Journal of Feline Medicine and Surgery (2009) **11**, 131–134
doi:10.1016/j.jfms.2008.06.004

ELSEVIER

jfms

Tritrichomonas foetus infection in cats with diarrhoea in a rescue colony in Italy

Malcolm Holliday DrMedVet, MRCVS[1], **Dario Deni** DrMedVet[2], **Danièlle A Gunn-Moore** BSc, BVM&S, PhD, MACVSc, MRCVS, RCVS Specialist in Feline Medicine[3*]

[1]*Rifugio per Gatti 'Cinni', Arezzo, Tuscany, Italy*
[2]*Istituto Zooprofilattico Sperimentale delle Regioni Lazio e Toscana, Sezione di Arezzo, Italy*
[3]*R(D)SVS Hospital for Small Animals, University of Edinburgh, Easter Bush Veterinary Centre Roslin, Midlothian, Scotland EH25 9RG, United Kingdom*

Faecal samples from 74 cats with chronic large bowel diarrhoea that were living in a rescue colony in Italy, were submitted for assessment of *Tritrichomonas foetus* by direct microscopy of faecal smears ($n = 20$) and *T foetus*-specific culture ($n = 74$), with confirmation by polymerase chain reaction ($n = 1$). Twenty-four of the cats (32%) were found to be infected with *T foetus*. The infected cats were predominantly over a year of age (67%) and were all neutered non-pedigree domestic cats.

Date accepted: 25 June 2008

Tritrichomonas foetus is a protozoan parasite that has been identified as a natural cause of diarrhoea in domestic cats.[1–5] Clinical signs are variable, ranging from asymptomatic infection to prolonged and intractable diarrhoea.[1–3,5] The predominantly large bowel signs may include increased frequency of defecation, passage of semi-formed to liquid often foul-smelling faeces containing fresh blood and mucus, anal inflammation, and faecal incontinence.[1,6] Most affected cats are otherwise clinically well.[1]

T foetus can be detected in faeces by (i) looking for motile trophozoites in fresh faecal smears with saline dilution, (ii) using the specific 'In Pouch TF' culture system (BioMed Diagnostics, Oregon, USA)[7] or (iii) by detection of *T foetus* ribosomal DNA using polymerase chain reaction (PCR: College of Veterinary Medicine, North Caroline State University, USA).[8] These methods have differing sensitivities: in one study direct microscopy was positive in 5/36 of cases, 'In Pouch TF' in 20/36 of cases, and PCR in 34/36 of cases,[3] and these may be further reduced by intermittent shedding of the parasite.[9]

To date, most reports of *T foetus* infection in cats have come from the USA. However, it is likely that the organism has a much wider distribution. It has been found in the faeces of over 20% of cats with diarrhoea from the UK,[10,11] in cats from Germany,[12] and in a single cat from Italy and another from Spain.[10]

T foetus is not believed to be a commensal of cats as it is not found in the faeces of feral cats or healthy indoor cats living in colonies that do not have diarrhoea.[1] However, it is commonly identified in cats from colonies that do have diarrhoea, especially those containing young pedigree cats, or young cats from rescue centres.[1,3,5] While cats of all ages can be infected, clinical disease is seen most commonly in cats of less than a year of age.[1,10,11] The infection is believed to be spread faecal-orally between cats by close and direct contact.[3]

The long-term prognosis for *T foetus*-infected cats is usually good, as most will eventually overcome the infection. However, this can take up to 3 years, with cats continuing to shed the organism for many months after resolution of diarrhoea.[1,5] Therapeutic interventions are currently limited. Many medications (including metronidazole and fenbendazole) are poorly effective,[1,3,5,13] and although recent work has indicated that treatment with ronidazole may be successful[14] there is currently no licensed form of this product for cats, and it can cause lethargy, ataxia, tremors and, occasionally, seizures in cats.[14,15]

