J. Comp. Path. 2001, Vol. 124, 223–226
doi:10.1053/jcpa.2000.0451, available online at http://www.idealibrary.com on IDEAL®

SHORT PAPER

A Joint Myxoma in a Dog

A. Berrocal, Y. Millán*, J. Ordás* and J. Martín de las Mulas*

*Departamento Patología, Escuela de Medicina Veterinaria, Universidad Nacional, Heredia, Costa Rica and *Departamento de Anatomía y Anatomía Patológica Comparada, Facultad de Veterinaria, Universidad de Córdoba, Campus Universitario de Rabanales, Edificio de Sanidad Animal, 14014 Córdoba, Spain*

Summary

Myxomas of the joints are extremely rare in domestic animals, only four cases, all in dogs, having been reported previously. This paper describes a myxoma originating from the synovium of the right radiocarpal joint of a mature female Dobermann pinscher with right front limb lameness. The tumour was excised surgically and no recurrence was detected during a 2-year follow-up period. Immunohistochemically, the tumour cells reacted with antibodies to vimentin and S100 protein but not with antibodies to cytokeratins (high and low molecular weight) or human callus keratin.

© 2001 Harcourt Publishers Ltd

Myxomas are rare tumours of suspected fibroblastic origin, characterized by a large amount of mucin in the intercellular matrix. These benign neoplasms may occur at any site at which there is connective tissue, but in the dog the most common site is the skin (Pool, 1990). Myxomas of the joints are extremely rare and, of all the domestic species, only the dog has been reported to be affected with such tumours (Pool, 1990; Griffon *et al.*, 1994). This report presents a case of myxoid tumour arising in the canine metacarpal joint.

An adult female Dobermann pinscher was presented at the clinic with a cold swelling on the lateral aspect of the right radiocarpal joint, causing mechanical lameness. A lobulated mass in the synovium was removed surgically. There was no destruction of articular cartilage or of the joint margins. The dog recovered well and no local recurrence was observed in a 2-year follow-up period.

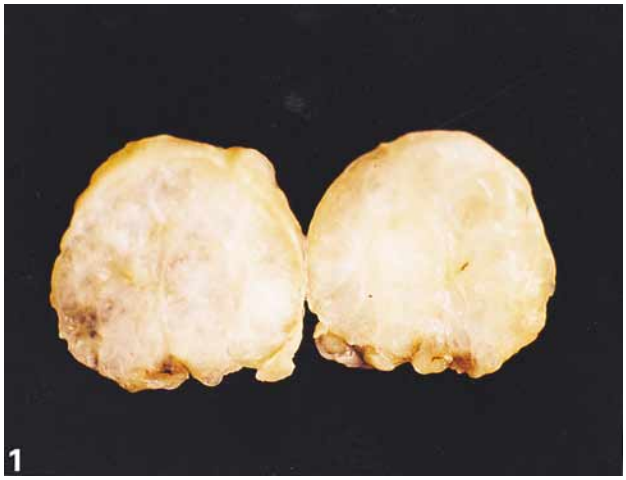
Grossly, the excised mass (0·5 × 1·0 × 3·0 cm) was well demarcated, whitish, soft and lobulated, with viscid mucinous material (Fig. 1). Tissue samples were fixed in 10% neutral buffered formalin, embedded in paraffin wax, sectioned (5–6 μm) and examined after staining with haematoxylin and eosin (HE) and Alcian blue at pH 2·5. In addition, the immunophenotype of the tumour cells was examined immunohistochemically. The avidin-biotin-peroxidase complex (ABC) technique (Hsu *et al.*, 1981) was used, with a rabbit polyclonal anti-calf lens vimentin antibody, a rabbit polyclonal anti-human callus keratin antibody, the mouse monoclonal RCK-102 antibody (which recognizes high and low molecular weight cytokeratins 5 + 8 + 18 of the Moll catalogue) and the mouse monoclonal NCL-5D3 antibody (which recognizes low molecular weight cytokeratins 8 + 18 + 19 of the Moll catalogue) (Moll *et al.*, 1982). All reagents were obtained from Eurodiagnostics B. V., Appeldorn, The Netherlands. In addition, a rabbit polyclonal anti-cow S100 protein antibody (Dako, Glostrup, Denmark) was used. The methods were as previously described by Pérez *et al.* (1996).

