Malignant, solitary, nasopharyngeal schwannoma in a cow

L. MANDRIOLI, A. GENTILE, M. MORINI, G. BETTINI, P. S. MARCATO

PERIPHERAL nerve sheath tumours (PNST) may occur nearly everywhere in the peripheral nervous system, and may have a multicentric (Johnson and others 1988) or solitary (Tanimoto and Ohtsuki 1992) distribution. In the cow, schwannomas have been reported in the brachial plexus, intercostal nerves, hepatic autonomic plexus and autonomic nerves of the mediastinum and heart (Bundza and others 1986, Johnson and others 1988, Bettini and Marcato 1992, Jubb and Huxtable 1993), and in cervical and thoracic spinal nerves, nerve rootlets and ganglia (Rebhun and others 1984, Johnson and others 1988, Tanimoto and Ohtsuki 1992). Two variants are classically described: benign forms, which present as encapsulated, globoid, lobulated masses of variable size and shape, and malignant variants, which are not usually encapsulated and infiltrative (Stoica and others 2001). This short communication describes a malignant, solitary, nasopharyngeal schwannoma in a cow.

A five-year-old Simmental cow was presented at the Veterinary Teaching Hospital of the Faculty of Veterinary Medicine of Bologna for marked inspiratory wheezing and severe snoring, indicative of an upper airways disorder. Clinical examination supported by endoscopy revealed the presence of a whitish, firm mass within the nasal cavity, almost totally occluding the nasopharyngeal opening. Guided endoscopic fine-needle biopsy showed numerous clusters of pleomorphic spindle and plump cells having elongated to round central nuclei, with stippled chromatin, inconspicuous nucleoli, delicate, wispy cytoplasmic processes and intercellular collagen. The cell morphology was consistent with a neoplastic process of mesenchymal origin (Fig 1). In view of the poor prognosis, the animal was euthanased.

At postmortem examination, after ablation of the mandible and tongue, a sagittal section of the head passing through the nasal septum revealed a mass 10 cm in diameter, with numerous randomly distributed foci of necrosis alternating with multiple haemorrhagic areas (Fig 2). The mass induced marked dilatation of the left nasopharyngeal cavity and ventral dislocation of the soft palate. It caused compression and atrophy of the right pterygoid process of the sphenoid bone and it infiltrated the pterygoid muscles.

Several samples of the mass were fixed in 10 per cent buffered formalin, embedded in paraffin and stained with haematoxylin and eosin. Immunohistochemical staining of selected sections was also performed with the panel of commercial antibodies given in Table 1, using a modified avidin-biotin peroxidase technique (LAB Vision). A positive control was present on each slide.

Histologically, the tumour was poorly circumscribed and it infiltrated the adjacent muscular fibres. It basically showed two different patterns: areas composed of densely packed spindle cells arranged in short, interlacing bundles and whorls (Fig 3) or in irregular nests divided by branching connective bands (Antoni type A pattern), and areas with loosely packed spindle to plump fusiform cells soaked in abundant extracellular mucoid material (Antoni type B pattern). Verocay bodies were absent. In the central part of the larger nests or whorls, foci of haemorrhages intermingled with necrotic blood were present. At a higher magnification, the spindle and plump cells did not show distinct cellular outlines; they had a single, oval to ellipsoid central vesicular nucleus, and one to two well-distinct central nucleoli. Mitotic figures were present at one to two per high power field; sparse lymphocytes infiltrated the thickest intratumoural connective septa.

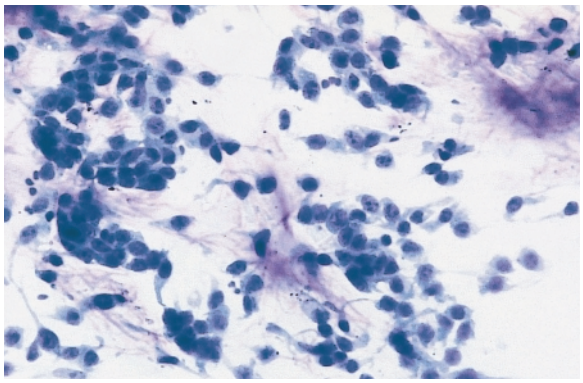

FIG 1: Cytological smear from a nasopharyngeal mass in a Simmental cow showing clusters of pleomorphic spindle cells with wispy cytoplasmic processes and distinct margins, elongated to round central nuclei and intercellular collagen. May-Grünwald-Giemsa. x 20

Immunohistochemically, a diffuse strong S-100 protein immunoreactivity was observed in the cytoplasm and occasionally in the nucleus of neoplastic cells (Fig 4). The same cells also showed a cytoplasmic immunopositivity for vimentin, while neuron-specific enolase, desmin, actin, wide-spectrum cytokeratin and CD34 were negative.

