

## Immunohistochemical and Ultrastructural Studies of Hemangiopericytomas in Tow Calves

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### Abstract

After castration of 2 male Japanese Black calves, hemangiopericytomas developed in the subcutis near the scrotum. Their pericytic origin was demonstrated by the absence of focal densities, positive immunoreactivity for alpha smooth muscle actin, and absent staining for desmin. A similar neoplasm has been reported in a castrated male Japanese Black calf. It is considered that hemangiopericytomas in calves may be closely related to castration and certain bovine breeds.

**Discipline:** Animal health

**Additional key words:** castration

### Introduction

Hemangiopericytoma is a relatively common subcutaneous neoplasm of dogs that is considered to originate from pericytes, but the tumor cells have never been unequivocally proven to be pericytes by histochemical and electron microscopic examination<sup>5</sup>. In contrast, a bovine hemangiopericytoma was considered to be of pericytic origin based on immunohistochemical and ultrastructural findings<sup>7</sup>. Here we describe 2 additional cases of hemangiopericytoma. It is assumed that such tumors may occur mainly in castrated male Japanese Black calves.

### Materials and methods

Case 1 was an 8-month-old, castrated male Japanese Black calf exhibiting 2 tumor masses (4 × 3 cm) and 3 smaller ones (2 × 1.5 cm) near the scrotum. These subcutaneous tumors, protruding above the surface of the skin, could be surgically excised with minimal bleeding,

because they were not connected to the underlying musculature. Case 2 was an 8-month-old, castrated male Japanese Black calf with a raised tumor nodule (4.5 × 2 × 1.5 cm) in the subcutis near the scrotum. The tumor, which was surgically removed, was not encapsulated and showed somewhat indistinct borders. All the tumors in cases 1 and 2 were similar macroscopically. The tumors were rubbery in consistency, and were grayish white to pink in color.

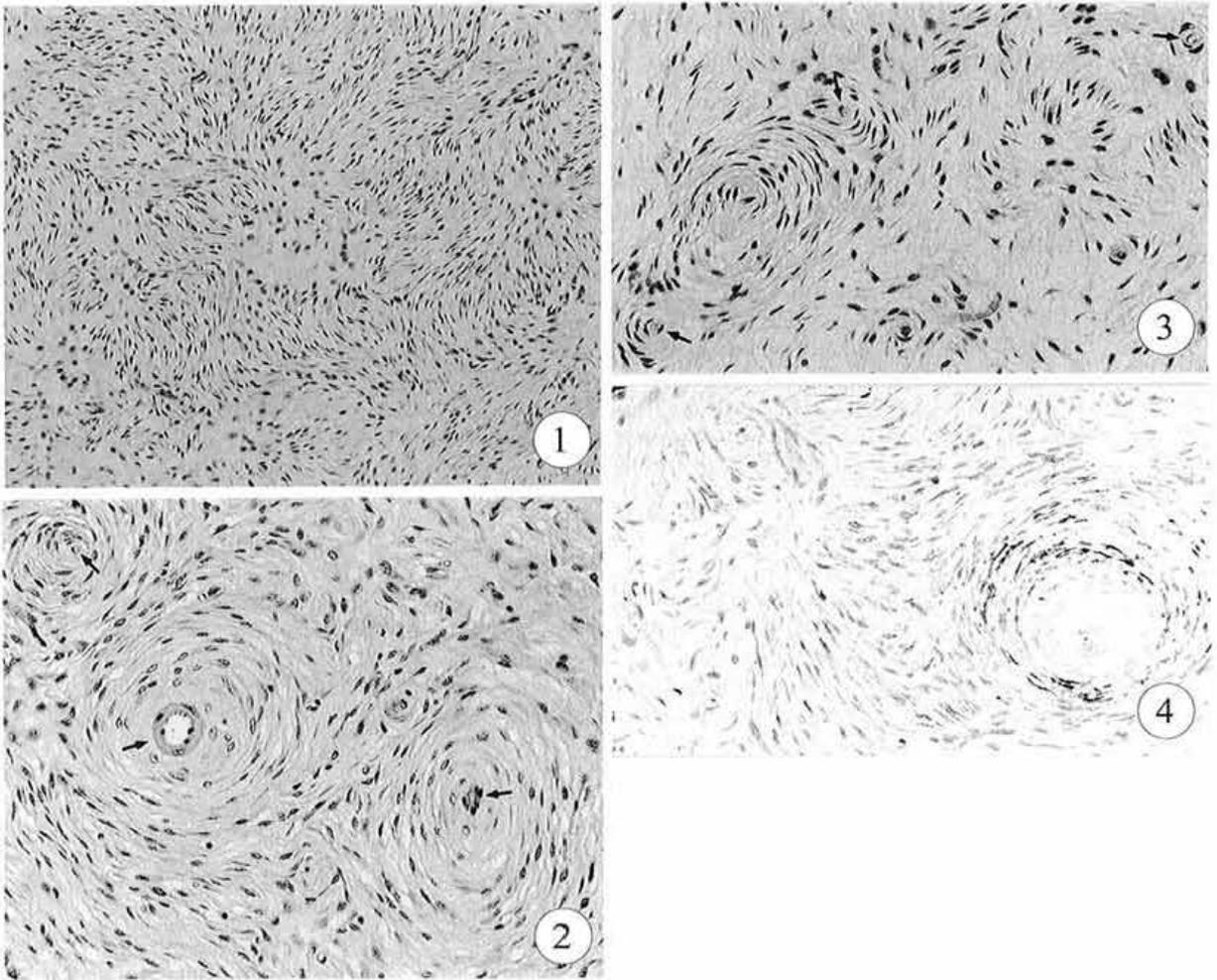
Tissues were fixed in 10% buffered formalin, embedded in paraffin wax, cut at 4 μm, and stained with hematoxylin and eosin (HE). For immunohistochemistry (IH) and electron microscopy (TEM), formalin-fixed tissues were treated as described previously<sup>4,7</sup>.

