The prevalence of *Toxoplasma gondii* IgM and IgG antibodies in dogs and cats from the Czech Republic

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ABSTRACT: Sera of 413 dogs and 286 cats from the Czech Republic were tested for antibodies to *Toxoplasma gondii* by the indirect fluorescent antibody test. The IgM antibodies to *T. gondii* were found in 10 (2.4%) dogs and 8 (2.8%) cats; IgG antibodies were found in 107 (25.9%) dogs and 126 (44.1%) cats. Of the dogs, the most exposed group were pet dogs, followed by police dogs; no antibodies were found in laboratory dogs. No statistically significant differences in prevalence were observed between clinically healthy (n = 115) and diseased pet dogs (n = 80); compare 0.87% and 1.25% for IgM, and 33.9% and 33.75% for IgG, respectively. Although *T. gondii* is a common parasite in domestic cats and dogs, the clinical importance is low.

Keywords: toxoplasmosis; seroprevalence; IFAT; dog; cat

Toxoplasma gondii and *Neospora caninum* are closely related apicomplexan parasites that may cause clinical diseases in domestic and wild animals (Dubey and Beattie, 1988; Dubey, 2003). Both protozoa have an indirect life cycle, with carnivores as definitive hosts. Cats and other Felids are definitive hosts of *T. gondii*; dogs and coyotes (*Canis latrans*) are definitive hosts of *N. caninum*.

Canine and feline toxoplasmosis is a multi-systemic disease; however a latent form of the disease usually develops (Dubey and Beattie, 1988; Dubey, 2003). In Europe, the antibodies to *T. gondii* were found in cats and dogs from Sweden (Uggla et al., 1990) and Germany (Tenter et al., 1994; Klein and Muller, 2001), in dogs from Austria (Wanha et al., 2005) and in cats from France (Roze, 1998) and Spain (Miro et al., 2004). In the Czech Republic, antibodies to *T. gondii* were found both in cat and dog sera (Havlik and Hubner, 1958; Svoboda and Svobodova, 1987; Svoboda et al., 1987a,b, 1988a,b, Svobodova et al., 1998). Antibodies to *T. gondii* were also found in dog sera from the former Czechoslovakia (Hejlicek et al., 1995, 1996).

The parasite *N. caninum* causes a neuromuscular and dermatological disease in dogs; in cats no case of clinical neosporosis has been reported (Dubey and Beattie, 1988; Dubey, 2003). In Europe, the antibodies to *N. caninum* were found in dogs from Germany (Rasmussen and Jensen, 1996), Great Britain (Barber and Trees, 1998), The Netherlands (Wouda et al., 1999) and Spain (Ortuno et al., 2002). In the Czech Republic, a serologic survey was done (Vaclavek et al., 2002) and also one case of clinical neosporosis in dogs was described (Koudela et al., 1998). Slapeta et al. (2002) found *N. caninum* oocysts in faeces of Czech police dogs; it was the first case of documented excretion of *N. caninum* oocysts in dogs from the Old World.

Dogs are important in the epidemiology of not only *N. caninum* but also *T. gondii*, reflecting environmental contamination. In recent years, the attention has been paid to neosporosis while toxoplasmosis in dogs has been missed out. But it would be interesting to find out if the change over to commercial diet influences the incidence of toxoplasmosis, and also which group of dogs is

the most endangered. The cats as definitive hosts of *T. gondii* infection were also examined.

MATERIAL AND METHODS

Blood sampling

In this study, the first part of dog and cat sera was submitted to our laboratory for serodiagnosis of toxoplasmosis, neosporosis, and some bacterial and viral diseases from different regions of the Czech Republic. The second part of serum samples was collected for biochemical analyses in Lobecek Veterinary Clinic, Kralupy nad Vltavou, Central Bohemia. Serum samples examined for the presence of *T. gondii* antibodies included 115 sera of clinically healthy police dogs from Western, Southern, Central and Northern Bohemia; 250 sera of pet dogs from Central Bohemia (115 clinically healthy, 80 diseased and other 55), 48 sera of laboratory dogs, and 286 sera of cats from different parts of the Czech Republic (the majority originated from Central Bohemia and Northern Moravia). Serum samples were tested from 2002 to March 2006 and were examined immediately after they were delivered to the State Veterinary Institute in Prague.

