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Pathology in Practice

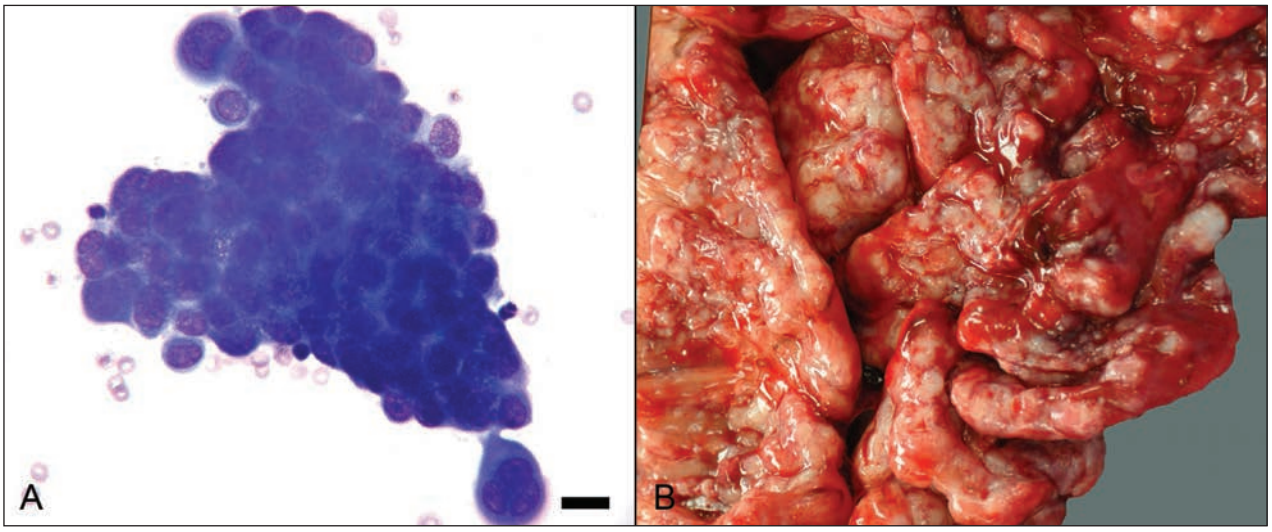

Figure 1—Photomicrograph of a fine-needle aspirate preparation from an abdominal mass (A) and photograph of the omentum obtained following euthanasia after exploratory celiotomy (B) in an 11-year-old Beagle with signs of pain elicited during abdominal palpation and a 1-month history of excessive panting. In the fine-needle aspirate preparation, clusters of round to polygonal cells with mild anisocytosis and anisokaryosis and a high nuclear-to-cytoplasmic ratio are visible. Most cells have a single round to oval nucleus with stippled chromatin, a prominent nucleolus, and a small to medium amount of deeply basophilic cytoplasm, occasionally with a pink, cytoplasmic fringe. Wright-Giemsa stain; bar = 20 µm. Grossly, the omentum is expanded by coalescing nodules that created a mass effect during abdominal palpation.

History

An 11-year-old 13.5-kg (29.7-lb) castrated male Beagle was evaluated at the General Practice at the North Carolina State University College of Veterinary Medicine because of a 1-month history of excessive panting.

Clinical and Gross Findings

On initial evaluation, the dog was panting. Abdominal palpation elicited signs of pain and revealed an approximately 8 × 4-cm mass within the left, caudoventral aspect of the abdomen. Abnormalities revealed by a CBC and serum biochemical analysis were minimal and considered unremarkable.

Three-view abdominal radiography revealed many soft tissue nodules within the abdominal fat. The nodules were most apparent along the ventral border of the abdomen. The liver was mildly enlarged, and there was no to trace peritoneal effusion.

Cytologic evaluation of a fine-needle aspirate (**Figure 1**) revealed clusters of round to polygonal cells with occasional spindle cells. The cells had mild anisocytosis and anisokaryosis and a high nuclear-to-cytoplasmic ratio. Most cells had a single round to oval nucleus with stippled chromatin, a prominent nucleolus, and a small to medium amount of deeply basophilic cytoplasm with occasional cytoplasmic blebs. Occasional intercellular junctions and mitotic figures were noted. Rare cells had up to 5 nuclei. Scattered nondegenerate neutrophils were present. Neoplasia was suspected; however, a definitive diagnosis was not made owing to the presence of inflammation and the possibility that the cells could be dysplastic mesothelial cells.