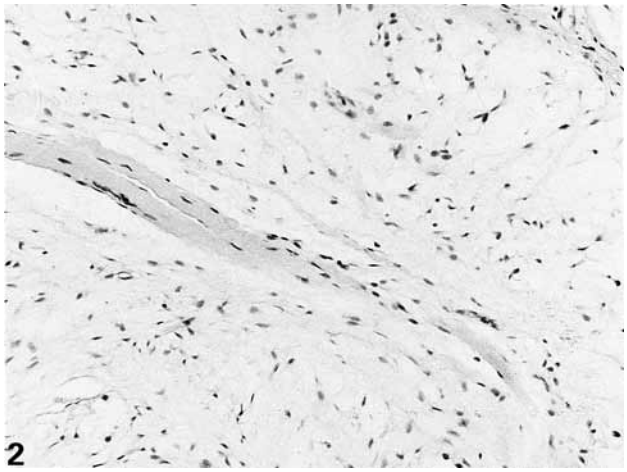
Microscopically, the tumour consisted of lobules delineated by poorly vascularized fibrous septa (Fig. 2). Within the lobules there were small numbers of bipolar or stellate cells set in an abundant non-fibrillary, gelatinous, Alcian blue-positive matrix

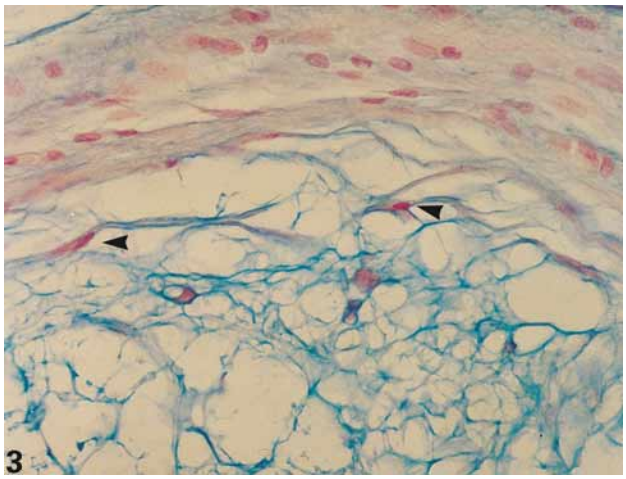
Correspondence to: J. Martín de las Mulas

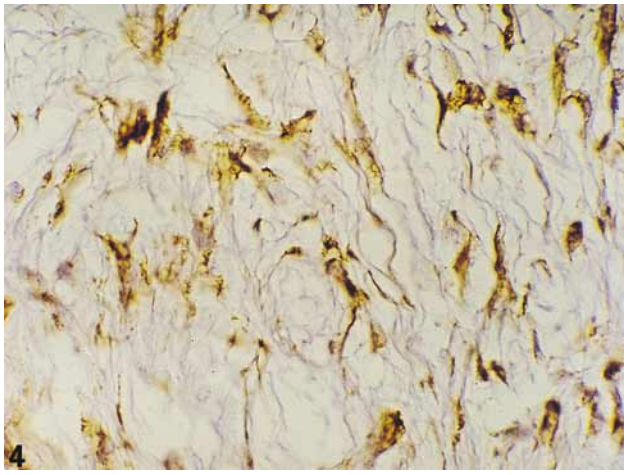
0021–9975/01/020223 + 04 $35.00

© 2001 Harcourt Publishers Ltd









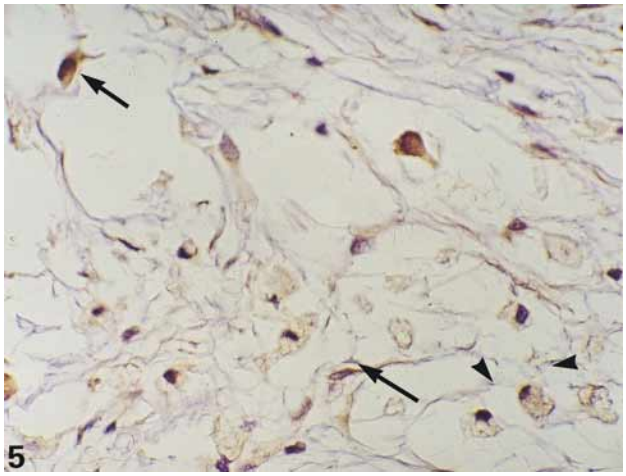


Fig. 1. Gross view of the excised mass after formalin fixation. The mass is well delineated by a band of white tissue, and the cut surface, which is white and gelatinous, is divided into large lobules by thin septa.

Fig. 2. The neoplasm has several lobules separated by thin fibrous septa. The lobules contain abundant extracellular matrix. HE. × 10.

Fig. 3. Fibrous capsule and blue-stained extracellular matrix. Tumour cells have a fusiform appearance (arrowheads). Nuclei are counterstained with nuclear red. Alcian blue, pH 2·5. × 40.

Fig. 4. Immunoreactivity with anti-vimentin polyclonal antibody is observed in fusiform and stellate cells whose nuclei are obscured by the deep immunolabelling of the cytoplasm. ABC. × 40.

