Wildlife Health Australia

Disseminated coccidiosis (*Caryospora cheloniae*) in green turtles

Fact sheet

Introductory statement

Coccidiosis in *Chelonia mydas* was originally described from an epizootic amongst mariculture-reared hatchling turtles on Grand Cayman in the British West Indies (Rebell *et al.* 1974). The organism responsible, *Caryospora cheloniae*, was described subsequently by Leibovitz *et al.* (1978). Coccidiosis in free-living *C. mydas* was first described in 1991, from an epizootic affecting large subadult and pubescent animals in south-east Queensland and northern NSW (Gordon *et al*. 1993; Gordon 2005). Subsequent epizootics and sporadic cases have been recorded in Queensland and NSW (Gordon 2005; Rose *et al.* 2003).

Neurological disease in the green turtle, *C.mydas*, due to the coccidial parasite *C. cheloniae* is a non-listed disease of particular interest to the OIE (http://www.daff.gov.au/__data/assets/pdf_file/0011/581888/oie-wildlife-diseases-dec04.pdf).

Aetiology

Caryospora cheloniae is a coccidian in the Phylum Apicomplexa, Family Eimeriidae.

Natural hosts

Green turtles are the only known natural host for *C. cheloniae*. The life cycle has not yet been elucidated. Attempts to establish experimental infections in *C. mydas* hatchlings were unsuccessful (Gordon 2005).

Other *Caryospora* spp. have carnivorous reptiles and birds as primary hosts, and rodents as secondary hosts, with either a one or two host (predator-prey) lifecycle. *C. cheloniae* has been included in the genus *Caryospora* on the basis of sporocyst morphology; endogenous development and structure could be quite different from other *Caryospora* spp. (Upton and Sundermann 1990).

World distribution

The disease has been reported in mariculture-reared hatchling turtles in the Cayman Islands (Rebell *et al*. 1974; Leibovitz *et al.* 1978).

Occurrences in Australia

Coccidiosis caused by *C. cheloniae* has been reported in stranded green turtles in southeast Queensland and northern NSW (Gordon *et al.* 1993; Gordon 2005), and in Port Stephens, NSW (Rose *et al.* 2003).

Epidemiology

The original epizootic of coccidiosis in mariculture-reared *C. mydas* hatchlings was attributed to poor hygiene (Rebell *et al*. 1974). Coccidiosis in free-living green turtles results in both sporadic mortalities and epizootics. The disease appears to be enzootic in the Moreton Bay region of south-east Queensland, with relatively unknown factors predisposing the population to epizootics (Gordon 2005).

There is an apparent seasonality to coccidiosis in free-living *C. mydas*, with most cases recovered during the warmer months of September to February (Gordon 2005; Rose 2003). Drought conditions have been speculatively linked with epizootics by Rose *et al.* (2003), who recorded algal blooms of *Trichodesmium erythraeum* in seagrass beds and postulated that drought conditions could allow a heavy build-up of infective stages of the parasite in the feeding grounds.

In south-east Queensland statistical analysis revealed that turtles with coccidiosis were significantly larger than those without coccidiosis (Gordon 2005). This may reflect increased exposure or susceptibility of large subadult, pubescent and adult turtles, compared to juvenile size classes.

Infection with *C. cheloniae* may be subclinical in green turtles. A necropsy survey from south-east Queensland demonstrated subclinical infection in 22% (11/50) of turtles which were found to have died of other causes. In these turtles, small numbers of oocysts were detected on faecal floatation, without concomitant intestinal or disseminated lesions (Gordon 2005).

Clinical signs

Green turtles with coccidiosis can present with both acute and chronic forms of disease.

Signs of acute disease include:

- Diarrhoea;
- Neurological signs, including head tilt, circling in the water and on land, and nystagmus
- Weakness, severe depression
- Dehydration, as indicated by sunken eyes and concavity of the plastron. These signs mimic emaciation, but acutely affected turtles are generally in good nutritional condition.

Turtles which survive the acute stage, or are kept alive in captivity, can develop chronic manifestations, which include:

- Intestinal tympany and obstipation; affected turtles may be abnormally buoyant, or list to one side

- Continuing neurological disease
- Emaciation

Diagnosis

The disease is diagnosed by histopathology, by analysis of intestinal lining and faeces for the presence of typical coccidia, and by examination of blood smears and buffy coat.

Clinical pathology

In affected turtles, faecal floation in concentrated salt or sugar solutions usually demonstrates large numbers of distinctive, ellipsoidal (cigar-shaped) oocysts of *C. cheloniae*, measuring between 37-51 microns in length and 15 microns in width. However, it can be difficult to obtain faecal samples from sick turtles ante mortem (Gordon 2005). Coccidia harvested from the intestinal tract or faeces can be induced to sporulate in filtered seawater. Excysted sporozoites form characteristic 8-pointed "stars" (Gordon *et al*. 1993). A diagnosis of systemic coccidiosis can also be made when coccidial zoites are identified within circulating monocytes in a blood film or buffy coat preparation (Rose *et al* 2003).