The dog was anesthetized and underwent exploratory celiotomy, during which myriad, coalescing, 0.3- to 2-cm-diameter tan nodules effacing the omentum were found (Figure 1). Similar coalescing nodules extended along the parietal peritoneum from the umbilicus to the left inguinal ring. The remainder of the abdomen was grossly unremarkable. The dog was euthanized prior to recovery from anesthesia. Samples of the nodules and omentum were submitted for histologic evaluation; however, necropsy was declined by the owner.

Formulate differential diagnoses from the history, clinical findings, and Figure 1—then turn the page →

This report was submitted by Brenda J. Stevens, DVM; Stephanie A. Montgomery, PhD, DVM; Kathryn L. Phillips, DVM; Maggie W. Wester, DVM; and Samuel H. Jennings, DVM; from the Departments of Clinical Sciences (Stevens), Population Health and Pathobiology (Montgomery, Jennings), and Molecular Biomedical Sciences (Phillips), College of Veterinary Medicine, North Carolina State University, Raleigh, NC 27607; and Carthage Animal Hospital, 5600-A US Hwy 15-501, Carthage, NC 28327 (Wester). Dr. Jennings' present address is Department of Biomedical Sciences, Cummings School of Veterinary Medicine, Tufts University, North Grafton, MA 01536.

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Address correspondence to Dr. Jennings (Samuel.jennings@tufts.edu).

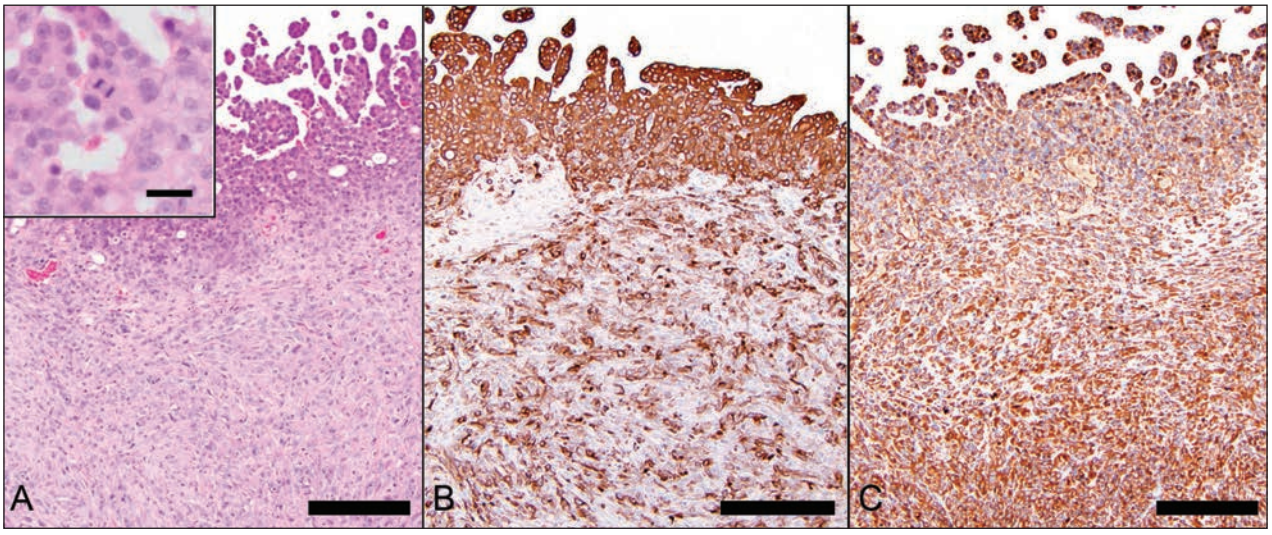

Figure 2—Photomicrographs of sections of the omental nodules from the dog in Figure 1. A—Histologically, neoplastic cells at the surface of the omentum are epithelioid and form short papillary projections; the cells blend into an underlying population of spindle cells that efface the omental fat. H&E stain; bar = 200 μm. Inset—Higher magnification image of the epithelioid cells of the papillary projection. A mitotic figure is present centrally. H&E stain; bar = 20 μm. B—Following immunohistochemical staining with an anti–pancytokeratin antibody, strong, diffuse, cytoplasmic labeling of the surface cells with slightly less consistent labeling of the spindle cells is evident in the nodule. Immunohistochemical stain for pancytokeratin with 3,3′-diaminobenzidine chromogen and hematoxylin counterstain; bar = 200 μm. C—Following immunohistochemical staining with an anti–vimentin antibody, strong, diffuse, cytoplasmic labeling of epithelioid cells and spindle cells is evident in the nodule. Immunohistochemical stain for vimentin with 3,3′-diaminobenzidine chromogen with hematoxylin counterstain; bar = 200 μm.

