

## Keloid in the Gray Reef Shark, *Carcharhinus amblyrhynchos*<sup>1</sup>

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**ABSTRACT:** A gray reef shark, *Carcharhinus amblyrhynchos*, was captured at Enewetak Atoll, the Marshall Islands, in 1972. Near the right pectoral fin was a large fungating tumor. Microscopically, no evidence of microorganisms or definite malignant transformation was observed, and inflammation and necrosis were minimal. However, the tumor appeared to be a keloid, the first to be reported in sharks.

THE LITERATURE ON SHARK TUMORS is remarkably small. The most recent review, by Wellings (1969), lists a total of 12 citations dating from 1908; the majority of these refer to surface tumors (melanomas). A review by Dawe (1969) concentrates specifically on neoplasms of blood cell origin and indicates an apparent lack of positive information about hematopoietic (reticular) neoplasms in cartilaginous fishes. Smith and Little (1969) described multiple tumors resembling hydatidlike cysts of the liver in an electric ray, *Torpedo californica*. Finally, the list of accessions to the Registry of Tumors in Lower Animals, Smithsonian Institution, 1965-1973 (Harshbarger 1974), records the first specimen of a hematopoietic neoplasm in a shark (a reticulum cell sarcoma of the spleen in a sandbar shark, *Carcharhinus milberti*) and, in addition, lists nine other tumors plus the electric ray liver cysts mentioned above.

In an attempt to learn more about spontaneous pathology, especially tumors, in sharks, we made a survey from 28 December 1971 through 12 January 1972, of those caught by hook and line in the Enewetak Lagoon, Marshall Islands. Three species were examined: the blacktip, *Carcharhinus melanopterus* (three individuals); whitetip, *Triaenodon obesus* (one individual); and gray reef, *Carcharhinus amblyrhynchos* (eight individuals). Pathology was common, and a variety was found: stomach

ulcers, intestinal polyps, testicular hyalin lesion, etc. These findings will be the subject of future reports. The present investigation was of a large, conspicuous, convoluted tumor on the body wall, just anterior and dorsal to the right pectoral fin, in a 119.38 cm (total length) male gray reef shark.

### MATERIALS AND METHODS

The tumor was completely excised with some surrounding normal-appearing tissue and fixed in 10-percent Formalin so that its nature and etiology (parasitic, infective, malignant, etc.) might be ascertained. The remainder of the animal, unfortunately, had been discarded and so was not available for examination of other organs.

The gross specimen, after fixation, was examined intact. Random sections were then made for exposure of underlying tissues and histological processing. The sections were dehydrated via an ethanol series, embedded in Paraplast, sectioned at 5 microns, and stained with hematoxylin and eosin.

### RESULTS

Gross examination revealed a highly lobulated, irregular tumor (Figures 1 and 2), well circumscribed, and measuring 2.5 × 3.0 × 5.0 cm. The overlying skin appeared to be intact but thinner than normal. The color was gray, like that of the normal skin, in about half the area; the remainder was whitish. The tumor felt smoother than the surrounding skin and was firm.

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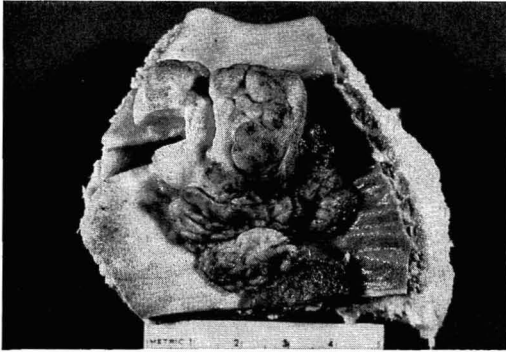


FIGURE 1. Gross view of the skin tumor, looking from above. Note the extensive convolutions, irregularity, and scattered pale areas. The most elevated portion is predominantly this shade.

