CRYPTOSPORIDIOSIS: AN UPDATE FOR REPTILE VETERINARIANS

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ABSTRACT

Cryptosporidiosis is a complex disease from both a medical and veterinary perspective. Changing perspectives on Cryptosporidium taxonomy begin to explain some of those complexities in regards to host variation. New studies evaluating diagnostics, treatment, and zoonotic concerns are discussed.

Introduction and New Information on the “Basics”

Cryptosporidiosis has long frustrated reptile veterinarians. Questions regarding diagnosis, cryptosporidiosis versus presence of Cryptosporidium, treatment, environmental control, and zoonotic risk, all still lack easy answers. Recent studies will be summarized to help understand why cryptosporidiosis is such an enigma. Many “findings” must be couched in “may” or “seems” or “suggests” because of the rapid changes in that understanding.

Taxonomy is a complex and ever-changing science where many of these questions may be answered. The genus Cryptosporidium has been suggested to be more closely related to the gregarines (parasites of invertebrates) than to the eimerians or haemosporina, based on small-subunit ribosomal RNA PCR amplification. Another study using the same technique but a different genetic segment supports the eimerian-Cryptosporidium relationship, though gregarines were not evaluated. As with any phylogeny, further repositioning will occur, as confirmation studies/further DNA evaluations come to light.

Controversy remains on speciating a Cryptosporidium oocyst. The best method is a combination of three factors: morphology, biology, and genetics. Morphology refers to size differences and shape index of oocysts. Biology refers to host specificity, organ location, pathogenicity, prepatent/patent periods, and intensity of oocyst shedding. Genetics refers to differences at multiple sites in nucleotide sequences of well-characterized genes. Unfortunately, even these rather broad identifying factors can be affected by a myriad of confounding variables such as oocyst morphology by host, propagation difficulties in laboratories, and age of the oocyst, among others. Another confounding variable is mixed species samples. This variable may explain why particular diagnostics or therapeutics perform well in one species or population but are ineffective in a similar group. As with the family Chlamydiaceae, genetic tests are finding more species (10+), genuses, and strains than previously described. Some species seem host specific, while others have several host species or
can populate or become pathogenic in accidental or immunocompromised hosts.

Currently, three species of *Cryptosporidium* are reported in reptiles: *C. serpentis, C. saurophilum* and *C. muris*. Reptile-specific species, *C. serpentis* and *C. saurophilum*, are described as having a limited host range—snakes and lizards respectively. The introduction of *C. serpentis* into ducks found no pathogenicity, though viable oocyst shedding occurred. Similar results in mice differed in that shedding was not reported. *Cryptosporidium serpentis* seems most closely related genetically to *C. muris* and *C. andersoni*, while *C. saurophilum* seems distantly related to *C. parvum*. Cryptosporidiosis from *C. muris* in reptiles has not been reported, but since species identification is difficult and controversial, this may change.

In a study with amphibians, reptiles, and fish, *C. parvum* was not transmissible and disease did not occur. A case of gastrointestinal cryptosporidiosis in a South African clawed frog, *Xenopus laevis*, has been reported. Recent shellfish research found *Cryptosporidium*, but no reports of cryptosporidiosis, in the shellfish themselves. Transmission attempts with *C. serpentis* from snakes to amphibians did not produce cryptosporidiosis; however, frogs and tadpoles did excrete viable oocysts. These pioneering studies answer important questions, but must be kept in perspective.

Since *Cryptosporidium* is often found in natural water sources where amphibians and reptiles can be exposed, carrier and shedder potential and even possible cryptosporidiosis, from nonreptilian species of *Cryptosporidium*, might occur. For herbivorous reptiles, raw vegetables can be a source of *Cryptosporidium*. Flies can be carriers of *C. parvum* and *Giardia lamblia*, with *C. parvum* in the fly’s digestive tract and *G. lamblia* on the exoskeleton. Reports of other insect sources have not been published.

**Diagnosis**

Histopathology remains the definitive diagnostic tool for cryptosporidiosis in veterinary medicine. The modified acid-fast stain test is the gold standard for diagnosis in humans. However, a “gold standard” does not always reflect the best sensitivity and specificity. Fresh feces, a cloacal/intestinal wash, a stomach wash, and regurgitated material may show the presence of *Cryptosporidium*. The main location for *C. saurophilum*, *C. serpentis*, and *C. muris* are the small intestine, stomach, and stomach respectively, suggesting sample site selection and contamination concerns for the latter species. For sampling in snakes, it has been recommended to force-feed then stomach lavage 3 days post ingestion. A variety of IFA and ELISA tests popular in human medicine create specificity and sensitivity concerns in reptile medicine and may be difficult for the average practitioner to access. All of the aforementioned tests do not easily differentiate between *C. saurophilum*, *C. serpentis* and *C. muris*. The newest testing is PCR-based techniques. However, they have not been standardized yet for clinical use, are not yet commercially available, and are quite expensive. A recent trial has shown success for testing using PCR-based techniques on slides with
fecal smears, indicating potential for submission of samples by practitioners to laboratories. 

Treatment

There still is no proven treatment for cryptosporidiosis. Numerous pharmaceuticals have been tried, some with “successes” that seem difficult to duplicate. One concern is that treatment in the “successes” may curb the pathogenesis temporarily, but recurrence or complete elimination of Cryptosporidium from an individual is in doubt. The list of those tried include: halofuginone, spiramycin, paromomycin, azithromycin, trimethoprim sulfamethoxazole, toltrazuril, benzindazole-4,9-quinones, nitazoxanide, praziquantel, mirazid, and bovine hyperimmune colostrums.

Once Cryptosporidium is detected, pathogenicity should be determined next. Species identification may help answer probability, but histopathology seems to be the best way to assess pathogenicity. For a clinically affected animal with confirmed pathogenicity, euthanasia is recommended, particularly in a reptile collection. Difficult scenarios include the single pet that is clinically affected with confirmed pathogenicity, the nonclinical shedding animal, and the clinical nonconfirmed animal; the veterinarian often has difficulty making decisions and appropriate recommendations to clients.

Prevention

Cryptosporidium parvum oocysts have been shown to be viable and infectious in water at 15 °C up to 7 mo. Unfortunately, Cryptosporidium is reported to bypass some current prevention attempts by drinking water utilities. Coagulation, sedimentation, various filters, ozonation with or without free chlorine, and ultraviolet radiation have all been suggested for prevention, but which technique or combination is the most effective is debatable. Many techniques are too expensive or impractical for individuals or smaller institutions. Disinfecting recommendations for Cryptosporidium include: 64 °C within 2 min or 72 °C for 1 min for items or water to be disinfected, and the use of filters rated 1 μm or less to disinfect water. Cryptosporidium is very resistant to chlorine and iodine. Industrial-strength ammonia has been suggested, but with ammonia levels up to 0.148M, viable oocysts remain. In human urine, oocysts are viable up to 63 days.

Zoonotic Potential

Reptile-based species of Cryptosporidium are not considered zoonotic, though most other Cryptosporidium species and strains are, including C. muris. Until Koch’s postulates have been disproven for C. serpentis and C. saurophilum, and since it is difficult for the average practitioner to differentiate species (i.e., C. muris), it may be advisable for veterinarians to assume that a zoonotic potential exists for Cryptosporidium from reptiles and amphibians. Future studies may prove this wrong, but until then, good sanitation and hygiene should be practiced and the
immunologic status of both patients and owners should be closely monitored.

**LITERATURE CITED**


