is rapidly increasing. A thorough knowledge of specific diseases, pathologic conditions, and predisposing factors is necessary for effective care of these animals. Further research into this and other conditions unique to llamas is necessary to determine the significance and impact of these conditions on the North American llama population. The high frequency of 1 tumor type, especially in a species with apparent low recorded tumor incidence, may indicate a significant predisposition of this genus for gastric squamous cell carcinoma.

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Intracranial squamous cell carcinoma causing Horner's syndrome in a cow

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Although ocular squamous cell carcinoma is a common neoplasm of cattle,[2,10,12] intracranial squamous cell carcinomas are rare in cattle and other domestic animals.[15] In previous reports of intracranial squamous cell carcinoma in cattle, there was extensive bony destruction as the lesion spread from the eye,[7,11] was suspected to spread from the maxillary sinus by a perineural pathway,[6,14] or extended from the eye to the intracranial location through the foramen orbitorotundum.[15] In this report, we describe squamous cell carcinoma in the pituitary and brain stem of a cow with Homer's syndrome. The cow had squamous cell carcinoma in the third eyelid but no bone involvement or extension through the foramen orbitorotundum was found.

A 5-year-old Holstein cow was presented to the University of Missouri College of Veterinary Medicine Veterinary Teaching Hospital because of a 1-month history of anorexia and weight loss. Clinical findings included poor body condition, weakness, profound depression, left ear droop, and left masseter and facial muscle atrophy. The left eye was deeply withdrawn into the orbit, the left menace response was absent, and the left pupil was constricted. The left eyelid was flaccid. A 0.5-cm papillary mass was noted on the right nictitating membrane.

The ocular abnormalities were consistent with a diagnosis of Homer's syndrome. Differential diagnoses for the third-eyelid mass included granulation tissue secondary to trauma or neoplasia. The cow's severely obtunded attitude could have been due to malnutrition, electrolyte imbalances, or neurologic disease or to a combination of these factors.

During the next 5 days, the cow was provided supportive care, including oral and intravenous electrolytes and rumen transfaunation. The cow was completely anoretic during the entire period of hospitalization and treatment and drank very little water. Because of the poor prognosis and lack of response to conservative treatment, the owner elected to have the animal euthanzed, and a complete necropsy examination was performed.

Necropsy findings included mucopurulent discharge from both eyes. On the right nictitating membrane, there was a

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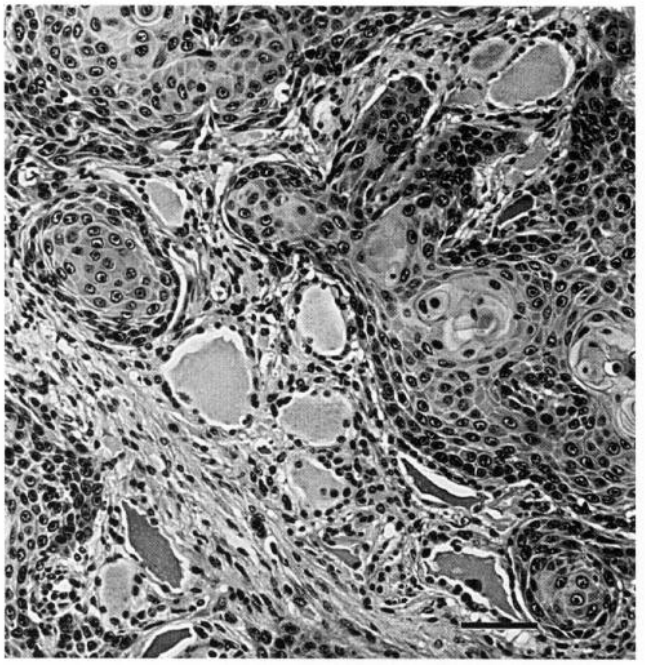

Figure 1. Nests of neoplastic squamous epithelial cells infiltrate the pars intermedia of the pituitary of a cow, as indicated by colloid filled follicles. HE, bar = 240 μm.

