VERMINOUS PNEUMONIA AND TRACHEOBRONCHITIS IN FOXES AND THEIR ZOONOTIC POTENTIAL

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Summary

An increase of the red fox (*Vulpes vulpes*) population has been documented in Europe after the success of the oral vaccination against rabies, and this trend is now becoming evident in Serbia as well. The role of the red fox as reservoir for zoonotic parasites becomes very important in suburban areas, especially for *Echinococcus multilocularis* and other parasitic diseases.

Foxes (N = 90) were collected during the hunt from every part of Vojvodina, northern province of Serbia, over a period from winter 2008 to January 2012. At the necropsy, carcasses were opened and the trachea from the larynx to the bifurcation was collected and preserved in 30% ethanol. Tracheas were opened on the anterior side by scissors and parasites were collected under a stereomicroscope and wet-mounted in glicerine-ethanol or lactophenol. Nasal cavity was opened through the palate, and the nasal mucosa was scrapped off and conserved in 30% ethanol. Pulmonary parenchyma are compressed and examined as wet-mount slides. Sections of lungs and trachea were also histologically examined. Faecal samples and urine were collected and then tested using the glycerin flotation method and wet-mount slides, respectively. Collected parasites were counted, and measured in the "Image J" free programme.

The estimated prevalence of the infection with *Capillaria aerophila*, *Capillaria boehmi* and *Crenosoma vulpis* was 84.3%, 90%, and 13.15%, respectively. Zoonotic potential of pulmonary capillariasis for humans and pet animals and crenosomosis for domestic and stray dogs are discussed. Identification of pulmonary capillariasis in one human patient increased interest for this zoonosis in Serbia.

Key words: Lungworms, fox, pneumonia, Serbia

Increasing of fox population that became evident after oral rabies vaccination campaigns, and phenomenon of urban foxes represents increased risk for zoonotic transmission of parasitic diseases on domestic animals, stray dogs and humans. In Vojvodina, Northern Province of Serbia, oral rabies vaccination started in winter 2010, and throughout 2011 a dramatic decrease of rabies cases in animals, together with signs of fox population increment, was noted.

Lungworms of carnivorous animals belong to different nematode species with different life cycles and pathogenic impact. These parasites are intensively

investigated recently but some of them are poorly known up to day (1). Their zoonotic potential has also been mentioned recently, when a case of human pulmonary capillariasis was diagnosed (2). Data about lungworms in foxes in Serbia are insufficient, and that was the reason we investigated them during the past years.

Materials and methods

Foxes (N = 90) were collected during the hunt from every part of the Vojvodina territory, over a three year period from the winter of 2008 to January 2012. At the necropsy, carcasses were opened and trachea, from larynx to the bifurcation, was collected from each animal and preserved in 30% ethanol. After extraction, tracheas were opened on the anterior side by scissors and parasites were collected under a stereomicroscope and wet-mounted in glicerine-ethanol or lactophenol. Nasal cavity of the foxes was opened through the palate, and nasal mucosa was scrapped off and conserved in 30% ethanol. Pulmonary parenchyma were compressed and examined as wet-mount slides. Sections of lungs and trachea were also histologically examined. Faecal samples and urine were collected and then tested using the glycerin flotation method and wet-mount slides, respectively. Collected parasites were counted, and measured in the “Image J” free programme.

Results and discussions

The estimated prevalence of the infection with *Capillaria aerophila* and *Capillaria boehmi* was 84.3% and 90% respectively, while *Crenosoma vulpis* infection was found in 13.15% of the cases.

In foxes infected only with *Capillaria spp*. no significant pathologic changes were seen on the tracheal mucosa or on the lung tissue. On the other hand, in dual infection with *Capillaria* and *Crenosoma* pathologic lesions were found on the pulmonary parenchyma of foxes. These lesions consisted of gray nodules, 1 to 10 mm in diameter, scattered over the surface of the lungs or arranged in clusters. In wet-mount slides from bronchial content many *Crenosoma spp.* larvae were found in those foxes. Histological examination of pulmonary tissue revealed interstitial pneumonia and foci of deposited *Crenosoma* eggs surrounded with inflammatory cells (Fig. 1). Eggs were in various developmental stages and formed larvae were seen in histological slides too. Histological sections of trachea where adults of *Capillaria aerophila* were found revealed no inflammation in mucosa (Fig. 2). Adults of *Capillaria* were adhered on the surface of the epithelial cells but not entered *lamina propria* of mucosa.

