Pathogenic *Giardia* Isolated from a Wild-Trapped Sulphur Crested Cockatoo (*Cacatua galerita*)

Adrian N. Gallagher[*], Brett D. Gartrell[*] and Jacqueline A. Upcroft[**]

Introduction

Giardia is a protozoan parasite of humans and many other species of animals. There are several species recognised.

1. *G. duodenalis* - This occurs in humans and mammals
2. *G. muris* - Rodents
3. *G. ardee* - Blue herons
4. *G. psittacae* - Parrots

Animals are a possible reservoir for human infection. Hence there is zoonotic potential for animal to human transfer. *Giardia psittacae* is morphologically distinct from the other species.[1] It occurs in budgerigars, cockatiels, lovebirds and grey-cheeked parrots in the United States. Amazons, Conures, Cockatoos. Macaws, Toucans, Galliformes and Anseriformes are rarely affected[2,3,4] but *Giardia* has never been recorded in finches or canaries. *Giardia* is common in birds overseas but rare in Australia.[5] In this paper, we describe the first confirmed psittacine case of giardiasis in Australia.

EPIDEMIOLOGY

Giardia has a simple direct life cycle. Transmission occurs directly by the faecal-oral route. There is no conclusive evidence of water-borne transmission for any species of *Giardia*. Infective cysts or trophozoites are ingested, the cysts hatch and attach to the mucosa of the duodenum and jejunum. The method of attachment is unclear but it is believed to involve the sucker disc. Reproduction is by binary fission although there is evidence of sexual reproduction in some species.[6]

In the lower small intestine an unknown trigger induces the trophozoites to form cysts. These have a thin chitinous wall and are passed out in the faeces. Whether cysts are immediately infective is unclear. Some require a maturation of seven days. The cysts are very resistant and can survive for up to two months in the environment under optimal conditions. Very few cysts are required to induce disease. In fact only one is required.

Excystation occurs quickly once ingested by a susceptible host. Incubation is 4-15 days duration.

In acute disease trophozoites can be passed in the faeces. If ingested these may be able to survive passage through the stomach to initiate disease.

[*] **Brighton Veterinary Surgery, 353 Beaconsfield Terrace, Brighton QLD 4017**

[**] **Queensland Institute of Medical Research, The Bancroft Ctr, 300 Herston Road, Brisbane QLD 4029**

In the United States *Giardia* is a very common disease in caged birds and the organism is common in faecal samples. Infected budgerigars and cockatiels are often asymptomatic, suggesting a carrier state. In 77 parakeets, 66% were shedding *Giardia*.[7] In another study 70% of cockatiels , 55% of budgerigars, 25% of lovebirds, 5% of grey-cheeked parakeets and <5% of other psittacine birds were shedding *Giardia*.[7] Shedding is often intermittent.

One budgerigar which tested positive for *Giardia* was monitored for five months and showed decreasing numbers of giardia prior to necropsy indicating a tolerance was developing.[2]

Juvenile birds and noenates can expect high mortality post-infection. Mortalities of 20-50% can be experienced in budgerigars.[7] Infection occurs from contact with asymptomatic carriers or contaminated food, water or nest material. The mechanism by which *Giardia* affects its host is unknown.[6]
Infected birds are thought to die of dehydration. Immunity if any, is short-lived. Reinfections are common.

Clinical Signs

As stated earlier many infected birds are asymptomatic and are therefore thought to be carriers. Highest mortality occurs in juveniles, Birds under six months of age experience:-

Diarrhoea - often very malodorous and mucoid
Anorexia
Depression
Weight loss
Weakness

Secondary infection with Gram-negative bacteria or yeasts are common.

Blood tests generally show an eosinophilia and hypoproteinaemia. Adult birds show similar clinical signs but with less severity. Two other syndromes are reported to be associated with *Giardia* in cockatiels ie, feather loss and "cockatiel paralysis syndrome". Pruritis, dry skin, self-mutilation and feather loss are reported overseas to be associated with *Giardia* infection (primarily the legs, flank, axilla and carpo-metacarpal areas are affected. This condition regresses on treatment for the concurrent giardiasis.[8] Anecdotal reports of metronidazole responsive pruritus exist in Australia but *Giardia* has not been isolated from these birds.

"Cockatiel Paralysis Syndrome"

This is Vitamin E/Selenium responsive disease which occurs frequently in cockatiels (especially Lutino Cockatiels) with concurrent infection with *Giardia* spp or *Hexamita* spp. It is thought that the protozoa may interfere with the absorption of Vitamins A & E from the intestine. The paralysis can affect a variety of muscles but generally the legs are worst affected. Oral paralysis is also seen and once again malabsorption of Selenium/Vitamin E secondary to giardiasis is thought to be the cause.[9]

Post Mortem

Generally minor hyperaemia of the small intestine is the only finding.

Diagnosis

Diagnosis is made by observing the organisms in faeces or in fresh mucosal scrapings. These can be examined on a wet mount. Trophozoites are very unstable outside the host and it is suggested that samples be examined within 10 minutes of collection. Fresh smears can be stained with iodine or carbol

fuschin to highlight the organisms. Smears can also be fixed in polyvinyl alcohol (P.V.P.) for trichrome staining. Flotation with zinc sulphate can improve detection by concentrating the organism. ELIZA tests for *Giardia* spp. exist for human infections but their efficacy in birds is unknown. Culture is possible which allows further studies ie, DN, scanning electron microscopy (S.E.M.) to be conducted to establish classification.