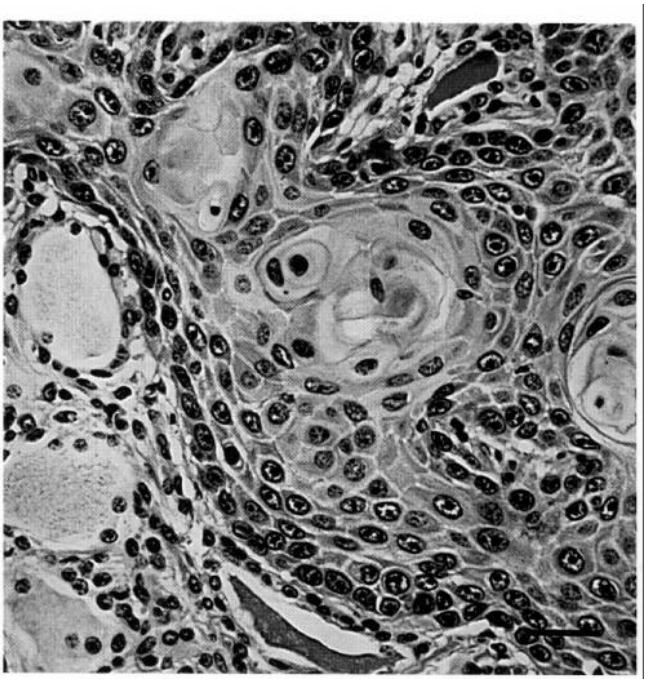

Figure 2. Pars intermedia of a cow is infiltrated by neoplastic squamous epithelial cells with areas of keratinization. HE, bar = 120 μm.

0.5- x 0.5-cm area of roughened mucosa from which a 0.5-cm papillary mass protruded. No lesions were seen in the conjunctiva, bulbs, or retrobulbar tissues. The pituitary gland was enlarged to approximately 1.5 times normal size, and the left half of the pituitary was yellow and firm. On sectioning, the left half of the pituitary had a tough, fibrous texture. In the ventral aspect of the left side of the brain stem beginning at the level of the pituitary and extending caudally for 2.0 cm, there was a 0.5-cm-wide band of tissue mottled dark red to tan. No gross lesions were found in the sella turcica. No gross lesions were present in other tissues, including oral cavity, nasal cavity, cervical lymph nodes, thoracic lymph nodes, and lungs.

On histologic examination, the left half of the pituitary was replaced with neoplastic tissue and fibrous connective tissue. The neoplasm was composed of nests and sheets of squamous epithelial cells and keratin pearls (Figs. 1, 2). The neoplastic squamous cells had round nuclei of various sizes, moderate to abundant eosinophilic cytoplasm, and distinct cell outlines. Frequent intercellular bridges between adjacent squamous cells were present. There were 1-3 mitotic figures per 400 x field. The right half of the pituitary was histologically normal. In sections taken from the discolored area of the left ventral brain stem caudal to the pituitary stalk, there was replacement of the neuropil and infiltration of the meninges by nests of neoplastic squamous cells with morphology similar to that of those in the left side of the pituitary (Fig. 3). The 0.5-cm papillary mass from the right nictitating membrane was composed of nests and cords of neoplastic squamous epithelial cells with round nuclei, eosinophilic cytoplasm, and frequent intercellular bridges. There were 0-3 mitotic figures per 400 x field. At the lateral borders of the papillary mass, the neoplastic cells blended in with adjacent normal mucosal epithelium. Neoplastic cells did not extend into tissues deeper than the mucosa. Histologic lesions were not seen in other tissues, including the eyes, optic nerves, spinal cord, lymph nodes, and lungs.

Immunohistochemical stains for vimentin and cytokeratins AE1 and AE3 were performed on sections of pituitary and brain stem neoplasms using an avidin-biotin complex immunoperoxidase method" according to labeled instructions. For vimentin stain, mouse anti-bovine antibody[b] at 1:20 dilution was used. For cytokeratins AE1 and AE3, prediluted mouse anti-human antibody cocktail[b] was used. Neoplastic cells in both the pituitary and the brain stem stained positively for cytokeratins AE1 and AE3 and stained negatively for vimentin.

