

Digenetic Trematodes as Possible Etiologic Agent for Fibropapillomas in Hawaiian Green Turtles (*Chelonia mydas*)

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Abstract

Neoplasms identified as fibropapillomas are being commonly found in green turtles in the Hawaiian Islands. Up to 10% of the nesting females tagged each year at the breeding colony of French Frigate Shoals have these epithelial growths ranging from a few millimeters to 30 cm in diameter. Fibropapillomas in turtles can result in reduced vision, disorientation, blindness, and physical obstruction to normal swimming and feeding. Observations in Hawaii also suggest that fibropapillomas probably cause a reduced ability to migrate and breed successfully. The etiology of fibropapillomas in green turtles remains unknown; however, the consistent presence of trematode ova within the fibrotic portion of the lesions indicates it could be a digenetic blood fluke of the family Spirorchiidae. In histological sections, the ova generally appear as oval, yellowish-brown acellular capsules containing undifferentiated cells. Host response consists of a capsule of epithelioid macrophages surrounded by fibrosis. The Hawaiian population of green turtles is geographically isolated and small. The occurrence of fibropapillomas is viewed as a severe problem that urgently needs to be addressed.

Discussion

Fibropapillomas in green turtles were first described nearly 50 years ago by Smith and Coates (1938). During that same year, Lucke (1937/38) mentioned that green turtles in the Dry Tortugas suffer from papillomatous neoplasms. Hendrickson (1958) stated that "occasional green turtles nesting in Sarawak, Malaysia had ulcerated fibromas on their throat and neck."

During 1985, 35% of the 51 stranded green turtles examined throughout Hawaii had fibropapillomas. These findings represent a dramatic increase in the past few years. Up to 10% of the nesting females tagged each year at the principal breeding colony of French Frigate Shoals have these epithelial growths ranging from a few millimeters to 30 cm in diameter. French Frigate Shoals is a cluster of sand islets in the northwestern Hawaiian Islands, situated at latitude 23° 45' N, longitude 166 10' W, the approximate midpoint of the 2,450 km linear Hawaiian archipelago.

The growths most frequently occur on the neck, eyes, flippers, tail, and sometimes the jaw and mouth. In Hawaii, fibropapillomas have been recorded in turtles as small as 45 cm juveniles to adult males and females over 85 cm. However, none have been found in turtles 35-45 cm, the minimum size range at which recruitment to the benthic habitat takes place in Hawaii. These fibropapillomas can result in reduced vision, disorientation, blindness, and physical obstruction to normal swimming, feeding and breeding successfully. The turtles also appear to be more readily entangled in fishing gear and preyed upon by tiger sharks.

The etiology of fibropapillomas in green turtles remains unknown. Possible causes suggested in the literature include secretion of hirudin by marine leeches, viruses, excessive solar radiation, chemical pollutants that impair the immune system, stress, a genetic predisposition to neoplasia and an immune response to trematode ova.

I would like to consider the latter as the possible agent. Parasites have a history of causing abnormal tissue growth. *Spirocerca lupi* in the esophagus of canines stimulates the formation of reactive granuloma and, subsequently, some change to sarcomas. The ova of blood flukes such as the Schistosomes are the most important factors in the production of endothelioid granulation of tissue. Green turtles are known to harbor 10 species of spirorchid digeneans, which parasitize the circulatory system (Smith, 1972). In sections of these granulomas of green turtles, trematode ova are commonly seen. In their 1939 publication, Smith and Coates reported seeing ova in over half of the 250 fibromas examined. Seven of 10 cases sent to Dr. John Harshbarger, at the Registry of Tumors in Lower Animals, contained ova, including specimens from Florida, the Cayman turtle farm, as well as Hawaii. Studies by Greiner et al., in 1980, found turtles from the Cayman farm heavily infected with the spirorchid blood fluke, *Learedius learedi*. This included 3 to 15 worms per turtle present in the heart or associated major vessels. Rand and Wiles in 1985 reported on 11 green turtles from Bermuda that were found moribund after a storm. They found (3-53) a mean of 21.5 adult *L. learedi* from all 3 heart chambers in 6 of 11 turtles. The turtle with 53 worms had a single concentration of these in one chamber. 1-23 *Neospirochis schistosomatoides* adults were found in the hearts of two turtles. These authors found eggs in lungs, liver and spleen with damage resulting from increased blood pressure caused by obstruction of the blood capillaries by eggs. The eggs of other spirorchids which occur in fresh water turtles are known to cause similar types of tissue damage (Guadchild and Dennis, 1967; Holliman, 1971).

Six juvenile green turtles with multiple cutaneous fibropapillomas were studied by Jacobson, Mansell and Sundberg at Sea World, Florida over a 6 month period. These researchers reported that "blood counts indicated all turtles were mildly to severely anemic and serum protein determinations indicated all turtles were hyperproteinemic and hypogammaglobulinemic."

