A Spontaneous Mesenchymal Cell Neoplasm in the Adult Newt, *Diemictylus viridescens*¹

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SUMMARY

An adult newt was received with a mass protruding from its left side slightly caudal to the left forelimb. A detailed light microscopic examination of this lesion by many scientists resulted in many different diagnoses. We believe that a diagnosis of mesenchymal cell neoplasm best describes this lesion.

INTRODUCTION

Reported cases of spontaneous neoplasms in the order Urodela are rare. Neoplasms of anurans are apparently not as rare (Refs. 1–3, 6, 7, 11, 12; M. Balls, personal communication, 1970). This paper presents a morphological description of a spontaneously occurring lesion in an adult newt, *Diemictylus viridescens*. We feel that this lesion is best described by using the nonspecific designation “mesenchymal cell neoplasm.”

MATERIALS AND METHODS

An adult common American newt, *D. viridescens*, with a white lump on its left side, was received from a commercial source in Donelson, Tenn. During the past 6 years, several thousand adult newts have been received from the same commercial source. Very few of these newts contain lumps. Most lesions in the animals are granulomatous inflammatory-parasitic lesions. The lesion presented in this paper is the only example of neoplasia that we have seen in 6 years of working with newts. Correspondence with the supplier of these newts reveals that the newts were collected in the wild from fresh water ponds and small lakes with no obvious evidence of pollution or environmental carcinogens. The animals were not artificially bred.

The animal appeared to be in satisfactory health. Preparations were made to sacrifice the newt with subsequent transplantation of pieces of the lesion to other newts, withholding a piece for histological analysis. Unfortunately and unexpectedly, the animal died before the lesion could be transplanted. By the time the death was noticed, some rigor mortis was apparent. Gross photographs were made and the entire lesion was fixed in Bouin’s fluid. The specimen was sectioned and stained with hematoxylin and eosin, Bodian’s silver impregnation, phosphotungstic acid-hematoxylin, Masson’s trichrome, PAS²-Alcian blue, toluidine blue at pH 2 and pH 4, and Gomori’s reticulum stain. This lesion is registered as Specimen RTLA 272 in the Registry of Tumors in Lower Animals, Museum of Natural History, Smithsonian Institution.

RESULTS

Gross Observations. The lesion extended from the back ventrally to the midlateral junction of dorsal and ventral integument and protruded laterally an appreciable distance from the body wall (Figs. 1 and 2). It measured 9/16 x 7/16 inches at its 2 greatest dimensions and was surfaced by mostly dorsal integument. On section the mass was solid. No gross areas of hemorrhage or necrosis were noticed. A dissection of the rest of the animal failed to reveal any gross evidence of metastases.

Microscopic Observations. Fig. 3 is a low-power photomicrograph of a section passing through the tumor and adjacent normal body wall. The right one-fourth of the figure shows normal epidermis, dermis with large glands, and underlying skeletal muscle. The left three-fourths of the figure shows an intact epidermis and some dermal elements overlying the tumor mass, which has infiltrated between the skeletal muscle fibers adjacent to its deep surface. Fig. 4 is a higher-power photomicrograph illustrating the local invasiveness of the tumor cells between skeletal muscle fibers. A capillary coursing through the tumor mass is seen to the right.

A small epidermal papilla containing a core of neoplastic cells enclosed by normal skin structures protruded from the tumor (not illustrated). Examination of serial sections from this region showed that the cells in the core of the papilla were connected to the main mass of tumor cells via the small stalk of the papilla.

The tumor cells showed varying degrees of nuclear and cytoplasmic pleomorphism (Figs. 5 and 6). The cells contained large hyperchromatic to pycnotic nuclei with an occasional prominent nucleolus. Some of the giant cells were uninucleate; whereas others were multinucleate. No large areas of necrosis were noted, but many micronecrotic areas or groups of cells were present. Many of the cells were not sectioned in the

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²The abbreviation used is: PAS, periodic acid-Schiff.
nuclear region, resulting in only cytoplasmic profiles. Mitotic figures were not observed in the sections studied.

In the Mason and hematoxylin-eosin preparations, fine to coarse red or acidophilic granules were found in the cytoplasm. In the toluidine blue preparations, the cytoplasm was granular and most of the basophilia persisted to a pH of 2. In the PAS-Alcian blue slide, the cytoplasm was granular and contained PAS-positive areas as well as areas that were positive to both PAS and Alcian blue (mixture of the respective colors).

Figs. 7 to 9 represent further examples of the types of cells found in this lesion. Fig. 7 represents a strap-like cell containing several long fibrils, which stained red in the Mason preparation. The presence of the red fibrils in this cell may indicate a type of skeletal muscle fiber degeneration or an abortive attempt at myoblast differentiation by one of the tumor cells. Fig. 8 is an example of a “tadpole-” or “racquet-” shaped cell which suggests the designation rhabdomyoma or rhabdomyosarcoma (4, 9, 14, 16). Fig. 9 is a strap-like cell showing both longitudinal and cross-striations in the cytoplasm. It is difficult to decide whether this cell is a rhabdomyoblast or an example of a dedifferentiating or differentiating skeletal muscle fiber.