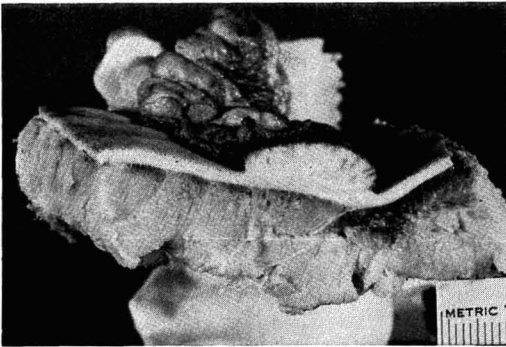


FIGURE 2. Gross view of the skin tumor, looking from the side. The thick white connective tissue of the dermis and overlying tumor are apparent in cut section.

The cut surface (Figure 2) revealed a preponderance of dense white tissue that was continuous with the dermis. The overlying epidermis appeared thinned, and the underlying musculature looked normal.

Histologic examination revealed a large mass of collagen fibers (Figure 3). These tended to show marked variation in size and arrangement (Figure 4), some hyalinization (Figure 4), and a tendency for fibroblasts to orient around the occasional blood vessel present (Figure 5). There was minimal cellular infiltrate. The hyalinized collagen bundles tended to occupy the mid- to lower dermis. There were no signs of parasites, microorganisms, calcinosis, metaplastic ossification, or malignant transformation. A placoid scale can be seen deep within the tumor mass (Figure 6).

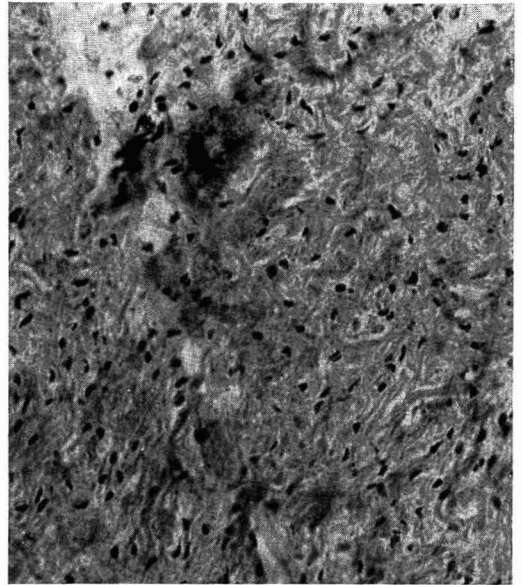


FIGURE 3. View to show abundance of connective tissue and moderate cellularity due mainly to fibroblasts. 100  $\times$ .

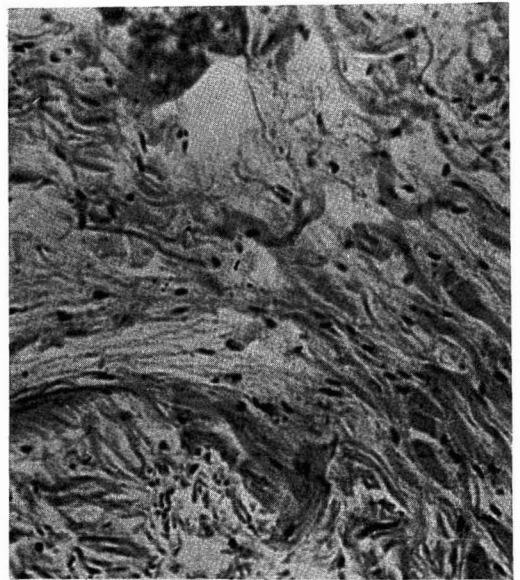


FIGURE 4. Collagen fibers, showing marked variation in size and arrangement. In addition, there is hyalinized collagen appearing darker and more homogeneous. 250  $\times$ .

The overlying epidermis tended to be reduced and occupied areas between scales. The cells appeared within normal limits, showing



FIGURE 5. Blood vessels within tumor, showing perivascular arrangement of fibroblasts. 100  $\times$ .