Differential Diagnosis

Numerous protozoa affect avian species. These include *Giardia*, *Hexamita*, *Cochlosoma* and *Trichomonas*. Listed below is the differential diagnosis of these organisms.

Giardia

- pear-shaped trophozoites
- 10-20µm x 5-15µm
- 2 nuclei
- 8 paired flagella (including anterior and trailing posterior pairs)
- sucking disc
- direct motion

Cysts

- oval
- 8-14µm x 6-10µm
- thin-walled, organism doesn't fill cyst.

Hexamita

- rare
- generally in Gallinaceous spp. and lorikeets.
- 6-12µm x 2-5µm
- pear-shaped
- bilaterally symmetrical
- 6 or 8 anteriorly directed flagella - 2 groups (3 or 4)
- 2 nuclei
- lacks sucking disc

Cochlosoma

- common in psittacine birds in Australia
- spherical to oval
- 6-19µm x 2-9µm
- 4 anterior flagella and an undulating membrane which is rds th lebgth of the organism.[11]
- progressively motile with a jerky tumbling motion

Treatment and Control

Palliative and supportive treatment is recommended

Dimetridazole (Emtryl® May & Baker) 3g/5L 7 days
Metronidazole (Flagyl® May & Baker) 0.05mg/g BW 5 days
Ronidazole (Ronivet® Vetafarm) 4g/L 7 days

Ipronidazole (Ipropan® Roche) No dose rate located

It is also important for control to maintain a dry environment and to prevent contamination of water vessels. It is also important to note that cysts survive standard chlorination procedures. Adequate nutrition and genetic outcrossing can reduce the incidence of disease by improving the general health of the birds.

CASE REPORT

We were warned of a client arriving with a moribund sulphur crested cockatoo. The bird was dead on arrival. It was one of five which arrived from Melbourne that day from a wholesaler for retail trade. The birds were from legally obtained wild-trapped stock. The four remaining birds were not examined but the owner stated they were quiet.

The dead bird was in good muscle condition with minor soiling around the vent. There was no evidence of dehydration. Autopsy revealed a hyperaemic small intestine with a particular nutmeg, zonal, serosal hyperaemia/haemorrhage.

Scraping revealed high numbers of motile protozoa consistent in type with *Giardia*.
Samples were collected for culture and histology. Gram stains (of mucosa and scrapings) failed to reveal any Gram-negative bacteria or yeasts. Histological examination of the small intestine was unremarkable.

Jacqueline Upcroft of the Queensland Institute of Medical Research was consulted. Jacqui has an interest in the classification of ancient prokaryocytes. She obtained samples fixed in P.V.P. and fresh samples for *Giardia* culture. Culture was positive for *Giardia* and this organism has been named "Polly". "Polly" appears robust and is morphologically indistinguishable from *G. duodenalis*. Future analysis and SEM studies will ensure its full classification. Despite treatment with Ronidzole® the four remaining in contact birds died within 48 hours of arrival. Unfortunately none was presented for autopsy.

CONCLUSION

The confirmed presence of high numbers of *Giardia* in the absence of any other established pathogen is basis for us to assume this to be the first documented case of *Giardia* in a psittacine species in Australia. The aggressive nature of the organism, the similarity to G. duodenalis and the uncertainty of zoonotic potential poses some concern. Cross-species infection is unusual but cannot be disregarded. It is likely this is an avian organism and not an aberrant infection by a mammalian *Giardia* spp.

Further studies on mice are being conducted at the moment to determine if cross-species infection is possible and to determine whether disease can be induced in these mice. If cross-species infection occurs then we have the potential for zoonosis from pet birds to their owners and also the possibility of spread of the pathogen via wild cockatoos into other localities.

References

1. Erlandsen, S.L. and Bemrick, W.J. (1987). SEM evidence for a new species: *Giardia psittacae*. J. parasitology. 73: 623-629

2. Box, ED (1981). Observation on *Giardia* of budgerigars. J. Protozoan 28: 491-494

3. Fudge, AM and McEntee, L. (1986). Avian giardiasis: syndrome, diagnosis and therapy. Proc. Assoc. Avian vet. pp. 155-164.

4. Scholtens, RG, New, JC, Johnson, S (1982). The nature and treatment of giardiasis in parakeets. J. Am. Vet. Med. Ass. 180: 170-173.

5. Forsham, D, Palmer, DG, Halse, SA, Hopkins, RM, Thompson, RCA (1992). Giardi in straw-necked ibis (Threskiornis spinicollis) in Western Australia. Vet. Rel. 131: 267-266.

6. Thompson, RCA, Lymbery, AJ, Meloni, BP. (1990). Genetioc variation in *Giardia kunstler* 1882. Taxonomic and epidemiologicl significance. Protozoolical abstracts 14: 1-9.

7. Panigrahy, B. et al (1979). Zoontic disease in psittacine birds: apparent increased occurrence of chlamydiosis (psittacosis, salmonellosis and giardiasis. J. Am. Vet. Med. Ass. 175: 359-361.

8. Cooper, JE and Harrison, GJ (1994). In Avian medicine, Principles and Application. 634.

9. Harrison, GJ (1986). Premliminary work with selenium/vitamin E responsive deficiencies in cockatiels and pther psittacines. Proc. Assoc. Avian Vet. pp 257-262.

10. Harper, FDW (1991). *Hexamita* spp. present in some avian spp in New South Wales. Vet Rec 128-130