Horner's syndrome has been associated with abscesses and cranial tumors in cattle.[6] A diagnosis of Horner's syndrome is based on clinical findings resulting from lesions of the ocular sympathetic tract. These signs include miosis, ptosis, enophthalmia, and in cattle loss of sweating on the ipsilateral side of the nose. These signs may result from abnormalities of the thoracic spinal cord, ventral spinal roots, cervical vagosympathetic trunk, petrous temporal bone, middle ear, or orbit.[5] In this animal, a brain stem lesion was suspected because of altered mentation and denervation of the facial musculature.[5]

Intracranial squamous cell carcinoma has been reported as a rare neoplasm in cattle[7,11,14,15] and humans.[4,9,13] In a literature review of human cases of intracranial squamous cell carcinoma in which criteria were set to exclude those neoplasms arising outside the dura, the majority of the neoplasms arose from malignant changes to epidermoid cysts.[4]

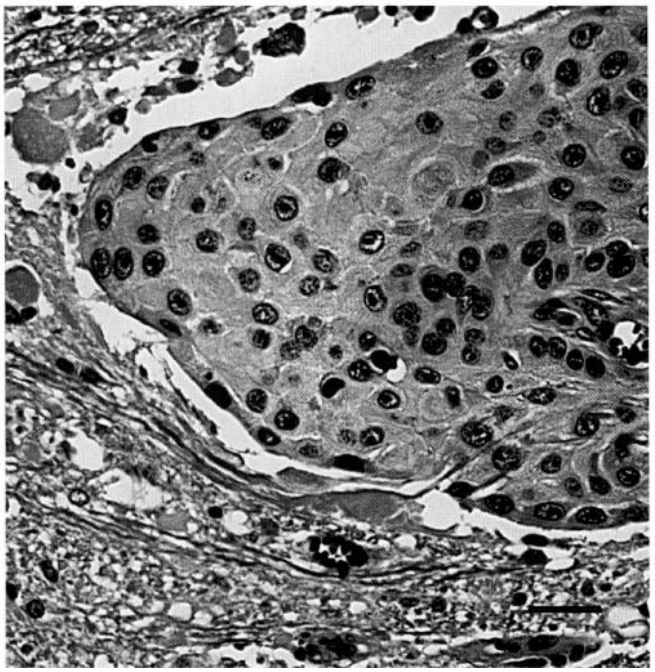

Figure 3. Brain stem of a cow is infiltrated by a sheet of neoplastic epithelial cells. HE, bar = 120 µm.

Cranial epithelial cysts are either epidermoid (pure squamous epithelium) or dermoid (squamous epithelium with skin adnexa). In humans, neoplasms arising in the hypothalamic suprasellar area are most often gliomas or craniopharyngiomas.[3] Craniopharyngiomas are derived from vestigial remnants of oropharyngeal ectoderm of the craniopharyngeal duct (Rathke's pouch)[1,3] and are classified as suprasellar cysts, intrasellar cysts, and adamantinomas.[13] Intrasellar cysts are lined by cuboidal or columnar epithelium but may have areas of squamous metaplasia and probably do represent the remnants of Rathke's pouch in contrast to suprasellar cysts, which are lined by squamous epithelial cells and are thought to be remnants of the hypophyseal duct.[13] Squamous cell carcinomas may arise from these sites as malignant transformation of the epithelial linings of the cysts or de novo in the same locations.[11,13]

Intracranial meningioma may display a variety of histologic patterns in animals, including meningotheliomatous (epithelioid) meningioma and psammomatous meningioma, which might be confused with the neoplasm in this cow.[8] Neoplastic cells in this cow stained positively for cytokeratins AE1 and AE3 and negatively for vimentin, confirming the epithelial origin of the neoplasm.

The exact origin of the intracranial squamous cell carcinoma in this cow is not certain. The finding of a small papillary squamous cell carcinoma in the nictitating membrane indicates 1 possible site for a primary extracranial squamous cell carcinoma. However, in other cases of metastasis of primary ocular or palpebral squamous cell carcinomas in cattle, spread to the intracranial sites was by local invasion with extensive bone destruction, by spread along perineural pathways, or by extension through the foramen orbitorotundum.[6,7,11,14,15] These routes of metastasis were not seen in the present case. Another possibility is that the neoplasm arose as a primary intracranial neoplasm coincident with but independent of the neoplasm in the nictitating membrane. Extension from intrasellar or suprasellar cysts would be a likely origin in this scenario. However, extension from cysts was not seen in this cow, and the exact origin of the intracranial neoplasm is not certain. Intracranial neoplasms, even though rare, should be considered as one of the differential diagnoses in cases of Horner's syndrome in cattle.

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a. Vector Laboratories, Burlingame, CA.
b. Dako Corp., Carpinteria, CA.

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