Histopathologic Findings

Poorly demarcated, infiltrative, plaque-like nodules effaced the surface and underlying adipose of the omentum. Sections of omentum were examined microscopically. Superficially, neoplastic cells were epithelioid and formed short, papillary projections with scant stroma (**Figure 2**). These cells blended into short streams of plump spindle cells on a moderately collagenous stroma. The neoplastic cells had indistinct cell borders and a moderate amount of faintly basophilic to eosinophilic cytoplasm, round to oval nuclei with peripheralized chromatin, and often a prominent nucleolus. The cells had moderate anisocytosis and anisokaryosis, with 4 mitotic figures in 10 high-magnification (400X) fields. There was evidence of mild, multifocal, lymphoplasmacytic, and neutrophilic inflammation.

Immunohistochemical staining with an anti–pancytokeratin antibody resulted in diffuse, strong, cytoplasmic labeling of the neoplastic epithelioid cells and 40% to 80% of the spindle cell population depending on the region of the neoplasm examined (Figure 2). Immunohistochemical staining with an anti–vimentin antibody resulted in diffuse, strong, cytoplasmic labeling of the epithelioid and spindle cells.

Initially, the differential diagnoses for the dog's clinical signs and radiographic findings included carcinomatosis, granulomatous peritonitis, and mesothelioma; following examination of the H&E-stained sections of the omentum, the differential diagnoses included intraperitoneal spread of a carcinoma or sarcoma or malignant mesothelioma. The surface orientation, lack of an identified primary tumor elsewhere, lack of gross lymph node involvement, and presence of both epithelial and mesenchymal features supported a diagnosis of malignant mesothelioma. Expression of both vimentin and cytokeratin further supported the diagnosis.

Morphologic Diagnosis and Case Summary

Morphologic diagnosis and case summary: malignant mesothelioma in a dog.

Comments

Although uncommon, mesotheliomas in young cattle, dogs, horses, cats, rats, and hamsters have been reported.[1–3] Affected dogs have mean age of 7.8 years; however, newborn and young animals can be affected.[4]

Mesotheliomas originate from the mesoderm-derived cells that line serosal surfaces.[5,6] As such, they can arise from the pleura, pericardium, peritoneum, or tunica vaginalis. As in the dog of the present report, these tumors are usually multinodular and disseminated throughout a cavity rather than single discrete masses.[5,6] In humans and dogs, the pleura is the main site of development; however, peritoneal mesothelioma, as in the case described in this report, may also develop. The radiographic conspicuity of the mesenteric nodules in the dog of the present report was unusual because mesotheliomas are often associated with peritoneal effusion. For this dog, signs of pain were the primary reason for evaluation and effusion was absent.

Dogs with mesothelioma have a poor prognosis.[7] In humans, treatment is often palliative because of the diffuse nature of the disease. This neoplasm has a high recurrence rate and is associated with a high mortality rate in humans. The disease in dogs has a similar progression. Surgical removal as well as adjunctive radia-

tion therapy or chemotherapy with platinum products, doxorubicin hydrochloride, and mitoxantrone hydrochloride have been attempted in affected dogs with limited success.[7–9]

Grossly, mesothelioma often resembles carcinomatosis.[1] Histologically, mesotheliomas are broadly separated into 3 categories: epithelial, sarcomatoid, and biphasic (the latter illustrated by the case described in this report); however, numerous subcategories are also described.[2,4,10] Given the variety of histologic subtypes, it is not surprising that mesotheliomas can histologically mimic various sarcomas and carcinomas.[1] Immunohistochemical evidence of cytokeratin and vimentin expression is often used to support a diagnosis of mesothelioma.[11,12]

In humans, asbestos exposure is associated with development of pleural and peritoneal mesotheliomas.[13] There are reports[15,16] linking asbestos exposure with development of mesotheliomas in dogs; however, this association remains speculative. Mesothelioma can be experimentally induced following asbestos exposure in dogs.[14] However, in dogs that naturally develop mesothelioma, the number of asbestos-associated fibers in the lungs is much lower than that typically detected in the lungs of people with mesothelioma.[15–17] The owner of the dog of the present report was questioned regarding the potential of exposure of the dog to asbestos, but this was deemed unlikely.

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