Grossly, the fibropapillomas are verrucous in appearance and consist of a minimal to mildly hyperplastic epidermis overlying a proliferative fibroplastic connective tissue.

It is thought that infected turtles have an increased susceptibility to parasitism by the marine leech *Ozobranchus branchiatus* and various crustaceans.

Trematode eggs can be found throughout the tissue, near the surface of the growth and also in the center of the tissue. Eggs are usually seen as an oblong homogeneous yellow capsule (37-59 μm long by 26-41 μm wide for *N. schistosomatoides* and 210 μm long by 28 μm wide for *L. learedi*) surrounded by discrete chronic granulomatous reactions consisting of epithelial cells and multinucleated giant cells. In cross section there can be seen a central area of undifferentiated cells which is the developing miracidial stage of the trematode.

Although the transmission and cycle of the marine species in the family Spirorchidae has not been worked, the cycle of *Spirochis parvus*, a freshwater species that lives in blood vessels, is known: Eggs are shed with miracidia--break through vessel wall -- through the tissue into lumen intestine -- miracidia hatch in water -- infect snail -- cercaria penetrate soft tissue of turtle around anus, eyes, nostrils, mouth, underside of tail, etc.

Additional coincidental evidence pointing to the possibility of a trematode etiology is that the problem did not occur in Hawaii until after the introduction of a red alga (*Hypnea musciformis*) from Florida in 1976 (Balazs et al., 1987). This alga is now spreading in the islands and is fed upon by turtles. The possibility of snail introduction with flukes is a consideration.

If trematode ova are in fact the etiologic agents, then the lesions represent a non-neoplastic host response, characterized by an exuberant cutaneous, foreign body fibrosis associated with papillary epidermal hyperplasia.

The experimental treatment of fibropapillomas in Hawaii has included surgical removal and strangulation. Neither has proven satisfactory due to the large number of growths. There is no evidence to suggest that this problem will go away. The green turtle is an endangered species and the occurrence of fibropapillomas is viewed as a severe problem that urgently needs to be addressed through continued research.

References

1. Balazs, G. H., R. G. Forsyth and A. K. H. Kam. 1987. Preliminary assessment of habitat utilization by Hawaiian green turtles in their resident foraging pastures. NOAA Tech. Memorandum NMFS. (NOAA-TM-NMFS-SWFC-71) March, 1987. 107 pp.
2. Goodchild, C. G. and E. S. Dennis. 1967. Comparative egg counts and histopathology in turtles infected with *Spirorchis* (Trematoda: Spirorchidae). *Journal of Parasitol.* 53(11):38-46.
3. Greiner, E. C., D. J. Forrester, and E. R. Jacobson. 1980. Helminths of mariculture-reared green turtles (*Chelonia mydas mydas*) from Grand Cayman, British West Indies. *Anthol. Soc. Wash.* 47(1):142-144.
4. Hendrickson, J. R. 1958. The green sea turtle, *Chelonia mydas* (Linne.) in Malaya and Sarawak. *Proc. zool. Soc. Lond.* 130:455-535.
5. Holliman, R. B., J. E. Fisher and J. C. Parker. 1971. Studies on *Spirorchis parvus* (Stunkard, 1923) and its pathological effects on *Chrysemys picta picta*. *Journal of Parasitol.* 57(1):71-78.
6. Jacobson, E. R., S. Mansell and J. P. Sundberg. 1986. Pathologic studies on fibropapillomas of green sea turtles, *Chelonia mydas*. Abst. from Turtle Workshop, Orlando, Fla.
7. Lucke, B. 1937/38. Studies on tumors in cold-blooded vertebrates. *Annu. Rep. Tortugas Lab., Carnegie Inst. Wash.* 937/38, p. 92-94.
8. Rand, T. G. and M. Wiles. 1985. Histopathology of infections by *Learedius learedi* Price, 1934 and *Neospororchis schistosomatoides* FrFice, 1934 (Digenea: Spirorchidae) in wild green turtles, *Chelonia mydas* L., from Bermuda. *J. of Wildlife Diseases*-274:461-464.
9. Smith, G. M. and C. W. Coates. 1938. Fibro-epithelial growths of the skin in large marine turtles, *Chelonia mydas* (Linnaeus). *Zoologica (N.Y.)* 23, 4:93-97.
10. Smith, G. M. and C. W. Coates. 1939. The occurrence of trematode ova, *Hapsifotrema constrictum* (Leared), in fibro-epithelial tumors of the marine turtle, *Chelonia mydas* (Linnaeus). *Zoologica (N.Y.)* 24, 26:379-7B7.
11. Smith. 1972. *Helminthol. Abstr. Ser. A41:161-204.*

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