Indirect fluorescent antibody test

Serum samples were examined for antibodies to *T. gondii* by an indirect fluorescent antibody test (IFAT) using a commercially available Sevatest Toxoplasma Antigen IFR (Sevapharma, Prague, Czech Republic). Species-specific conjugates anti-dog IgM immunoglobulin (VMRD Inc.), anti-dog IgG immunoglobulin (Sigma Aldrich), anti-cat IgM immunoglobulin (VMRD Inc.) and anti-cat IgG immunoglobulin (Sigma Aldrich) were used. The sera were diluted in a two-fold series starting at 1:40 as a basic dilution. The titre ≥ 40 was considered positive.

Statistical analysis

The statistical analysis of *T. gondii* prevalence between clinically healthy and diseased pet dogs was performed by chi-square test, using Unistat 5.1 statistical program. The differences were considered statistically significant when $P \leq 0.05$.

RESULTS

The IgM antibodies to *T. gondii* were found in 10 of 413 (2.4%) dogs and 8 of 286 (2.8%) cats; IgG antibodies were found in 107 of 413 (25.9%) dogs and 126 of 286 (44.1%) cats. The most exposed group of dogs was pet dogs. The range of titres is given in Table 1. No statistically significant differences in prevalence were observed between 115 clinically healthy (0.87% IgM with titre 40 and 33.9% IgG with titres 40 to 640) and 80 diseased pet dogs (1.25% IgM with titre 40 and 33.75% IgG with titres 40 to 2 560).

DISCUSSION

In the present study, *T. gondii* antibodies were found in 25.9% of dog sera and 44.1% of cat sera. Similar results were obtained in other European countries. In Sweden, sera of 303 dogs and 244 pet cats were examined by an enzyme-linked immuno-

Table 1. The prevalence of serum antibodies to *T. gondii* in dogs and cats by the IFAT

Group of animals	Number of serum samples	IgM antibodies		IgG antibodies	
		number of positive samples (%)	range of titres	number of positive samples (%)	range of titres
Police dogs	115	0 (0)	ND	25 (21.7)	1:40–1:640
Pet dogs	250	10 (4)	1:40–1:320	82 (32.8)	1:40–1:10 240
Laboratory dogs	48	0 (0)	ND	0 (0)	ND
Pet cats	286	8 (2.8)	1:40–1:1 280	126 (44.1)	1:4 0–1:81 920

ND = not determined

sorbent assay (ELISA) with 23% and 42% positivity, respectively (Uggla et al., 1990). Similarly, 26% of 242 dogs from Austria (Wanha et al., 2005) and 29% of 200 dogs from Germany (Klein and Muller, 2001) had antibodies to *T. gondii* in IFAT. Tenter et al. (1994) examined 306 suburban cats from Germany with 45% positivity in ELISA; infection rates varied from about 32% for cats kept indoors to about 55% for stray cats. Dogs and cats from Spain are less infected compared to the other countries, because only 12.2% of 139 dogs (Ortuno et al., 2002) and 32.3% of 585 cats had antibodies to *T. gondii* in IFAT; infection rates varied from about 25.5% for household cats, 33.3% for farm cats to about 36.9% for stray cats (Miro et al., 2004).

We recorded lower positivity, both in dogs and cats, when we compared our results with previous prevalence studies conducted in the Czech Republic. Antibodies to *T. gondii* were found in 31% of 86 dogs (Havlik and Hubner, 1958), 57% dogs (Vokoun, 1982), 50% of 1 002 dogs (Svoboda and Svobodova, 1987), 36.7% of 240 clinically normal and 54.2% of diseased dogs (Svoboda et al., 1987a). In cats, 91% of 86 (Havlik and Hubner, 1958) and 40.3% of 620 had antibodies to *T. gondii* in SFR (Svoboda et al., 1988a) and 61.3% of 357 in IFAT (Svobodova et al., 1998).