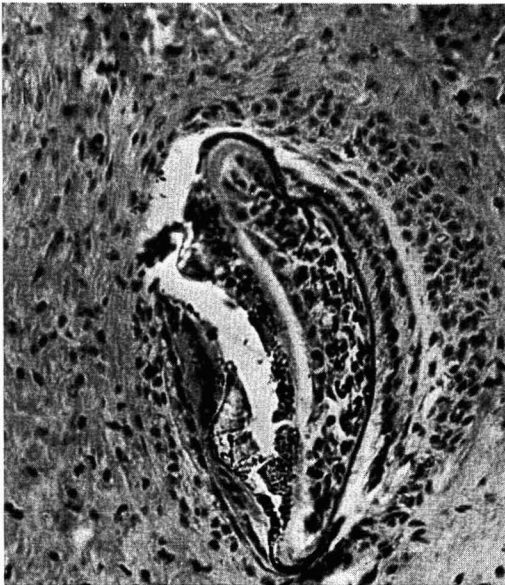


FIGURE 6. Placoid scale within tumor mass. Surface of tumor is toward top of figure. 128  $\times$ .

no excessive mitotic activity, anaplasia, pleomorphism, or definite invasion of the dermis. However, the epidermal-dermal junction seemed somewhat less sharply defined than normal.

#### DISCUSSION

The tumor histologically resembles a keloid, as has been described in detail for humans (Allen 1967, Lever 1967). The combination of plump and fine fibers, in contrast with the whorls and fascicles of relatively uniform narrow bands of collagen in the usual scar, especially identifies the keloid. The sclerosed fibers, fibroblast orientation, sparsity of blood vessels, and minimal nonspecific round cell infiltrate also support the diagnosis of keloid. In addition, the concentration of hyalinized collagen bundles in the mid- to lower dermis suggests that the keloid is of medium age; older keloids, at least in humans, show these bundles extending to the epidermis.

Keloids are well known in humans, in which they represent a posttraumatic tissue proliferation. Specifically, they may develop after chemical irritation, mechanical injury, cauterization, burns, or even after injections. Malignant changes in keloids have been described, but the predilection, if any, applies only to the overlying epidermis rather than the dermis.

Whether or not the gray reef shark of this study had sustained trauma and the keloid had formed in response is not known. Similarly, it is open to question whether gray reef sharks, unlike other species, have a special predisposition, like human populations of African ancestry, toward keloid formation. In the literature, there is a reference to only one other fish species with an apparent keloid; however, this was in a bony fish and not a shark. The fish was a Spanish mackerel, *Scomberomorus maculatus*, collected in a marine pathology survey off the southwest Florida coast (Smith and Taylor 1972).

#### SUMMARY AND CONCLUSIONS

1. A survey of sharks in Enewetak Atoll, the Marshall Islands, revealed that a variety of pathology was common.
2. One specimen, the gray reef shark, *Carcharhinus amblyrhynchos*, had a conspicuous tumor immediately anterior and dorsal to the right pectoral fin.
3. The literature on shark tumors is small, and none had been reported from this species.

4. The tumor from the gray shark was studied histologically and found to consist primarily of collagen fibers, many of variable size and hyalinized. These and other characteristics strongly support the diagnosis of a keloid of medium age. There was no clear-cut evidence of malignant transformation of either the keloid or the epidermis.
5. It is possible that the keloid formed, as it typically does in humans, as a response to trauma. It is also possible that this shark species has a special predilection toward keloid formation. Further, and more extensive, surveys of these and other shark species may answer these questions.
6. This is the first report of a keloid in sharks.

#### ACKNOWLEDGMENTS

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#### NOTE ADDED IN PROOF

Appearing in press after submission of this manuscript were the following three references:

- Harshbarger, J. C. 1975. Activities report, Registry of Tumors in Lower Animals, 1974. Supplement. National Museum of Natural History, Smithsonian Institution, Washington, D.C. (Lists an additional shark tumor, a probable neurilemmoma [schwannoma].)
- Lever, W. F., and G. Schaumberg-Lever. 1975. *Histopathology of the skin*. 5th ed. J. B. Lippincott, Philadelphia. 793 pp. (Provides an updated description of keloid in a new edition of the Lever [1967] reference cited above.)
- Mawdesley-Thomas, L. E. 1975. Neoplasia in fish. Pages 805-870 in W. E. Ribelin and G. Migaki, eds. *The pathology of fishes*. The University of Wisconsin Press, Madison. (Includes a list of references on shark tumors.)