*Corresponding author. E-mail: danielle.gunn-moore@ed.ac.uk

1098-612X/08/020131+04 $34.00/0

Materials and methods

In May 2006, 105 cats were living in the rescue cattery in Arezzo, Tuscany, Italy. Most had been rescued from the street but a few came from owners who were unable to keep them. On arrival at the cattery the cats received a full physical examination, were tested for feline immunodeficiency virus and feline leukaemia virus, were de-wormed (pyrantel and praziquantel as per manufacturer's recommendations; Drontal Cat, Intervet) and vaccinated against feline herpes virus, feline calicivirus and feline panleukopenia virus (Purevax RCP, Merial; or Nobivac Tricat, Intervet); they had microchips placed and were neutered. They were then placed in indoor quarantine for 21 days, after which they joined the rest of the cats in large outdoor runs with communal dirt pits as latrines. It was in these large outdoor runs that, from May 2006, 74 cats developed persistent large bowel diarrhoea. Affected cats were found to be negative for nemotodes, cestodes, giardiasis, cryptosporidiosis and toxoplasmosis, using routine diagnostic methods, and refractory to common treatments, including dietary manipulation (Hill's i/d; Hill's Pet Nutrition), and the administration of routine anthelmintics (see above, and Ivermectin, Ivomec, given as per manufacturer's recommendations) which were administered to all affected cats.

Faecal samples from the cats with diarrhoea were collected using rectal swabs and assessed using direct smears with saline dilution ($n = 20$) and the In Pouch TF culture system ($n = 74$)[7] (the latter was performed at the Sezione di Arezzo of the Istituto Zooprofilattico Sperimentale delle Regioni Lazio e Toscana). The 24 cats that were found to be positive for *T foetus* were treated with ronidazole (Orffa UK) at 30 mg/kg per os, twice daily for 14 days, kept in group isolation, then re-tested for *T foetus* by culture 2 weeks after treatment had been completed ($n = 17$; 7/24 were considered too stressed to undergo repeat rectal swabbing) and by PCR ($n = 1$; due to financial limitations) (processing, primers and controls[8]; test performed by Capital Diagnostics, Edinburgh, Scotland[10]).

Results

Of the 20 cats that were assessed by direct faecal smear only one was found to be positive (5%). In comparison, of the 74 cats that were assessed by *T foetus*-specific culture 24 (32%) were found to be positive. These 24 cats were then treated with ronidazole which in all cases resulted in either resolution or a dramatic reduction of the clinical signs of colitis. Faecal samples from 17/24 ronidazole-treated cats were re-assessed by *T foetus*-specific culture and were found to be negative. However, a faecal sample from one of these cats was also submitted for *T foetus* PCR and was found to be positive. Since treatment, the cats have continued to have their faeces monitored, albeit only visually, and while loose stools are still passed by some of the cats, the problem is much less severe and less frequent than before.

Two severely affected kittens developed what was believed to be sepsis followed by rapid death: one cat was 7 months of age, had been confirmed to be *T foetus*-positive by culture and received 2 days of ronidazole treatment before dying; the other was 4 months of age, had not been confirmed to be *T foetus*-positive and received no treatment. Due to financial limitations a post-mortem examination was only performed on one, and while the gross changes were consistent with sepsis, confirmatory testing could not be performed.

Of the 24 cats that were confirmed to be infected with *T foetus*, 16 (67%) were adults (determined by physical examination to be between 18 months and 7 years of age), and eight (33%) were between 6 and 12 months of age. They were all neutered non-pedigree domestic cats; 14 (58%) were females and 10 (42%) were males.

