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## Mammary Gland Tumors in Captive African Hedgehogs

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**ABSTRACT:** From December 1995 to July 1999, eight mammary gland tumors were diagnosed in eight adult captive female African hedgehogs (*Atelerix albiventris*). The tumors presented as single or multiple subcutaneous masses along the cranial or caudal abdomen that varied in size for each hedgehog. Histologically, seven of eight (88%) mammary gland tumors were malignant. Tumors were classified as solid (4 cases), tubular (2 cases), and papillary (2 cases). Seven tumors had infiltrated into the surrounding stroma and three tumors had histologic evidence of neoplastic vascular invasion. Three hedgehogs had concurrent neoplasms. These are believed to be the first reported cases of mammary gland tumors in African hedgehogs.

**Key words:** *Atelerix albiventris*, African hedgehog, case reports, mammary adenocarcinoma, mammary gland, neoplasm.

From December 1995 to July 1999, eight, captive-born, female, African hedgehogs (*Atelerix albiventris*) were diagnosed with mammary gland tumors at Northwest ZooPath (Snohomish, Washington, USA). The mean  $\pm$  SD age of hedgehogs at time of diagnosis was  $3.75 \pm 0.50$  yr and ranged from 3 to 4 yr (four had unknown ages and were classified as adult). The average lifespan for African hedgehogs in captivity is 3 to 5 yr. Four hedgehogs were privately owned and four were from zoological parks. All hedgehogs were reproductively intact, but their breeding histories were unreported. In all cases but one, the tumors presented as a solitary, subcutaneous mass in either the right or left cranial or caudal abdomen that varied in size (0.2 cm to 2.0 cm). One hedgehog had multiple, subcutaneous masses in both the right and left cranial abdomen.

Sections of mammary gland tumor from all eight hedgehogs were submitted fixed in 10% neutral, buffered formalin and were embedded in paraffin, sectioned at 5.0  $\mu$ m, and stained with hematoxylin and eosin (H&E). Histologically, tumors were

classified as solid (4 cases) (Fig. 1), tubular (2 cases), and papillary (2 case). Seven of eight (88%) mammary gland tumors were malignant. Malignant tumors consisted of neoplastic epithelial cells with single, round to oval, anisokaryotic, central to eccentric, nucleus with one to several nucleoli, and moderate eosinophilic to foamy, anisocytotic cytoplasm (Fig. 2). Mitotic figures were numerous in some neoplasms. Neoplastic cells were usually arranged in layered sheets and nodules up to 15 cell layers thick that occasionally formed papillary or tubuloalveolar formations. Most (71%) tumors had scattered areas of necrosis and hemorrhage. All malignant mammary gland tumors were partially encapsulated but infiltrated the surrounding fibrous connective tissue capsule and panniculus (Fig. 3). Three tumors had histologic evidence of lymphatic invasion. Axillary lymph node was examined from only one hedgehog, and there was histologic evidence of metastatic disease within the lymph node. One of eight mammary gland tumors was classified as a papillary adenoma and consisted of well differentiated neoplastic epithelial cells arranged in papillary projections.

Two hedgehogs had return of the tumor shortly after surgical excision and were euthanized. One hedgehog died shortly after being diagnosed with mammary gland adenocarcinoma, but was lost for follow-up necropsy. The remaining five hedgehogs with mammary gland tumors have been lost to follow-up reexamination.

The light microscopic features of these neoplasms were consistent with tumors of mammary gland differentiation. Neoplastic disease is common in African hedgehogs as evidenced by the liberal number of published articles pertaining to tumors in hedgehogs (Wadsworth and Jones, 1985;

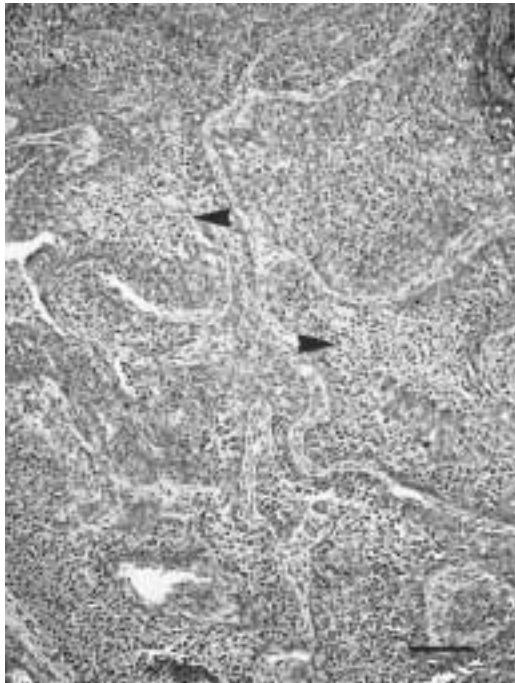


FIGURE 1. Solid mammary gland carcinoma from an African hedgehog. There are multiple central areas of necrosis (arrowheads). H&E. Bar = 200  $\mu$ m.

