PERIPHERAL NERVE SHEATH TUMOURS IN CATTLE

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Abstract

Samples of morbid bovine tissues obtained from slaughterhouse were submitted to histopathological examination. Neoplastic growth within the peripheral nerves was observed microscopically, with the presence of Antoni A and Antoni B patterns, and sporadically Verocay bodies. Additionally, immunohistochemical examination of the sections revealed positive reaction to vimentine, neuron specific enolase, protein S100, and glial fibrillary acidic protein. The results indicate that the examined neoplasms may belong to the type of benign peripheral nerve sheath tumours called schwannoma.

Key words: cattle, nerve sheath tumours, histopathology, immunohistochemistry.

Peripheral nerve sheath tumours (PNSTs) are a heterogeneous group of neoplasms originating from Schwann cells, modified Schwann cells, perineurial cells, or fibroblasts. They are most commonly found in mature animals and usually occur in certain cranial nerves, brachial plexus, or intercostal nerves. Autonomic nerves of the liver, heart, mediastinum, and thorax can also be affected (1, 2, 12-15, 20). Several authors, referring to well-classified nomenclature of human neoplasms, described these tumours as neurinomas, neurilemmomas, schwannomas, neurofibromas, and neurofibrosarcomas, depending on their presumed cell of origin (2, 13). In regard to the doubts as to straightforward classification of the lesions to one of above mentioned types, some researchers chose to use the term “peripheral nerve sheath tumours” instead.

Regarding domestic animals, the occurrence of PNSTs was reported mostly in the cattle, but also in dogs and, more rarely, in horses, pigs, and cats (1, 2, 5-7, 10, 19, 21, 22). In the cattle, the tumours were usually identified in older animals; however, their occurrence in young calves was also reported.

We failed to find in available literature any reports regarding PNSTs occurrence in animals in Poland, therefore this is probably the first report describing such cases in Polish slaughtered cattle. Typically, these changes are random findings during post-mortem inspection (1, 7, 13), although the literature provides examples of clinical symptoms caused by the pressure of tumour tissue on the nerves (12, 17).

In the present study, histomorphological features and immunohistochemical reactivity of different monoclonal and polyclonal antibodies of the peripheral nerve neoplasms were investigated.

Material and Methods

Tissue samples. The examined material consisted of the sections of pathological tissues and the lymph nodes originating from 15 slaughtered cows. The age of the cows varied between 7 and 13 years, with the exception of two of them being 3 and 5-year-old. The samples were collected during 6-year period and came from one slaughterhouse. Originally, the samples were taken with the purpose of bovine leukemia testing and subsequently for the recognition of another character of the lesions. Locations of the lesions from which the samples had been excised were known only in a few cases, and included intercostal muscles, tissues of axillary area, subcutaneous tissues of cervical and thoracic areas, and the basis of the heart.

Histopathology. For histopathological examination, the collected tissues were fixed in 10% buffered formalin and processed routinely to paraffin sections. The sections (5 µ) were stained with haematoxylin and eosin (HE).

Immunohistochemistry. Five-micron sections on poly L-lysine-coated glass slides were dewaxed in xylene and rehydrated in alcohols. Endogenous peroxidase activity was blocked by incubating the sections in 3% hydrogen peroxide in water for 10 min at room temperature. Four different primary antibodies: mouse monoclonal antibody against vimentin (VIM, dilution 1:100; Dako, Denmark), rabbit antiserum against S-100 (prediluted product; Biotrend, Germany), neuron-specific enolase (NSE, prediluted product; Biotrend, Germany), and glial fibrillary acidic protein (GFAP, dilution 1:500; Dako, Denmark) were used in the analysis (Table 1).
Table 1
Antibody source and dilution

<table>
<thead>
<tr>
<th>Antibody</th>
<th>Source</th>
<th>Dilution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monoclonal mouse anti-vimentin, clone V9</td>
<td>Dako Cytomation, Denmark</td>
<td>1:100</td>
</tr>
<tr>
<td>Polyclonal rabbit anti-S100</td>
<td>Biotrend, Germany</td>
<td>Prediluted</td>
</tr>
<tr>
<td>Polyclonal rabbit anti-neuron specific enolase</td>
<td>Biotrend, Germany</td>
<td>Prediluted</td>
</tr>
<tr>
<td>Polyclonal rabbit anti-glial fibrillary acidic protein</td>
<td>Dako Cytomation, Denmark</td>
<td>1:500</td>
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</table>