Pieces of formalin-fixed tissues were fixed in 2·5 per cent glutaraldehyde, postfixed in 1 per cent osmium tetroxide, rinsed in cacodylate buffer solution, dehydrated and embedded in acrylic resin (Durcupan ACM). Ultrathin sections stained with uranyl acetate and lead citrate and examined using a CM 10 transmission electron microscope (Philips) revealed a basal lamina, a paucity of cytoplasmic organelles and occasional desmosome-like intercellular junctions of the neoplastic cells. Microscopic, immunohistochemical and ultrastructural findings were coherent with a definitive diagnosis of solitary malignant schwannoma.

An intranasal mass in a cow can theoretically be related to a chronic inflammatory process (for example, a foreign body reaction or granuloma) or neoplastic process (that is, ethmoidal adenocarcinoma of olfactory epithelium, fibrosarcoma, schwannoma or osteoma) (Radostits and others 2000). In the present case, the cytological and histopathological findings were supported by the S-100 immunopositivity and the ultrastructural findings to suggest a neoplastic process originating from peripheral nerves, that is, a malignant PNST or a malignant solitary schwannoma.

The histopathological Antoni type A and type B patterns

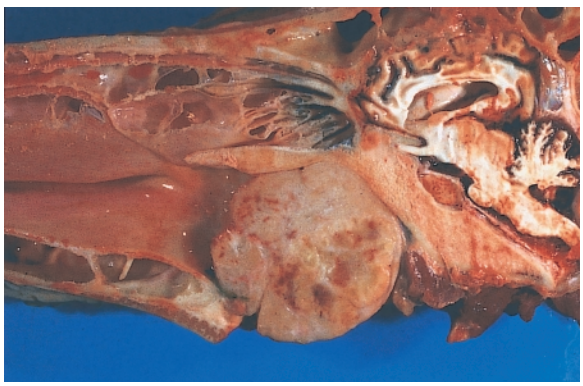

FIG 2: Nasopharynx of a Simmental cow showing the well-circumscribed mass, with numerous foci of necrosis alternating with multiple haemorrhagic areas occluding the nasopharyngeal opening

Veterinary Record (2005) **156,** 552-553

L. Mandrioli, DVM,
M. Morini, DVM,
G. Bettini, DVM,
P. S. Marcato, DVM,
Department of Veterinary Public Health and Animal Pathology, Pathological Anatomy Laboratory Service,
A. Gentile, DVM,
Department of Veterinary Clinical Sciences, Faculty of Veterinary Medicine,
Alma Mater Studiorum – University of Bologna,
Via Tolara di Sopra 50,
40064, Ozzano Emilia,
Bologna, Italy

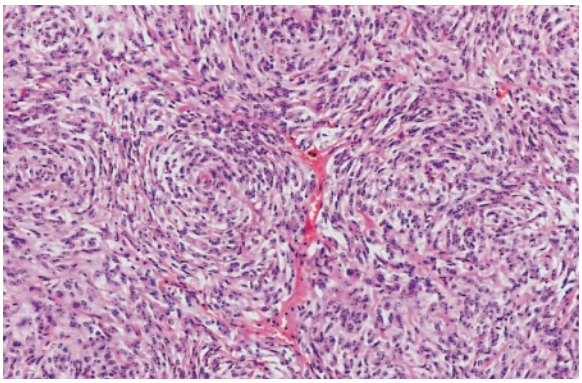

FIG 3: Histopathology of the tumour showing areas of densely packed spindle cells arranged in short interlacing bundles and whorls (Antoni type A). Haematoxylin and eosin. x **10**

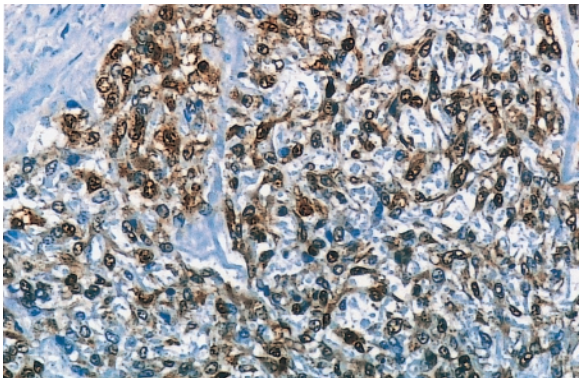

FIG 4: Strong S-100 protein immunoreactivity is shown in the cytoplasm and occasionally in the nucleus of neoplastic cells. x **20**