Fig. 10 illustrates granular degeneration of a skeletal muscle fiber which was surrounded by tumor cells. This degeneration presumably is due to the invasive-expansive properties of the tumor. The Bodian preparations demonstrated several nerve fibers in the tumor.

DISCUSSION

This lesion was submitted to several different pathologists and biologists (see “Acknowledgments”) for microscopic examination and diagnosis. The following diagnoses were accumulated: sarcoma, mesenchymal cell tumor, granular cell myoblastoma, rhabdomyoma, rhabdomyosarcoma, histiocytoma, fibrosarcoma, and skeletal muscle degenerations or atrophy due to denervation. Four consultants considered the lesion to be skeletal muscle degeneration due to denervation. Three consultants diagnosed the lesion as a granular cell myoblastoma. All other diagnoses were from one consultant each. The presence of tadpole cells and strap-like cells with cross-striations strongly suggests a diagnosis of rhabdomyoma or rhabdomyosarcoma. However, the PAS-positive granules and the presence of many nonnucleated cylindrical cytoplasmic profiles suggest a diagnosis of granular cell myoblastoma. In the absence of a definitive specific diagnosis, the diagnosis of mesenchymal cell neoplasm seems appropriate.

The diagnosis of skeletal muscle atrophy or degeneration as a probable result of denervation or nerve injury deserves comment. In denervation atrophy of skeletal muscle, there is a form of granular degeneration (5) very similar to that seen in this lesion (Fig. 10). However, the fact that the Bodian preparations showed nerve fibers in the substance of the neoplasm as well as the fact that the mass was a firm lump which protruded from the side of the animal (Figs. 1 and 2) does not suggest a denervation atrophy. It seems logical to assume that if this were simply denervation atrophy there would be a wasting of the tissue in this region instead of the cellular mass reported here. There is no doubt, however, that some skeletal muscle degeneration has occurred in this lesion. This degeneration is believed to be related to the expansive, invasive nature of the neoplasm and not to denervation.

One of us (E. R. Burns, work to be published elsewhere) has experimentally denervated adult newts by removing or rerouting the brachial plexus from the forelimb. In no case did a histological picture similar to the one presented in this paper result. Nerves are capable of regenerating into the newt limb after denervation (10, 13). Experimental maintenance of a nerveless state did result in degenerative changes in the muscle, but these changes apparently did not produce a histological pattern similar to that reported in this paper (10). Also, considering the regenerative ability of the peripheral nerves in the newt, it is doubtful that a long-standing denervation via natural causes could occur in Diemictylus.

The biological implications of this single case of neoplasm in a urodele are difficult to assess. The infrequency of reported spontaneous tumors in animals which regenerate well (Ref. 1; M. Balls, personal communication, 1970) may support the concept that strong individuation fields such as the regeneration field of a regenerating urodele limb prevent neoplastic transformation (8, 12, 15). On the contrary, neoplasia in urodeles may be more common than reported simply because so few people working with urodeles notice neoplasms or have any interest in this area.

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REFERENCES

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Fig. 1. Gross photograph of lateral view of tumor in situ. X 1.5.
Fig. 2. Gross photograph of ventral view of tumor in situ. X 1.8.
Fig. 3. Section of body wall containing the junction of tumor and normal body wall structures. In the normal area (extreme right), epidermis, dermis with large glands, and underlying skeletal muscle may be seen in normal relation to each other. The tumor may be seen in the upper left three-fourths of the photograph. The deep surface of the tumor shows local invasion into skeletal muscle. Masson, X 15.
Fig. 4. Base of the tumor where tumor cells can be seen invading between the skeletal muscle fibers. Extreme right, capillary sectioned longitudinally. Masson, X 90.
Fig. 5. Area of the tumor immediately adjacent to the epidermis. Note the replacement of normal dermal structures by the very pleomorphic tumor cells. There is a mitotic figure in the epidermis. The 2 intensely black cells between epidermis and tumor are melanocytes. H & E, X 300.
Fig. 6. Mass of tumor cells illustrating the nuclear and cytoplasmic pleomorphism of the tumor cells. H & E, X 600.
Fig. 7. Elongate cell showing several prominent long filaments which stained red, possibly indicating myofibrils. Masson, X 1000.
Fig. 8. An example of the "tadpole"- or "racquet"-shaped cells occasionally found in this tumor. Phosphotungstic acid-hematoxylin, X 1000.
Fig. 9. Elongate ribbon-like cell showing both longitudinal and cross-striations in the cytoplasm. Phosphotungstic acid-hematoxylin, X 1000.
Fig. 10. Granular degeneration of a skeletal muscle fiber surrounded by tumor cells. The granules tend to appear along the myofibrils in parallel fashion. PAS-Alcian blue, X 1000.
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