Fig. 5. Immunoreactivity with anti-S100 protein polyclonal antibody is observed in the nuclei and cytoplasm of isolated fusiform and stellate cells (arrows). Macrophages with dark blue, pyknotic nuclei and vacuolated cytoplasm are also observed (arrowheads). ABC. × 40.

(Fig. 3). The nuclei were round to elongate, uniform and without visible nucleoli. The margins of the mass were composed of well-vascularized fibrous tissue, with or without lymphocytic infiltration.

Immunohistochemically, the tumour cells reacted with vimentin and S100 protein antibodies exclusively. Immunoreactivity with vimentin antibody was observed in the cytoplasm of the majority (*c.* 95%) of tumour cells, as well as in vascular endothelial cells and fibroblasts (Fig. 4); immunoreactivity with S100 protein antibody was found in both the nucleus and cytoplasm of a minority (less than 10%) of cells (Fig. 5).

The tumour described here had the gross and microscopical features of a myxoma (Enzinger and Weiss, 1988; Hendrick *et al.*, 1998), a type of neoplasm not included in the list of joint tumours of either human beings (Fechner and Mills, 1993) or domestic animal species (Slayter *et al.*, 1994). However, myxomas of joints were described previously in four dogs. The first three cases were reported as joint lesions which did not belong to any of the existing categories of tumours or tumour-like lesions of animal joints (Pool, 1990); they were centred in the synovial linings and the term "myxoma of the synovium" was used. Of the three animals, two were mature Dobermann pinschers (a male and a female), each with a single affected joint (stifle), and one was a 9-year-old English spaniel with two adjacent ipsilateral apophyseal joints affected in the cervical spine (C-2 and C-3). Two of the cases described showed locally infiltrative neoplastic growth, the myxoid tumour tissue extending beyond the fibrous layer of the joint capsule and infiltrating along fascial planes of adjacent musculature. The third case, a male Dobermann pinscher, resembled the case described here, in which no infiltrative growth was observed macroscopically and no sign of recurrence appeared within 2 years of surgical removal.

The fourth recorded case of joint myxoma, described by Griffon *et al.* (1994), also had features similar to those of the present case; it arose, however, from the joint capsule. The dog was a 10-year-old female Alaskan malamute with left front limb lameness; the tumour, which was excised, originated from the left radiocarpal joint capsule and was identified histopathologically as a myxoma. Tumour recurrence was not evident during a 4-year follow-up period.

In addition to gross and microscopical similarities to myxomas at other locations (Enzinger and Weiss, 1988; Hendrick *et al.*, 1998), and to the clinical and pathological similarities to previously reported cases of canine joint myxoma (Pool, 1990; Griffon *et al.*, 1994), the immunohistochemical phenotype of the tumour cells described here supports the diagnosis of myxoma. Thus, vimentin is the intermediate filament protein characteristic of normal and tumoral mesenchymal cells and is detected in myxomas (Enzinger and Weiss, 1988). Other markers have been detected in myxomas at different locations. Thus, in man, some odontogenic myxomas, but not other oral myxoid lesions, may express S100 protein (Lombardi *et al.*, 1995). Also in man, cardiac myxomas (Rubin *et al.*, 1995; Deshpande *et al.*, 1996) and a myxoma of the breast (Arihiro *et al.*, 1993) have been shown to contain S100 protein immunoreactive cells. Other markers such as factor VIII-related antigen (Rubin *et al.*, 1995; Deshpande *et al.*, 1996), *Ulex europaeus*, CD34 (Rubin *et al.*, 1995), desmin (Deshpande *et al.*, 1996), myoglobin (Deshpande *et al.*, 1996) and alpha smooth muscle actin (Horie *et al.*, 1995) have been detected in some myxomas. These findings suggest the presence of totipotential primitive mesenchymal cells among the more mature fibroblastic cells, which express only vimentin (Lombardi *et al.*, 1995; Rubin *et al.*, 1995; Deshpande *et al.*, 1996).

Several types of soft tissue tumour may have areas of myxoid change or myxoid variants (Enzinger and Weiss, 1988; Gross *et al.*, 1992) and true myxomas must be distinguished from them. Among such tumours, those with a keratin-negative, vimentin-positive and S100 protein-positive immunophenotype include lipomas and liposarcomas, melanomas, mesenchymomas and schwannomas (Enzinger and Weiss, 1988; Pérez *et al.*, 1996). Liposarcomas and mesenchymomas have been described in joint tissues (Slayter *et al.*, 1994); both, however, are neoplasms with histological characteristics of malignancy. In addition, liposarcoma is characterized by the presence of atypical lipoblasts, and mesenchymoma by the presence of at least two independent sarcoma cell types (e.g., osteosarcomatous and liposarcomatous) in a fibromatous-like pattern (Slayter *et al.*, 1994). An unusual variant of benign schwannoma is myxoid schwannoma; this soft tissue tumour, located in the digits of dogs, has a multilobular configuration reminiscent of Pacinian corpuscles and is composed of small spindle and stellate cells forming loose, concentric swirls in an abundant background of mucin (Gross *et al.*, 1992). It is easily confused with myxoma, especially in view of the immunophenotype of myxoma tumour cells. However, areas of spindle (Antoni type A) or polygonal (Antoni type B) cells, or both types of area, as well as serpentine nuclei, are found in all variants of schwannomas (Gross *et al.*, 1992).