TABLE 1: Results and antibodies used for immunohistochemistry on the bovine schwannoma

Antibody specificity	Supplier	Dilution	Result
Vimentin*	Dako	1:40	+
S100†	Novocastra	1:40	+
Neuron-specific enolase*	CellMarque	1:50	–
Smooth muscle actin*	Dako	1:100	–
Desmin*	Dako	1:100	–
Wide-spectrum cytokeratin*	NeoMarkers	1:50	–
CD34*	NeoMarkers	1:50	–

* Monoclonal antibody
† Polyclonal antibody
+ Positive,– Negative

are a classic feature of schwannomas in animals and in human beings (Jubb and Huxtable 1993), and the positive immunohistochemical staining for S-100 protein is also an essential feature, suggesting the tumour originated in the Schwann cells (Tanimoto and Ohtsuki 1992). Ultrastructurally, Schwann cells exhibit a complete basal lamina, have a paucity of cytoplasmic organelles and intercellular junctions (Johnson and others 1988).

The histogenetic classification of PNSTs previously accepted in human and veterinary medicine is now controversial. In 1999, the World Health Organization Fascicle for the International Classification of Tumours of Domestic Animals proposed to simplify the classification scheme by grouping together benign and malignant schwannomas and neurofibromas, and using the terms benign PNST (BPNST) or malignant PNST (MPNST) (Koestner and others 1999). A further distinction between malignant schwannomas and MPNSTs has been recently proposed by Stoica and others (2001), mainly based on the immunohistochemical pattern. Malignant schwannomas, which are described grossly as not encapsulated, ulcerated, invasive neoplasms, are positive to S-100 protein and vimentin, while MPNSTs with the same macroscopic and histological features, show an immunohistochemical reaction limited to vimentin (Stoica and others 2001).

In the present case, the histopathological findings, the immunoreactivity to S-100 protein and the ultrastructural features strongly support the Schwann cell origin of the tumour and thus it should be referred to as a malignant schwannoma with an unusual anatomic location, based on the distinctions proposed by Stoica and others (2001).

References

BETTINI, G. & MARCATO, P. S. (1992) Primary hepatic tumours in cattle. A classification of 66 cases. *Journal of Comparative Pathology* **107,** 19-34

BUNDZA, A., DUKES, T. W. & STEAD, R. H. (1986) Peripheral nerve sheath neoplasms in Canadian slaughter cattle. *Canadian Veterinary Journal* **27,** 268-271

JOHNSON, R. C., ANDERSON, W. I., LUTHER, P. B. & RYAN, A. M. (1988) Multicentric schwannoma in a mature Holstein cow. *Veterinary Record* **123,** 649-650

JUBB, K. V. F., & HUXTABLE, C. R. (1993) The nervous system. In Pathology of Domestic Animals. Vol 1. 4th edn. Eds K. V. F. Jubb, P. C. Kennedy, N. C. Palmer. San Diego, Academic Press. pp 267-439

KOESTNER, A., BILZER, T., FATZER, R., SCHULMAN, F. Y., SUMMERS, B. A. & VAN WINKLE, T. J. (1999) Histological Classification of Tumours of the Nervous System of Domestic Animals. Second Series. Vol V. Washington, Armed Forces Institute of Pathology and the World Health Organization Collaborating Center

RADOSTITS, O. M., GAY, C. C., BLOOD, D. C. & HINCHCLIFF, K. W. (2000) Veterinary Medicine. 9th edn. London, W. B. Saunders

REBHUN, W. C., DELAHUNTA, A., BAUM, K. H., KING, J. & ROTH, L. (1984) Compressive neoplasms affecting the bovine spinal cord. *Compendium on Continuing Education for the Practicing Veterinarian* **6,** S396-S400

STOICA, G., TASCA, S. I. & KIM, H-T. (2001) Point mutation of *neu* oncogene in animal peripheral nerve sheath tumors. *Veterinary Pathology* **38,** 679-688

TANIMOTO, T. & OHTSUKI, Y. (1992) A solitary schwannoma in the cecum of a cow. *Veterinary Pathology* **29,** 81-83