	7.7

+ positive finding, - negative finding

minthiases for being solved and under control. It was replaced by more struggling problems with giardiasis, cryptosporidiasis, enterobiasis and toxocariasis.

In studies dealing with the problems of intestinal parasites in sewage plants, Horak (1988) and Plachy (1995) stated the number of Ascaris ova in 100 g faeces of all types. The findings were as follows: Ascaris species ova, 24–105 items were found, Trichuris species ova, 2–33 items. A part of them may be contributed to animals, but numerous ones come from people. It is evident, that there are more people invaded by this parasitic worm than was traditionally believed.

Plachy (1995) claimed that Ascaris species ova was present in all observed sewage plants – 8, but Trichuris species in 4 only. In the specimen of stabilized faeces before their using in agriculture, there was 78.2 % of positive vital helminths ova. This is one point in the range of unsatisfactory controlled spreading of geohelminthiases. Resulting questions concerned an inadequate number of ova in sewage plants in comparison to very low incidence of ascariasis in human population. Additionally, the use of faeces in agriculture enables the circulation of numerous helminths infection.

Those facts made us looking for articles and studies claiming at least a little increased incidence of A. lumbricoides and T. trichiura. We did not found them. On contrary, Skracikova and Straka (1991) diagnosed A. lumricoides and T. trichiura in the stool of 5/0.3 % respectively 7/0.4 % person from 1763 secondary school students. A year later Flakova (1993) diagnosed A. lumbricoides in 111/1.7 % and T. trichiura in 139/2.1 % in 6519 stool specimen. Such results admit the feasibility of increase in incidence Straka and et al (2001) published charts listing contrary facts to those mentioned above. Every 10 years, there is a considerable decrease of ascariasis in Martin district, from 4.3 % to 0.1 %. In the 1997 – 1999 (Konakova, 2000), a report written by National Reference Center for Intestinal Parasites describe an increase of A. lumbricoides and T. trichiura from 0.5 % to 0.7 % in the years 1997, 1998 and 1999, respectively from 0.27 % to 0.29 %. The increase in 1999 compared to 1997, regarding A. lumbricoides, meant 12 500 newly diagnosed cases in Slovakia.

Epidemic situation of geohelminthiases demonstrates regional differences. We thoroughly examined 2050 children from Bratislava at the age of 2–15 and we asserted an important increase of A. lumbricoides from 3.95 % in kindergartens to 5.34 % in primary school (Totkova, 1999). These reports of Konakova (2000) and Totkova (1999) fit better to the series of explanations, why the environment became contaminated by A. lumbricoides after the failure of sewerage system. If the incidence of this parasitic worms was as reputed since 80s, we could not discover a high occurrence in the sewage system. If we add another fact, a frequent avoiding of already mentioned ban, it is more than probable, that people are exposed to the infection of geohelmiths ova or protozoa cysts (Jirovec et al, 1977; Kadlubowski et al, 1979; Genis, 1985; Jira, 1998) and others.

Consumption of fruit and vegetables in pre-school and school children is associated with the risk of parasite infection. If it is not washed properly, protozoa cysts and geohelminths ova stay on the surface of fruit and vegetables and resist runny warm water (Jirovec et al, 1977).

There are more causes of possible parasite infection, like in the family of Patient 1 There was a failure of sewage system in the flat of her daughter (Family II), leading to destruction of the flat and degradation of hygienic standard. In the cleaning works in the flat and removal of the failure, all family members were involved (Families I, II, III and IV) and all of them were exposed to possible infection. The contagiosity of ascariasis arose intensively and resulted in general infection. 10/76.92 % from 13 more or less exposed family members was infected. Among laboratory positive persons 7/70.0 % claimed severe clinical signs in prepatent period. They had digestive problems, “flu” symptoms (sore throat, coughing, breathing problems, increased temperature to 38 °C). Adult people got rid of these signs in a couple of days, in children they lasted longer. Two persons with prevalent G. intestinalis and one person with E. vermicularis had only minor digestive problems. The length of prepatent period was 73–78 days, in accord with data listed in all parasitology compendia (Piekarski, 1975; Jirovec et al, 1977; Kadlubowski et al, 1979; Genis, 1985; Catar and Bohmer, 1997; Jira, 1998) and

others. A. lumbricoides ova were first detected in stools on November 12th to 17th 1998.

G. intestinalis was the second most frequent intestinal parasite in people working on cleaning (53.9 %). Many workplaces noticed a dropping rate of G. intestinalis and A. lumbricoides, but not in children in Bratislava. Totkova (1999) detected G. intestinalis in the set of pre-school (9.9 %) and primary (8.4 %) children. In comparison to previous years epidemic situation of certain parasitosis got worse.

Regional differences are not surprising. The results of Straka et al (2001) serve as the right opposite to findings in Bratislava. They claim, that the incidence of intestinal helminths and protozoa is much better in children in Martin District, especially concerning geohelminths incidence. A sharp fall was registered even in intestinal protozoa.

If such a failure had occurred in Martin, would the findings be similar? What types of intestinal protozoa would be detected in sewage water? We suppose that the intensity of infection would not be lower than in Bratislava.

Decrease or increase of prevalence in collective reflects the long-lasting influence of many factors. We could considered another aspect in four families mentioned above, who took part in sanitary work in the flat of Family II and were exposed to massive invasion at the same time with the same hygienic problems.

We can provide the scheme of the onset and intensity of infection, when 100 % of persons were infected in the primary source of infection (Family II). The infection spread to Family I 66.7 % persons were infected. In the Family III, the percentage was the same, 66.7 %. In the Family IV, the infection was high, 75.0 % members were infected. Exact time of infection was registered and the infection was associated with clinical symptoms typical for individual parasitosis during the pre-patent period. The number of persons with clinical problems and persons with laboratory proved parasite infection expresses the degree of intensity of epidemic process and reflects its activity in limited time. It is expressed by degrees of morbidity. If morbidity reaches a degree, which can be considered for normal in the given field and in the observed period, we speak about sporadic incidence. If number of infected persons is large on certain place, time and if it remarkably exceeds the sporadic incidence (Kmety and et al, 1981, 1993), or there is a connection between individual cases (Egnerova, 1999) we can speak about epidemic. Such intensive degree of incidence could be registered in the case of a large family of Patient 1 and their friends after the failure, which served as an opportunity for infection. This case can be considered as family epidemic, although a small one, due to the number of infected persons and, very rare as ascariasis is believed. Ascaris lumbricoides species was diagnosed 6.4 and 3.3 times more often in adults and children in comparison to sporadic incidence. Giardia intestinalis was detected 5.6 and 8.6 times more often.

There were 4 new seats and 9 sources of intestinal parasites infection. We want to stress that similar situations should be considered as real but not coming spontaneously and at once. If we looked for parallel situations, we have to remind returning floods. Flooded flat and houses can be contaminated sometimes higher than 50 cm, only the degree of infection and the biological agents can be different. The epidemiological effects are more serious than we can imagine or register. It is necessary to express following premises: “It does not mean that unknown things do not exist”.

We would be glad:

– if the positive attitude of Patient 1 (1946) and her family members to examination for parasites was not so rare,

– if positive employees did not refuse the examination for parasites in their family members,

– if they understood that every carrier of infection in the family means an increased possibility of infection to spread to other members of family or collective.

Due to responsible attitude of all sanitary work participants to laboratory examinations, even repeated ones, treatment and controls, the epidemic situation was under control and we were able to avoid a repeated infection, interrupt all ways of transmission and eradicate the seats of infection.

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