References

Arihiro, K., Inai, K., Kurihara, K., Takeda, S., Khatun, N., Kuroi, K., Kawami, H. and Toge, T. (1993). Myxoma of the breast. Report of a case with unique histological and immunohistochemical appearances. *Acta Pathologica Japonica*, **34,** 340–346.

Deshpande, A., Venugopal, P., Kumar, A. S. and Chopra, P. (1996). Phenotypic characterization of cellular components of cardiac myxoma—a light microscopy and immunohistochemistry study. *Human Pathology*, **27,** 1056–1059.

Enzinger, F. M. and Weiss, S. W. (1988). *Soft Tissue Tumours*, 2nd Edit., G. Stamathis, Ed., The C. V. Mosby Company, St Louis.

Fechner, R. E. and Mills, S. E. (1993). Tumours of the bones and joints. In: *Atlas of Tumour Pathology. Third Series*, Vol. 8, J.Rosai and L. H., Sobin, Eds, Armed Forces Institute of Pathology, Washington D.C., pp.1–300.

Griffon, D. J., Wallace, L. J., Barnes, D. M. and Johnston, G. R. (1994). Myxoma arising from the radiocarpal joint capsule in a dog. *Journal of the American Animal Hospital Association*, **30,** 257–260.

Gross, T. L., Ihrke, P. J. and Walder, E. J. (1992). Fibrocytic tumours (Chapters 26 and 28). In: *Veterinary Dermatopathology*, R. W. Reinhardt, Ed., Mosby Year Book, St Louis, pp. 407–416 and 430–448.

Hendrick, M. J., Mahaffey, E. A., Moore, F. M., Vos, J. H. and Walder, E. J. (1998). Histological classification of mesenchymal tumours of skin and soft tissues of domestic animals. In: *World Health Organization Second Series of the International Histological Classification of Tumors of Domestic Animals*, Vol. 2, Armed Forces Institute of Pathology, Washington D.C., pp. 12–16.

Horie, Y., Ikawa, S., Okamoto, I., Nagata, M. and Tamai, A. (1995). Myxoma of the conjunctiva. A case report and a review of the literature. *Japanese Journal of Ophthalmology*, **39,** 77–82.

Hsu, S. M., Raine, L. and Fanger, H. (1981). The use of antiavidin antibody and avidin-biotin-peroxidase complex in immunoperoxidase techniques. *American Journal of Clinical Pathology*, **75,** 816–821.

Lombardi, T., Lock, C., Samson, J. and Odell, E. W. (1995). S100, alpha smooth muscle actin and cytokeratin 19 immunohistochemistry in odontogenic and soft-tissue myxomas. *Journal of Clinical Pathology*, **48,** 759–762.

Moll, R., Franke, W. W., Schiller, D. L., Geiger, G. and Krepler, R. (1982). The catalogue of human cytokeratins: patterns of expression in normal epithelia, tumours and cultured cells. *Cell*, **31,** 11–24.

Pérez, J., Bautista, M. J., Rollón, E., Chacón, M., de Lara, F., Carrasco, L. and Martín de las Mulas, J. (1996). Immunohistochemical characterization of hemangiopericytomas and other spindle cell tumours in the dog. *Veterinary Pathology*, **33,** 391–397.

Pool, R. R. (1990). Tumours and tumour-like lesions of joints and adjacent soft tissues. In: *Tumours in Domestic Animals*, 3rd Edit., J. K. Moulton, Ed., University of California Press, Berkeley, pp.102–156.

Rubin, M. A., Snell, J. A., Tazelaar, H. D., Lack, E. E., Austenfeld, J. L. and Azumi, N. (1995). Cardiac papillary fibroelastoma. An immunohistochemical investigation and unusual clinical manifestations. *Modern Pathology*, **8,** 402–407.

Slayter, M. V., Boosinger, T. R., Pool, R. R., Dämmrich, K., Misdorp, W. and Larsen, S. (1994). Histological classification of bone and joint tumors of domestic animals. In: *World Health Organization Second Series of the International Histological Classification of Tumors of Domestic Animals*, Vol. 1, Armed Forces Institute of Pathology, Washington D.C., pp. 15–16.

Received, July 1st, 1999
Accepted, October 24th, 2000