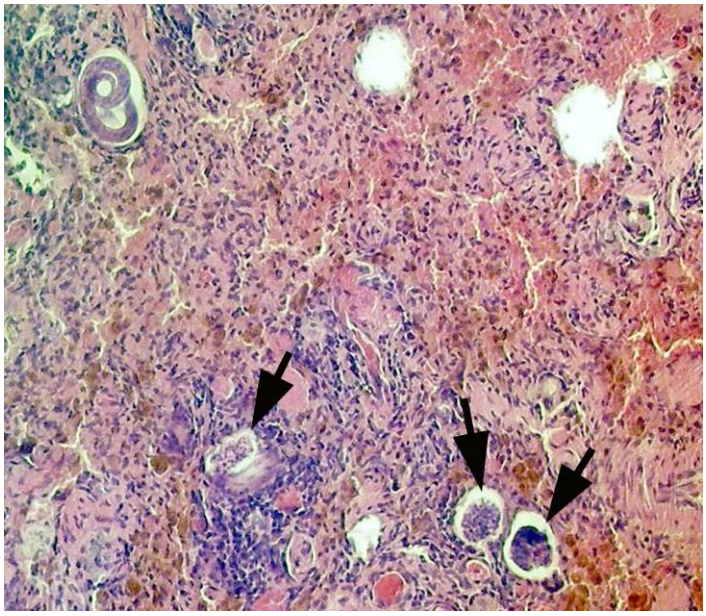

Fig. 1. Pneumonic focus in fox lung, eggs (arrows) and migratory larva of *Crenosoma vulpis*

Fig. 2. A cross section of *Capillaria aerophila* female in fox trachea, lemon-shaped eggs were seen, semi-thin section, Toluidin blue

In appropriate cross sections numerous lemon-shaped *Capillaria* eggs were found. Layer of respiratory epithelium below the *Capillaria* adult was thinner but no infiltrating leukocytes were observed.

Number of adult *Capillaria spp.* per fox was counted as 1-71 for *C. aerophila* and 1-20 for *C. boehmi*. Influence of number of adult parasites per foxes on longitude of *C. aerophila* males or females was not recognized. In foxes which were parasitized higher number of adults, their longitude is slightly higher but not significant. Average length of Capillarii females were 27.19 mm from three foxes with average number of female parasites of 11, and in two foxes with average number of female parasites of 20.5, their average length was 28.32 mm (table 1).

Table 1

Average length of male (M) and female (F) *C. aerophila* in comparison with number of adult parasites per foxes

Fox No.	*C. aerophila*	Number of adults	Length (mm)	Average length (mm)
1	M	7	10.41-18.91	16.83
	F	9	16.01-24.18	20.31
2	M	16	13.45-20.27	17.22
	F	13	23.63-29.83	26.71
3	M	16	17.97-25.11	22.28
	F	11	30.62-41.84	34.55
4	M	27	16.36-22.55	19.34
	F	20	17.16-34.72	26.95
5	M	15	11.79-22.75	18.45
	F	21	21.94-36.05	29.69

Infection rates of pulmonary capillariasis in foxes are various around the world. In Croatia a low incidence of 4.7% of foxes was recorded (3) but in Norway 88% (4), the highest reported up today, closely to our results for Pannonian foxes. *Capillaria aerophila* in dogs in Romania was recorded of 0.59-6.2% (5). Pathogenic significance of *Capillaria* and *Crenosoma* not yet had been clearly elucidated (1). Borovkova found that earthworms served as intermediate hosts for *Capillaria spp.*, and about ten earthworms may transmit lethal number of larvae per fox, caused bronchopneumonia (6). *Crenosoma* infection in foxes are relatively rare, but transmission on dogs is possible and recently recorded in Europe, when various clinical pictures were described (7, 8).

Conclusions

Capillaria aerophila infection rate in foxes from Pannonian Basin was found of 84.3%, *C. boehmi* of 90% and *Crenosoma vulpis* 13.15%.

Inflammatory foci in pulmonary parenchyma of foxes are well developed around *Crenosoma* eggs and developmental larvae.

Capillaria aerophila adults in fox trachea no cause any histological signs of inflammation.

Acknowledgements

This study was supported by Ministry of Education and Science of Serbia, grant No. TR31084.

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