### Results and discussion

The neoplasms in cases 1 and 2 showed very similar histological, immunohistochemical and ultrastructural features. The neoplastic tissues in cases 1 and 2 were present in the dermis and subcutis, and the borders with surrounding connective tissue were well defined. The

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Received 6 September 1999, accepted 13 September 1999.



**Fig. 1. Case 1: Intertwining bundles of slender spindle cells produce a typical storiform pattern (HE  $\times 100$ )**

**Fig. 2. Case 1: Blood vessels of various sizes (arrows) are present in the center of concentric whorls of tumor cells (HE  $\times 200$ )**

**Fig. 3. Case 2: Tumor cells form whorls around capillaries that contain red blood cells (arrows) (HE  $\times 200$ )**

**Fig. 4. Case 2: Tumor cells showing SMA positivity are arranged in fascicles and encircle a hair follicle (right) (IH  $\times 200$ )**

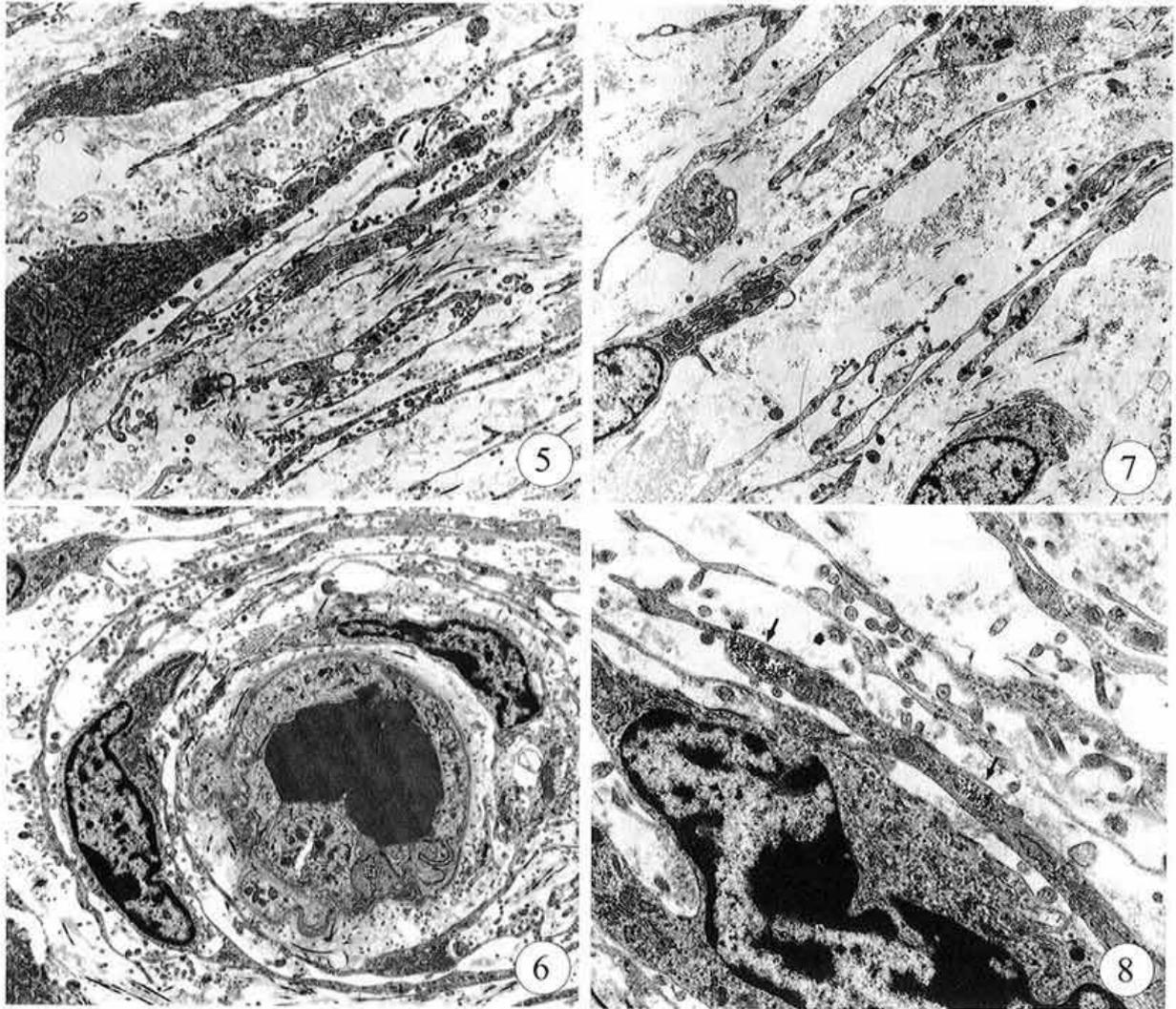
tumor tissues were composed of diffusely distributed cells, and there was an edematous, mucinous or fine fibrillary stroma between the cells. In some areas, neoplastic cells grew in a storiform pattern (Fig. 1), and it was uncommon to find cells arranged in a concentric fashion around blood vessels with varying sizes (Figs. 2, 3) or hair follicles. The most predominant cells were slender spindle cells with fusiform nuclei. However, some cells were larger in size and varied from plump spindle cells to ovoid or stellate cells, with large oval nuclei. Mitotic figures were seldom observed.