Pathology

Gross necropsy findings include a mucoid to severely necrotising enteritis, generally involving the entire length of the intestine (Gordon *et al.* 1993; Gordon 2005). Most turtles are in good nutritional condition, suggesting relatively acute disease. Occasionally pinpoint white foci can be visualised in thyroid gland, kidney and brain. Sparse petechial haemorrhages may be present in the kidney. Reddening or cloudiness of the meninges may also be observed (Ladds 2009).

Histological findings reveal coccidial infection of the intestine and a variable range of other tissues. In some animals, infections appear to be confined to the intestine only. Coccidial gamonts are found only in the intestinal epithelium, whereas schizonts are found in intestinal epithelium and lamina propria, as well as a number of extra-intestinal sites, including brain, thyroid gland, kidney, adrenal gland and urinary bladder. Heavily infected intestinal epithelium may undergo necrosis, and is accompanied by a variable inflammatory response. Disseminated infection is associated with inflammation in a number of tissues, especially brain, where it can result in multifocal, necrotising meningoencephalitis. Schizonts may be present in some tissues without an accompanying inflammatory response.

Differential diagnoses

Diarrhoea, if present, is a very specific indicator of coccidiosis, but could theoretically occur with any cause of enteritis. The differential diagnosis of neurological disease in green turtles includes spirorchid fluke infection (Gordon *et al*. 1998), bacterial meningoencephalitis (ARWH case reports 3402/1, 3402/22) and trauma.

There are many causes of debility and emaciation in green turtles, including spirorchid fluke infection, foreign body ingestion, constipation, bacterial and fungal respiratory disease.

Laboratory diagnostic specimens

Procedures for specimen collection should follow those presented by Rose (2007). Key organs to target for histopathological examination include the small and large intestine, brain, thyroid gland, kidney and urinary

bladder. Faeces or scrapings of intestinal mucosa should be sent for parasitological examination. Whole blood can be collected from the paired cervical sinuses (Owens and Ruiz 1980) or the midline supravertebral sinus (Hulst 2000).

Laboratory procedures

Histological examination of tissues for the presence of coccidia.

Faecal floatation to detect coccidial oocysts (see Clinical Pathology). Microscopy of mucosal scrapings to detect coccidial schizonts, gamonts or oocysts.

Examination of blood film or buffy coat for the presence of coccidial zoites (See Clinical Pathology)

Treatment

None. Turtles which are moribund or severely weakened, or exhibiting neurological signs should be euthanased (J Barnes, *unpublished*).

Prevention and control

Strict hygiene procedures should be observed when handling or caring for sick and injured marine turtles. Detailed information describing resistance to physical and chemical action is not known.

Surveillance and management

Wildlife disease surveillance in Australia is coordinated by Wildlife Health Australia. The National Wildlife Health Information System (eWHIS) captures information from a variety of sources including Australian government agencies, zoo and wildlife parks, wildlife carers, universities and members of the public. Coordinators in each of Australia's States and Territories report monthly on significant wildlife cases identified in their jurisdictions. NOTE: access to information contained within the National Wildlife Health Information System dataset is by application. Please contact admin@wildlifehealthaustralia.com.au.

There is no targeted surveillance program or AUSTVETPLAN for disseminated coccidiosis in green turtles caused by *Caryospora cheloniae*.

Statistics

See the National Wildlife Health Information System Surveillance Database (www.wildlifehealthaustralia.com.au).

Research

No targeted research into disseminated coccidiosis in green turtles is being undertaken.

Human health implications

None reported.

Conclusions

The epizootic and sporadic nature of *C. cheloniae* infection in green turtles complicates any ongoing epidemiological investigation of the disease. The onset appears to be related to drought conditions and subsequent algal blooms. Surveillance of green turtles should be scaled up during these weather conditions. Further investigation of the parasitic life cycle of *C. cheloniae*, as well as continued monitoring of naturally-occurring mortalities need to be done.

References and other information

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To provide feedback on this fact sheet

We are interested in hearing from anyone with information on this condition in Australia, including laboratory reports, historical datasets or survey results that could be added to the National Wildlife Health Information System. If you can help, please contact us at admin@wildlifehealthaustralia.com.au.
Wildlife Health Australia would be very grateful for any feedback on this fact sheet. Please provide detailed comments or suggestions to admin@wildlifehealthaustralia.com.au. We would also like to hear from you if you have a particular area of expertise and would like to produce a fact sheet (or sheets) for the network (or update current sheets). A small amount of funding is available to facilitate this.

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