Discussion

This case report shows that *T foetus* infection was a common cause of refractory large bowel diarrhoea in the cats in this rescue centre in Italy. Thirty-two percent of clinically affected cats were found to be infected with *T foetus*; the majority of which were adults of over 18 months of age, and all were neutered non-pedigree cats. The prevalence of infection was similar to that reported for cats at a cat show in the USA[3] and for pedigree cats with diarrhoea in the UK.[10] However, while other studies have found pedigree cats to be more likely to develop *T foetus*-associated diarrhoea[1,3,5,10,11] the cats in the current report were all non-pedigree. It is not currently known whether *T foetus* infection is seen more commonly in pedigree cats because of genetic predisposition, or simply because these cats tend to be kept in large multi-cat households. The latter is consistent with the knowledge that high population density is the most important risk factor for this infection because it predisposes to high levels of faecal-oral spread.[1,3,5]

The current report is in disagreement with data from the USA and UK in relationship to the age of the *T foetus*-infected cats. In other studies the majority of infected cats have been a year of age or younger.[1,3,5,11] The reason for this discrepancy is unknown, but it may have arisen if this was the first time the infection entered this cat population so a lack of acquired immune protection allowed older cats as well as younger cats to developed clinical signs. Certainly, one of the authors (DG-M) has seen other cases of *T foetus*-associated diarrhoea in older cats on the initial introduction of the parasite to a household.

It was not possible to determine the true prevalence of *T foetus* infection in the current study population. Seventy-four of 105 cats (70%) developed significant large bowel diarrhoea clinically consistent with *T foetus* infection. However, due to practical and financial limitations wide-spread testing could not be undertaken. With limited testing being confined to clinically affected cats 1/20 (5%) were found to be positive for *T foetus* by direct faecal microscopy and 24/74 (32%) were positive by culture. It is likely that this underestimated the level of infection as it missed any asymptomatic carriers. In addition, direct faecal microscopy and culture are considerably less sensitive than PCR; direct faecal microscopy being found to be 14% sensitive in one study, compared to 56% sensitivity for culture and 94% for PCR.[3] In addition, the parasite may only be shed intermittently[9] and most cats were only sampled once.

Previous studies have shown that while cats with *T foetus* infection may develop severe diarrhoea few show systemic signs of ill-health.[1] However, in the current report two kittens with severe diarrhoea developed sudden systemic illness, followed by rapid death. Unfortunately, only one post-mortem examination was performed and additional testing to confirm sepsis was not possible (due to financial limitations). It could, therefore, only be presumed that these deaths resulted from endotoxic shock secondary to deep lesions in the colonic mucosa, as has occasionally been reported previously, typically in young kittens.[1]

Ronidazole is currently the treatment of choice for *T foetus* in cats, although it is not a licensed product and it can cause significant side effects.[13–15] In the current study ronidazole was effective at resolving the clinical signs, but finding that at least one of the treated cats was PCR-positive suggests that some of the treated cats may have become carriers.[14] Since the time of treatment some of the treated cats, and other cats in the colony, have continued to produce occasional loose stools. However, due to financial limitations it has not been possible to undertake further investigations and it is not known how many of the cats may still be infected with *T foetus*.

The report shows that *T foetus* was found commonly in the diarrhoeic faeces of cats from this rescue centre in Italy. This protozoon is, therefore, an important differential diagnosis to consider when investigating cats with persistent large bowel diarrhoea, particularly when they come from a multi-cat establishment. The prevalence of this infection may be more widely distributed than previously thought.

Information

Address of the rescue cattery: Rifugio per Gatti 'Cinni', Loc. Cicaleto, Sargiano, 52100 Arezzo, Tuscany, Italy. Mobile phone: 339/7004862. E-mail: dariadark@alice.it.

AISPA (Anglo-Italian Society for the Protection of Animals), 136 Baker Street, London W1U6DU. Tel.: 01743232559. E-mail: aispa@clara.co.uk, www.aispa.org.uk, Registered Charity number 208530.

More information about *T foetus* infection in cats is available on the FAB website www.fabcats.org, the PCR and 'In Pouch TF' tests are available in the UK from Capital Diagnostics in Edinburgh (0131 535 3145) and in the USA from North Caroline State University, USA, www.cvm.ncsu.edu/mbs/gookin_jody.htm, and information on the use of ronidazole for the treatment of this infection in cats in the UK is available from danielle.gunn-moore@ed.ac.uk.