Immunohistochemically, the neoplastic cells in cases 1 and 2 were positive for vimentin, and the vast majority was also positive for alpha smooth muscle actin (SMA) (Fig. 4). Desmin-positive neoplastic cells were

absent.

In both cases the most outstanding ultrastructural feature of the neoplastic cells was the presence of extremely elongated cell processes, from which a large number of microvillous projections protruded in case 2 (Figs. 5, 6), while they were inconspicuous in case 1 (Fig. 7). The rough endoplasmic reticulum (RER) was moderately well developed. Subplasmalemmal densities could be observed, unlike focal densities. In case 2, a few cells showed highly irregular nuclear contours or contained glycogen particles (Fig. 8).

In a bovine hemangiopericytoma<sup>7)</sup>, the tumor cells, characterized by a perivascular whorl formation, SMA positivity and absence of focal densities, were considered to have arisen from a pericyte<sup>7)</sup>. Because the same fea-



**Fig. 5.** Case 2: Many microvillous projections protrude from the surface of tumor cells (TEM  $\times 3,750$ )

**Fig. 6.** Case 2: A capillary containing erythrocytes is surrounded by tumor cells with microvillous projections (TEM  $\times 4,500$ )

**Fig. 7.** Case 1: As shown in Fig. 5, tumor cells display long slender cytoplasmic processes, with few microvillous projections (TEM  $\times 3,750$ )

**Fig. 8.** Case 2: Aggregates of glycogen particles (arrows) are detected in a cytoplasmic process, and the nucleus of an adjoining tumor cell shows an irregular contour (TEM  $\times 9,000$ )

tures could be confirmed, the present neoplasms were diagnosed as hemangiopericytomas. The perivascular whorled pattern, however, was less conspicuous compared with that in the previous case, and in the neoplasms described here tumor cells were arranged distinctly in a storiform pattern in some areas. It is highly probable that such neoplasms have been mistakenly diagnosed as fibroblastic or fibrohistiocytic tumors showing a storiform pattern.

As in the case of bovine hemangiopericytoma, the typical histological pattern in canine hemangiopericytomas is characterized by the presence of layers of tumor

cells arranged in a concentric fashion around a small central lumen, but this pattern is often lacking and the lumen is mostly devoid of any erythrocytes<sup>3,9</sup>. Madewell et al.<sup>6</sup> showed that canine hemangiopericytomas were ultrastructurally similar to their human counterpart neoplasms, which apparently differed from canine and bovine hemangiopericytomas in the growth pattern<sup>7</sup>. In contrast, Pérez et al.<sup>8</sup> considered that canine hemangiopericytomas were pericytic in origin based on the following immunohistochemical results; muscle actin was expressed by some tumor cells in 22 out of 44 cases analyzed, but desmin was absent. It is, however, difficult to

rule out the possibility that the actin-positive, desmin-negative cells were myofibroblasts, because myofibroblasts were indistinguishable from pericytes by immunohistochemistry alone<sup>4,11</sup>. Thus, there is a considerable controversy regarding the histogenesis of canine hemangiopericytomas, and there has never been a conclusive evidence that they are derived from pericytes<sup>5,9</sup>.

Trauma is related to human soft tissue sarcomas<sup>10</sup> and testicular tumors<sup>12</sup>, but the etiological role has not been determined. A Sertoli cell tumor was detected in a bullock, but its exact etiology was unknown<sup>2</sup>. It was suggested that a vulval myofibroblastoma in a cow was affected by sex hormones<sup>1</sup>. Because the present and previous neoplasms occurred at sites different from operation wounds<sup>7</sup>, a hormonal imbalance after castration may have contributed to the development of the neoplasms. In addition, since the tumors occurred in 3 young animals of the same breed, it is suggested that Japanese Black calves may be prone to the development of hemangiopericytomas.

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