Table 2
Results of immunohistochemical staining of bovine peripheral nerve sheath tumours

<table>
<thead>
<tr>
<th>Antibodies</th>
<th>VIM</th>
<th>S100</th>
<th>NSE</th>
<th>GFAP</th>
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<tr>
<td></td>
<td>15/15</td>
<td>15/15</td>
<td>12/15</td>
<td>13/15</td>
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Results

The sections for anti-vimentin were boiled in 10 mM citrate buffer, pH 6, for 5 min. Slides for detection of S-100 protein and GFAP were treated with proteinase K (ready to use; Dako, Denmark) for 1.5 and 5 min. The primary antibodies, diluted in antibody diluent (Dako, USA), were incubated for 30 min at room temperature in a moist chamber. Staining was performed using an HRP/LSAB kit (Dako, Denmark). For visualisation, 3,3’-diaminobenzidine-4HCl (Vector, USA) was used. Sections were counterstained with Mayer’s haematoxylin, dehydrated, and mounted. Tissue sections of normal bovine nerve from the brachial plexus were used as a positive control. Negative controls consisted of tissue sections incubated with normal mouse or rabbit serum as primary antibodies.

Macroscopically, the changes occurred in the form of single or multiple, more or less extensive (mainly few centimetre wide) nodular or restiform thickenings protruding from surrounding tissues, and usually well separated. The tumours were mostly of a hard texture, with single areas of more soft and gelatinous consistency. Cross section areas varied between pale yellow and gray in colour, and usually were smooth and shining, sometimes bulging.

Histopathological examination of collected tissue samples showed no lesions typical for bovine leukosis. Instead, in all cases typical morphology of peripheral nerve sheath tumours was evident.

Microscopic examination frequently revealed two types of the changes, sometimes coexisting in tissue samples collected from one cow. Mostly dense, cellular areas composed of interlacing bundles and streams of monomorphic, usually spindle-shaped, or fusiform cells were observed. Proliferating cells with sharply delineated basophilic nuclei formed wave-like structures with prominent whorling and clefts (resembling Antoni A pattern) (Fig. 1). Sometimes small infiltrates of lymphocytes were visible. Occasionally, cells nuclei formed palisading structures (resembling Verocay bodies) (Fig. 2). In any case, however, no nerve fibers were observed within the tumour mass.

![Fig. 1. Antoni A pattern, HE, 100x.](image1)

![Fig. 2. Verocay body, HE, 400x.](image2)
The results of immunohistochemical staining are presented in Table 2. In all specimens, tumour cells showed strong expression of vimentin and protein S-100 (Fig. 5). Diffuse nucleocytoplasmic positive reaction for the presence of NSE was observed in 12 cases (Fig. 6). Among the other neuronal markers, focal expression of GFAP was found in 13 tumours (Fig. 7).

Discussion

The WHO classification for demands of veterinary medicine assumes the division of PNSTs to benign and malignant ones (9, 11). The group of benign tumours, histogenetically different, includes schwannoma and neurofibroma. In human medicine, most of peripheral nerve sheath tumours present features typical for either schwannoma or neurofibroma - the pathomorphological, immunohistochemical, and ultrastructural examinations allow a clear distinction between these two types (8, 16, 23). In animals, however, histopathological pattern of PNSTs is not always similar to the one observed in humans. Nevertheless, several authors claim that unlike the neoplasm of dogs, schwannoma of cattle and horses strongly resembles the human schwannoma (3, 4, 10, 21).

Histological pattern of the examined tumours confirms the observations made by other authors, regarding the type and appearance of the tumour tissue and their characteristic arrangement (1, 3, 13-15, 17, 20, 21). The presence of typical for human schwannoma Antoni A and Antoni B patterns in animal cases was described previously by many authors (3, 6, 8, 12-14,
Positive reaction to vimentin and to such neuronal markers as S-100, GFAP, or NSE was observed in majority of the cases. The intensity of the positive reaction to GFAP was observed mostly in benign PNSTs, both in humans and animals, whereas the markers were not expressed in malignant neoplasms (6, 12, 14).

Finally, the results of histopathological and immunohistochemical examinations allow for assuming that the investigated neoplasms belong to the benign type of PNSTs - schwannoma. Considering, that the samples were obtained from only one slaughterhouse, it is possible, that tumours of this type occur in the cattle more often in Poland.

References