Acknowledgements

Malcolm Holliday wishes to thank Bryn Tennant, Capital Diagnostics, for his generous help and advice; Bunny Holliday, for her valuable assistance and attention to detail; and AISPA (Anglo-Italian Society for the Protection of Animals), for their ongoing support as without them the Rifugio per Gatti 'Cinni' would not exist.

References

1. Gookin JL, Breitschwerdt EB, Levy MG, Gager RB. Diarrhoea associated with trichomoniasis in cats. *J Am Vet Med Assoc* 1999; **215**: 1450–4.
2. Gookin JL, Levy MG, Law JM, Papich MG, Poore MF, Breitschwerdt EB. Experimental infection of cats with *Tritrichomonas foetus*. *Am J Vet Res* 2001; **62**: 1690–7.
3. Gookin JL, Stebbins ME, Hunt E, et al. Prevalence and risk factors for feline *Tritrichomonas foetus* and *Giardia* infection. *J Clin Microbiol* 2004; **42**: 2707–10.
4. Levy MG, Gookin JL, Poore M, Birkenheuer AJ, Dykstra MJ, Litaker RW. *Tritrichomonas foetus* and not *Pentatrichomonas hominis* is the etiologic agent of feline trichomonal diarrhoea. *J Parasitol* 2003; **89**: 99–104.
5. Foster DM, Gookin JL, Poore MF, Stebbins ME, Levy MG. Outcome of cats with diarrhoea and *Tritrichomonas foetus* infection. *J Am Vet Med Assoc* 2004; **225**: 888–92.
6. Mardell EJ, Sparkes AH. Chronic diarrhoea associated with *Tritrichomanas foetus* infection in a British cat. *Vet Rec* 2006; **158**: 765–6.
7. Gookin JL, Foster DM, Poore MF, Stebbins ME, Levy MG. Use of a commercially available culture system for diagnosis of *Tritrichomonas foetus* infection in cats. *J Am Vet Med Assoc* 2003; **222**: 1376–9.
8. Gookin JL, Birkenheuer AJ, Breitschwerdt EB, Levy MG. Single-tube nested PCR for detection of *Tritrichomonas foetus* in feline faeces. *J Clin Microbiol* 2002; **40**: 4126–30.
9. SAC (SAC Veterinary Services) Monthly Report. *Vet Rec* 2007; **161**(16): 544–6. Available from:. <www.sac.ac.uk/consultancy/veterinary/publications/monthlyreports/2007>.
10. Gunn-Moore DA, Tennant B. *Tritrichomonas foetus* in cats in the UK. *Vet Rec* 2007; **160**(24): 850–1.
11. Gunn-Moore DA, McCann TM, Reed N, Simpson KE, Tennant B. Prevalence of *Tritrichomonas foetus* infection in cats with diarrhoea in the UK. *J Feline Med Surg* 2007; **9**: 214–8.

12. Gookin JL, Stebbins ME, Adams E, et al. Prevalence and risk of *T. foetus* infection in cattery cats. [abstract]. *J Vet Intern Med* 2003; **17**: 380.
13. Kather EJ, Marks SL, Kass PH. Determination of the in vitro susceptibility of feline *Tritrichomonas foetus* to 5 antimicrobial agents. *J Vet Intern Med* 2007; **21**(5): 966–70.
14. Gookin JL, Copple CN, Papich MG, et al. Efficacy of ronidazole for treatment of feline *Tritrichomonas foetus* infection. *J Vet Intern Med* 2006; **20**: 536–43.
15. Rosado TW, Specht A, Marks SL. Neurotoxicosis in 4 cats receiving ronidazole. *J Vet Intern Med* 2007; **21**(2): 328–31.