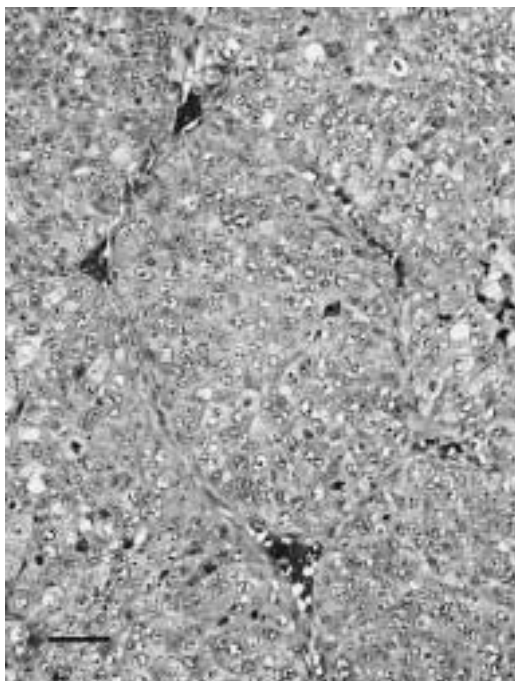


FIGURE 2. Sheets and nests of neoplastic epithelial cells from a solid mammary gland carcinoma in an African hedgehog. H&E. Bar = 100  $\mu$ m.

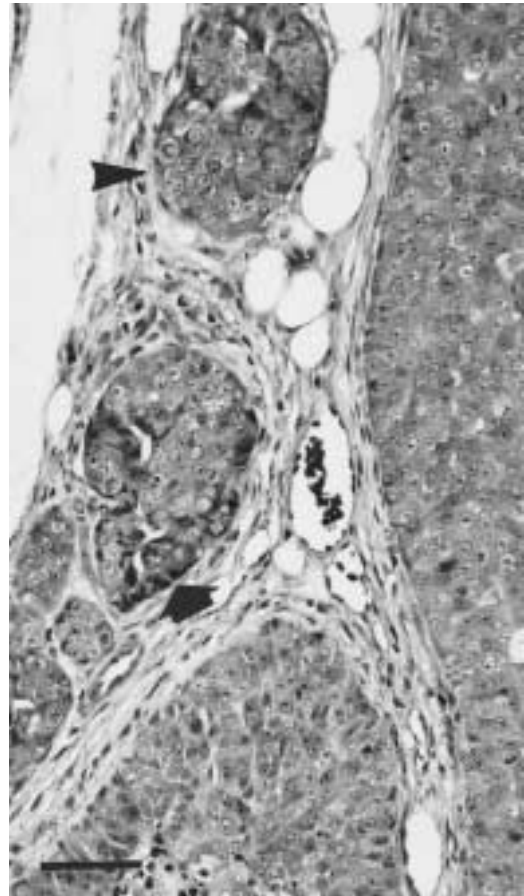


FIGURE 3. Infiltration of mammary gland carcinoma into the fibrous capsule (arrow and arrowhead) in an African hedgehog. H&E. Bar = 100  $\mu$ m.

Schmidt and Hubbard, 1987; Hruban et al., 1992; Reams and Janovitz, 1992; Buntton, 1993; Peauroi et al., 1994; Raymond et al., 1997; Ramos-Vara et al., 1998; Raymond et al., 1998). In one retrospective study, neoplastic disease was noted in approximately 30% of hedgehog necropsies (Raymond and White, 1999). Mammary gland tumors have been commonly reported in dogs and cats and rarely in other domestic animals. (Moulton, 1990; Yager and Scott, 1993). Mammary gland tumors have been even less frequently reported in nondomestic animals (Bhowmik and Iyer, 1978; Carpenter et al., 1980; Schmidt et al., 1986; Hotchkiss, 1995; Harrenstien et al., 1996; Garcia-Iglesias et al., 1997). We

believe this is the first report of mammary gland tumors in African hedgehogs.

Infection with type B retrovirus has been associated with mammary gland tumors in mice (Percy and Barthold, 1993). In addition, type A and type C retroviral particles have been detected in feline mammary gland tumors (Weijer et al., 1974). In hedgehogs, retroviral particles have been observed by transmission electron microscopy in skeletal sarcomas and intestinal lymphosarcoma (Peauroi et al., 1994; Raymond et al., 1998). Further studies are needed to evaluate the possible role of retroviral infection in the development of mammary gland tumors in hedgehogs.

There is evidence of an apparent increased incidence of mammary gland tumors in dogs that are not ovari hysterectomized before two years of age (Schneider et al., 1969), and there is no change in the 2 yr survival of dogs ovari hysterectomized at time of mastectomy for malignant mammary gland tumors (Morris et al., 1998). All hedgehogs in this study were reproductively intact and one hedgehog was ovari hysterectomized at time of mastectomy. However, the nature of any relationship between mammary carcinogenesis and ovari hysterectomy in hedgehogs remains undetermined.

In our experience, multiple neoplasms in the same hedgehog are a frequent occurrence. In addition to mammary gland tumors, three hedgehogs had concurrent neoplasms. One hedgehog had a cutaneous mastocytoma and a cutaneous hemangiosarcoma. One hedgehog had oral squamous cell carcinoma and uterine leiomyosarcoma, and one hedgehog had a uterine adenocarcinoma.

In conclusion, mammary gland tumors in hedgehogs are usually malignant and tend to be locally infiltrative. Mammary gland tumor should be considered as a differential diagnosis for a subcutaneous mass in the ventral abdomen of adult female hedgehogs.

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