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Authors: Shell, Linda, Ketzis, Jennifer, Hall, Rebecca, Rawlins, Gilda, and du Plessis, Wencke

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Linda Shell¹, Jennifer Ketzis², Rebecca Hall¹, Gilda Rawlins¹
and Wencke du Plessis¹

Abstract

Case summary A 1-year-old, female spayed, domestic shorthair, indoor cat on the island of St Kitts was diagnosed with platynosomiasis, infection with a feline-specific liver fluke, and treated with praziquantel at the marketed dose for tapeworms (5 mg/kg; actual calculated dose 5.75 mg/kg). Serial fecal analyses showed that egg counts decreased to zero within 10 days of treatment but re-emerged at day 17 and persisted at low levels until a second treatment was administered on day 78. After the second treatment, all fecal samples (n = 15) from day 85 to day 350 post-initial treatment were negative for *Platynosomum* ova.

Relevance and novel information Treatment of platynosomiasis is poorly documented; no drugs are labeled for use against *Platynosomum* and the efficacy of suggested treatments is unknown. Using 5.75 mg/kg once, a dose that is significantly lower than published recommended doses for platynosomiasis, egg counts initially disappeared but re-emerged and persisted at low levels until a second treatment was administered. We hypothesize that immature forms may not have been killed and subsequently matured to produce eggs, or that the one-time dose may not have been completely effective at eliminating all adult flukes. However, administering praziquantel at 5.75 mg/kg twice, several weeks apart, appeared to be effective in treating this cat with platynosomiasis, as evidenced by monitoring of fecal egg counts over the course of 350 days.

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Case description

A female domestic shorthair indoor cat, estimated to be 1 year of age, presented to the Ross University School of Veterinary Medicine (RUSVM) Veterinary Clinic for a routine examination. The cat had been a stray 6 months previously and had been kept strictly indoors since then. Vaccines had not been administered and the cat was not on a heartworm preventive. Ovariohysterectomy had been performed 5 months earlier, at which time feline leukemia virus and feline immunodeficiency test results were negative. Four months prior to this examination (2 months after becoming an indoor cat), a short bout of diarrhea prompted a fecal flotation, which was positive for *Eucoleus* species, psoroptic mites and mite eggs. The presence of mites and mite eggs were considered spurious, and no further investigations were made. While none of the fecal examination findings explained the diarrhea, oral fenbendazole (Panacur 10% oral suspension; Intervet) was administered at 50 mg/kg bodyweight (BW) daily

for 3 days and the diarrhea resolved until 2 weeks prior to this appointment, when another episode was noted and abated without treatment.

No significant findings were found on physical examination. The history of recent diarrhea prompted submission of a fecal sample. Using a double centrifugation method (2 g feces; Sheather's Sugar Flotation Solution), *Platynosomum* species eggs were found and reported as number of eggs per gram of feces (EPG) (Table 1).^{1–3} The history of

¹Departments of Clinical Sciences, Ross University School of Veterinary Medicine, Basseterre, St Kitts, West Indies

²Biomedical Sciences, Ross University School of Veterinary Medicine, Basseterre, St Kitts, West Indies

Corresponding author:

Linda Shell DVM, DACVIM, Department of Clinical Sciences, Ross University School of Veterinary Medicine, PO Box 334, Basseterre, St Kitts, West Indies
Email: lshell@rossvet.edu.kn



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Table 1 Results of serial fecal examinations

Day	Fecal results (EPG)
0 (treatment): 23 mg praziquantel	52
1	37
2	33
3	73
4	16
5	8
6	9
8	2
9	1
10, 11, 13, 15	0
17, 57	3
62	0
63, 65	1
78 (treatment): 23 mg praziquantel	–
79	1
80, 82	0
83	1
85–89	0
91, 93, 95, 97, 99, 100, 109, 111, 125, 129, 174, 288, 350	0

EPG = eggs per gram

intermittent diarrhea and presence of *Platynosomum* eggs prompted additional diagnostic testing. Client consent was obtained to perform a hemogram, chemistry profile and an abdominal ultrasound examination.