The most exposed group of dogs in our study was pet dogs (32.8%), followed by police dogs (25.9%) and no antibodies were found in laboratory dogs. Svoboda and Svobodova (1987) revealed that the most exposed group of dogs was police dogs with 39.52% positivity (n = 396), followed by crossbreds with 20.36% (n = 204), hunting dogs with 19.96% (n = 200), pets with 12.48% (n = 125) and watchdogs with 6.59% (n = 66). The high positivity 39.3% was also found in army dogs (Hejlicek et al., 1995) from the Czech Republic and Slovakia, and only 9.8% positivity in border police dogs from the Czech Republic (Hejlicek et al., 1996). Different positivity of dog groups can be explained by different hygiene level, diet (consumption of raw meat, cooked food or commercial diets) and different ways of stabling (contact with cats or soil contaminated by cat faeces, cots without access of cats).

A clinical disease with neuromuscular symptoms (paraplegia and myositis) was found in five dogs with no IgM *T. gondii* antibodies. Four of them were positive for IgG *T. gondii* antibodies with different titres; the brain of the seronegative dog with negative antibody prevalence was examined also by an isolation assay (Dubey and Beattie, 1988), but with negative result. No statistically significant differences were observed in antibody prevalence between clinically healthy and diseased pet dogs; only higher IgG titres were found in diseased dogs compared to healthy ones. Two cats with suspected toxoplasmosis in their anamnesis were IgM and IgG negative. So we can conclude that there is not always a correlation between the clinical anamnesis and the antibody prevalence results. Nevertheless, the serological examination is one of the important diagnostic tools to inform us that the animal was in contact with the parasite infection. Positive antibody IgM or IgG titres inform us if the infection is in acute or chronic stage, respectively.

Dogs may act as mechanical vectors by rolling in foul-smelling substances and by ingesting faecal materials. Experimental infections of dogs support the hypothesis that dogs may play a role in the mechanical transmission of *T. gondii* infection to humans (Frenkel and Parker, 1996; Lindsay et al., 1997). People and especially immunocompromised individuals and pregnant women should observe the hygienic principles not only after contact with soil, cats, before eating, but also after contact with dogs.

REFERENCES

Barber J.S., Trees A.J. (1998): Naturally occurring vertical transmission of *Neospora caninum* in dogs. International Journal for Parasitology, 28, 57–64.

Dubey J.P. (2003): Review of *Neospora caninum* and neosporosis in animals. Korean Journal of Parasitology, 41, 1–16.

Dubey J.P., Beattie C.P. (1988): Toxoplasmosis of Animals and Man. CRC Press, Boca Raton, Florida. 220 pp.

Frenkel J.K., Parker B.B. (1996): An apparent role of dogs in the transmission of *Toxoplasma gondii*. The probable importance of xenosmophilia. Annals of the New York Academy of Sciences, 791, 402–407.

Havlik O., Hubner J. (1958): Sérologický průkaz toxoplasmosy u některých domácích volně žijících zvířat. Československá Epidemiologie, Mikrobiologie a Imunologie, 7, 396–402.

Hejlicek K., Literak I., Lhotak M. (1995): Prevalence of antibodies to *Toxoplasma gondii* in army dogs in the Czech Republic and Slovak Republic. Veterinarni Medicina, 40, 137–140.

Hejlicek K., Literak I., Sebek J. (1996): Prevalence of antibodies to *Toxoplasma gondii* in border police dogs from the southern part of the Czech Republic. Acta Parasitologica, 41, 81–83.

Klein B.U., Muller E. (2001): Seroprevalence of antibodies to *Neospora caninum* in dogs with and without clinical suspicion for neosporosis in Germany. Praktische Tierarzt, 82, 437–440.

Koudela B., Svoboda M., Bjorkman C., Uggla A. (1998): Neosporosis in dogs: the first case report in the Czech Republic (in Czech). Veterinarni Medicina, 43, 51–54.

