Ectopia Cordis In Hatchling

Alligator mississippiensis

Ectopia cordis is an unusual developmental anomaly in which the heart protrudes through a congenital cleft in the ventral body wall (Cotran et al. 1989). We have noted this abnormality extremely rarely in hatchling American alligators Alligator mississippiensis, which either died during incubation or were likely to be non-viable at the time of hatching. During the alligator hatching season in August 1991 however, we observed several cases of this unusual anomaly in hatchling alligators which initially appeared to be otherwise strong and vigorous. We attempted to salvage these alligators and herein describe their courses.

In June 1991, approximately 25,000 alligator eggs were collected from marshes in southwest Louisiana and from Rockefeller Wildlife Refuge in Grand Chenier, Louisiana. The eggs were collected and incubated as previously described (Jaanen and McNease 1977, 1987, 1989). Incubation temperatures were checked daily with bulb thermometers, and water and incubator temperatures monitored continuously with Taylor recorders. The average temperature was 31–32°C. The first clutch of eggs hatched on 6 August 1991 and the peak of hatching was 19 August 1991.

Alligator “A” hatched on 16 August 1991 and a small ventral body wall defect with protruding heart and pericardium was noted immediately (Fig. 1). The heart was beating in a regular fashion and the hatching was quite vigorous — able to support its own weight, swim, and locomote normally. It was separated from other alligators in a plastic storage box tilted to provide an area of clean water and a dry resting area. The container was left in the incubator at 31–32°C to avoid any sudden change in temperature. Attempts were made to keep the container and water as clean as possible, with minimal disturbance to the hatching. On 17 August 1991 the hatching measured 25.0 cm in length, and weighed 50.6 g. By the morning of 18 August 1991 the alligator was much less vigorous, with less spontaneous movement, and continued to deteriorate throughout the day. The alligator was found dead the next morning. At necropsy a pericardial exudate was found, and the lungs appeared slightly atrophic and congested. The liver appeared unusually fatty and residual yolk mass was 7.7 g. Internal examination of the gonads showed the animal was a female.

Alligator “B” hatched on 18 August 1991 and was 25.5 cm in length, and weighed 46.4 g. The hatching was treated and maintained in the same manner as alligator “A.” It also appeared normal and healthy except for the ectopia cordis. However, the hatching gradually deteriorated and on 19 August was becoming lethargic, had little spontaneous movement, and showed development of a thin pericardial film. The hatching was found dead on 21 August 1991, though it had probably died on 20 August 1991. On necropsy what appeared to be a heavy pericardial fibrinous exudate was noted, though histopathology was not available. The lungs were slightly congested and atrophic. The liver and other abdominal organs appeared normal, and the residual yolk mass was 6.1 g. Internal and external examination showed the hatching was a female.

Alligator “C” hatched on 23 August 1991. The hatching was 25.5 cm long and weighed 49.2 g on 25 August. The hatching was reasonably strong; it was able to support its weight, locomote, and swim normally. We believed that the development of the pericardial film may have compromised cardiac function or led to the development of pericarditis in the two hatchlings already described, thus we mechanically stripped off the gray pericardial material exudate in alligator “C” and the area was cleansed with betadine, an antimicrobial solution.

On 26 August the alligator appeared somewhat weaker. The pericardial material had reaccumulated, and was stripped and the area cleaned again. Despite these measures, the animal was found dead on 27 August. At necropsy the gray pericardial film was again noted, but the lungs were normal. The liver was moderately fatty, and the residual yolk mass was 8.3 g. Internal and external examination again revealed the hatching was female. No attempts were made to feed alligators A, B, or C as we generally do not initiate feeding until hatchlings are three to four days old.

Three other alligators were hatched with ectopia cordis and multiple other defects. No attempts were made to sustain life, the animals were immediately euthanised.

![Fig. 1. Hatchling Alligator mississippiensis with ectopia cordis.](image-url)
Alligator "D" had a large ventral defect with protrusion of the beating heart, stomach, fat body, and residual yolk. The weight was 45.9 g after formalin fixation. Alligator "E" also had a massive ventral cleft with herniation of the entire heart, and parts of the stomach, gall bladder, spleen, liver, and intestine. Other abnormalities included spinal scoliosis, hypopigmentation, and absence of the mandible. The weight was only 24.96 grams after formalin fixation. Alligator "F" had a massive yolk herniation in association with the cardiac defect and craniofacial abnormalities, including bilateral anophthalmia, and maxillary and mandibular malformation. The length was 15.5 cm and weight 28.1 g. Residual yolk mass was 11.0 g. A thick black material covered the exposed heart. The sex of alligator "F" could not be determined due to tissue necrosis; alligators "D" and "E" were females by cloacal examination of the chitonoposis.

Many congenital abnormalities have been described in reptiles (Bellairs 1981; Ewert 1979) and reptilian developmental anomalies were recently reviewed (Frye 1991). Ferguson (1985) reviewed developmental abnormalities of crocodilians including thoraco-abdominal herniation, and the comparative anatomy of the crocodilian heart has been described in detail (Webb 1979). We are not aware of previous descriptions of living alligators with ectopia cordis. A similar condition has been described previously in an eastern hog-nosed snake, Heterodon platyrhinos (Frye 1991). We are aware of only one other case of ectopia cordis in another crocodilian; Dr. G. Webb (pers. comm.) noted one case in approximately 31,000 Crocodylus porosus hatchlings examined; the animal was believed to be non-viable and was euthanised.

The pathogenesis of most reptilian developmental abnormalities is unknown; abnormally high or low incubation temperatures have been suggested as possible factors (Ferguson 1985; Frye 1991). Webb and Cooper-Preston (1989) noted more abnormal embryos developed at high incubation temperatures in C. porosus. It is of interest that all alligators in our series able to be sexed were females, as most crocodilians are known to have temperature dependent sex determination. We are unaware of any abnormal high/low temperatures incurred during incubation of the affected alligators, and temperature recordings were continuous on 24 h recorders.

The alligators in our study were probably too small to attempt surgical repair of the ventral defect. Further study is warranted as to the pathogenesis of reptilian developmental anomalies, particularly in the interest of commercial and conservation crocodilian farming and ranching programs, which incubate and hatch thousands of crocodilians worldwide annually.

**Literature Cited**


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