No significant changes were found on a hemogram. Abnormalities found on a chemical profile were slight elevations in alanine transaminase (ALT; 104 U/L; normal range 20–100) and total protein (8.5 g/dl; normal range 5.4–8.2). Ultrasonographic examination of the liver showed dilation of the entire bile duct system, an enlarged duodenal papilla (0.5 × 0.36 cm), and an enlarged gallbladder with slightly thickened and hyperechoic walls. The pancreas was within normal limits.

The presence of an enlarged duodenal papilla without clinical or laboratory signs of obstruction or concurrent pancreatitis in conjunction with the history and fecal examination findings led to an ultrasonographic diagnosis of cholecystitis, most likely from a *Platynosomum* infection. Praziquantel was administered once orally at the label dose for tapeworms in cats (23 mg Droncit for cats [Bayer]; 5.75 mg/kg), and serial fecal and ultrasound examinations were performed to determine if this dose of praziquantel would have an effect on the infection (Table 1). Institutional Animal Care and Use Committee approval was obtained to treat the cat at this dose.

A formalin-ether technique has been described as the best method to detect eggs.⁴ However, owing to the prevalence of *Platynosomum* species on St Kitts,⁵ our diagnostic laboratory had previously determined that

double centrifugation with Sheather's Sugar was a reliable and consistent method to detect *Platynosomum* species, and this method was used for fecal analysis.

Platynosomum species ova increased on day 3 post-treatment but gradually decreased thereafter until ova were absent at day 10 post-treatment. However, low numbers of ova were detected on days 17, 57, 63 and 65 post-treatment, which prompted a second treatment with praziquantel (23 mg Droncit for cats; 5.75 mg/kg once orally) on day 78. One egg was detected on days 79 and 83 (days 1 and 4 post-second treatment) and subsequent fecal samples, up to day 350 post-initial treatment, were negative for *Platynosomum* ova. Over the initial 6 months of treatment, ultrasonographic findings remained largely unchanged: dilated bile ducts and a hyperechoic, thickened gallbladder wall persisted. The previously elevated ALT (78 U/L) and total protein (8 g/dl) results were normal when re-checked on day 177 post-initial treatment. The cat has remained clinically normal.

Discussion

Platynosomum fastosum (Syn *Platynosomum concinnum*) is a feline-specific liver fluke that resides in hepatic bile ducts and the gallbladder. It is commonly found in tropical and subtropical regions of the world (eg, southern USA, South America). *Platynosomum* flukes use mollusks or terrestrial isopods as intermediate hosts, lizards as paratenic hosts and cats as the final host.^{6–8} Once a cat ingests a host with metacercariae, infective stages of the fluke migrate to the common bile duct and into the

gallbladder and smaller bile ducts where they mature into adult flukes (2×16 mm, depending on maturity) within 8–12 weeks. Embryonated eggs are passed in bile into the alimentary system and can be detected in the feces as early as 8 weeks after infection. Infected cats can be asymptomatic or have ‘lizard poisoning’ syndrome, which is characterized by diarrhea, vomiting, anorexia and icterus, and can result in death. Historically, this cat had two episodes of diarrhea but lacked other clinical signs.

A previous report on the ultrasonographic findings in cats infected by *Platynosomum* species described hepatomegaly, tortuous bile ducts, echogenic gallbladder walls and accentuated distension of the gallbladder.⁹ With the exception of hepatomegaly, our findings were similar. To our knowledge, no one has investigated how ultrasound results may change following treatment for *Platynosomum*. Numerous histopathological reports describe periductal fibrosis in *Platynosomum* cases;^{10–13} fibrosis would imply that ultrasound improvement may not occur with treatment. Ultrasound changes did not improve in this case over the course of a year, yet the cat did not develop any clinical signs of cholestatic disease. We assume that the persistent ultrasound changes were due to chronic damage to the biliary system associated with bile duct fibrosis following sexual maturation of the flukes.^{10–13} However, other causes of these ultrasound findings cannot be excluded without histopathology.