Lindsay D.S., Dubey J.P., Butler J.M., Blagburn B.L. (1997): Mechanical transmission of *Toxoplasma gondii* oocysts by dogs. Veterinary Parasitology, 73, 27–33.

Miro G., Montoya A., Jimenez S., Frisuelos C., Mateo M., Fuentes I. (2004): Prevalence of antibodies to *Toxoplasma gondii* and intestinal parasites in stray, farm and household cats in Spain. Veterinary Parasitology, 126, 249–255.

Ortuno A., Castella J., Almeria S. (2002): Seroprevalence of antibodies to *Neospora caninum* in dogs from Spain. Journal for Parasitology, 88, 1263–1266.

Rasmussen K., Jensen A.L. (1996): Some epidemiologic features of canine neosporosis in Denmark. Veterinary Parasitology, 62, 345–349.

Roze M. (1998): Feline uveitis: A clinical and serological study of 44 cases. Pratique Médicale et Chirurgicale de l'Animal de Compagnie, 33, 123–130.

Svoboda M., Svobodova V. (1987): Effects of breed, sex, age, management and nutrition on the incidence of *Toxoplasma gondii* antibodies in dogs and cats. Acta Veterinaria Brno, 56, 315–330.

Svoboda M., Jagos P., Konrad J. (1987a): Toxoplasmosis and its relationship to other infectious-diseases in dogs. Schweizer Archiv fur Tierheilkunde, 129, 595–604.

Svoboda M., Konrad J., Svobodova V. (1987b): Relations between the appearance of antibodies against *Toxoplasma gondii* and clinical findings in examined dogs. Wiener Tierarztliche Monatsschrift, 74, 379–388.

Svoboda M., Konrad J., Svobodova V. (1988a): Diagnosis and prevention of toxoplasmosis in the cat. Tierarztliche Praxis, 16, 69–74.

Svoboda M., Svobodova V., Konrad J. (1988b): Relations between the occurrence of antibodies to *Toxoplasma gondii* and the clinical findings in cats subjected to clinical examination (in Czech). Veterinarni Medicina, 33, 119–126.

Svobodova V., Knotek Z., Svoboda M. (1998): Prevalence of IgG and IgM antibodies specific to *Toxoplasma gondii* in cats. Veterinary Parasitology, 80, 173–176.

Slapeta, J.R., Modry, D., Kyselova, I., Horejs, R., Lukes J., Koudela, B. (2002): Dog shedding oocysts of *Neospora caninum*: PCR diagnosis and molecular phylogenic approach. Veterinary Parasitology, 2432, 1–11.

Tenter A.M., Vietmeyer C., Johnson A.M., Janitschke K., Rommel M., Lehmacher W. (1994): Elisas based on recombinant antigens for seroepidemiological studies on *Toxoplasma gondii* infections in cats. Parasitology, 109, 29–36.

Uggla A., Mattson S., Juntti N. (1990): Prevalence of antibodies to *Toxoplasma gondii* in cats, dogs and horses in Sweden. Acta Veterinaria Scandinavica, 31, 219–222.

Vaclavek P., Koudela B., Sedlak K., Sebesta R. (2002): Seroprevalences of antibodies against *Neospora caninum* in cattle and dogs in the Czech Republic. In: 32nd Annual Meeting, 8–12 April, 2002, Kunin, the Czech Republic, Journal of Eukaryotic Microbiology, Abstract No. 75, p. 22A.

Vokoun P. (1982): Depistáž toxoplazmózy u psů a koček ve městě. Veterinářství, 32, 129–131.

Wanha K., Edelhofer R., Gabler-Eduardo C., Prosl H. (2005): Prevalence of antibodies against *Neospora caninum* and *Toxoplasma gondii* in dogs and foxes in Austria. Veterinary Parasitology, 128, 189–193.

Wouda W., Dijkstra Th., Kramer A.M.H., Maanen C., Brinkhof J.M.A. (1999): Seroepidemiological evidence for a relationship between *Neospora caninum* infections in dogs and cattle. International Journal for Parasitology, 29, 1677–1682.

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