Treatment of platynosomiasis is poorly documented; no drugs are labeled for use against *Platynosomum* and the efficacy of suggested treatments is unknown.^{14–16} Based on the extensive number of studies conducted with another liver fluke, *Fasciola hepatica*, evaluation of treatment efficacy can be difficult in the live animal. Serial fecal examinations are often used because of intermittent excretion of a low numbers of eggs. Because eggs can be found in feces for several weeks after adult fluke death, treatment efficacy based on EPG typically does not occur until 10–14 days post-treatment.^{17–20} However, if the product is not effective against early or late immature adults, positive fecal results >3 weeks post-treatment are less indicative of efficacy against adult flukes and more related to immature flukes reaching full maturity and producing eggs.^{19,20} While it is unclear if a similar situation occurs with *Platynosomum* infections, the re-emergence of eggs post-treatment in a prior study and in this case report are evidence that it could occur.¹⁴

Currently, most treatments for *Platynosomum* infections are based upon a 1978 study in which praziquantel (20 mg/kg BW) was administered to five cats.¹⁴ Negative fecal egg counts were achieved by 2 weeks post-treatment but thereafter positive fecal egg counts were found at irregular intervals.¹⁴ Other recommended doses of praziquantel have varied from 5 mg/kg q12h for 3 days to 20 mg/kg BW orally for 3 days.^{15,16}

In this case study, praziquantel, at the marketed dose for tapeworms (5 mg/kg), was used. Clinical signs, serial fecal examinations and ultrasound evaluations were used to evaluate efficacy. The results suggest that this dose could be effective, as evidenced by steadily decreasing fecal egg counts that dropped to zero within 10 days of treatment. The increase in EPG on day 3 post-initial treatment could have been due to natural fluctuation of egg shedding or an increase in egg release by dying adult flukes.

The reappearance of eggs 17 days post-initial treatment is similar to the data presented by Evans and Green,¹⁴ where a higher dose (20 mg/kg) of praziquantel was used. Several explanations can be suggested for the reappearance of eggs on days 57, 63 and 65 post-initial treatment. First, the dose of 5 mg/kg praziquantel may have killed the adult flukes but may not have affected immature forms, which subsequently matured and started to produce eggs in low numbers. Praziquantel, depending on the fluke species and host animal, has limited efficacy against immature flukes.^{21,22} Second, the cat could have continued to ingest infected lizards that are commonly found inside homes on St Kitts. Indoor-only cats have previously been found, via fecal examinations, to be positive for *Platynosomum* species (Ketzis and Shell, unpublished data). Finally, treatment efficacy may have been <100% against the adult flukes. The treatment might have temporarily suppressed egg production from the surviving adult flukes. Upon their subsequent recovery, egg production might have recommenced. If this was the case, it is difficult to evaluate the exact efficacy of the single treatment of praziquantel, as the direct relation of EPG to adult *Platynosomum* has not been well documented.

A second treatment of praziquantel at 5 mg/kg was administered on day 78, and 6 days after this no further eggs were found on numerous fecal examinations over the next 3 months. In addition, follow-up fecal examinations at 6, 10 and 12 months post-diagnosis showed no *Platynosomum* eggs and the cat has remained asymptomatic.

Conclusions

Based upon repeat ultrasound evaluations, which showed no worsening of the initial changes, multiple repeat fecal examinations that were negative for *Platynosomum* eggs after the second praziquantel treatment, and the absence of any clinical and laboratory signs of cholestasis, we propose that 5 mg/kg praziquantel administered twice several weeks apart may be effective in eliminating *Platynosomum*. While any use of praziquantel to treat *Platynosomum* is off label, this treatment has the advantage that the dose (5 mg/kg) is within the recommended dose range for praziquantel. The length between two treatments is unclear without controlled studies; however, we suggest an interval of 3–4 weeks.

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Conflict of interest The authors do not have any potential conflicts of interest to declare.

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