A Case Report of Traumatic Neuroma of the Cervical Spinal Cord in a Dog

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ABSTRACT. Traumatic neuroma of the cervical spinal cord was diagnosed in a 14-year-old male mixed-breed dog. A gross view showed two intradural extramedullary masses, measuring 1 and 0.6 cm in length and 0.7 and 0.4 cm in diameter, attached to the left side of the spinal cord at the level of the sixth and seventh cervical vertebrae. Microscopically, the cervical spinal masses comprised interlacing fascicles of axons and Schwann cells surrounded by collagenous stroma. Immunohistochemically, the fascicles were stained positively for neurofilament and S-100 proteins. Ultrastructurally, variably sized myelinated fibers and onion bulb-like structures were observed. To our knowledge, this is the first report of a traumatic neuroma in the cervical spinal cord of a dog.

KEY WORDS: canine, cervical spinal cord, traumatic neuroma.

found between the spinal cord and mass. Mild infiltration of macrophages, giant cells, and lymphocytes was observed between the mass and leptomeninges of the spinal cord. Calcification was also observed in the leptomeninges within the masses. There was no invasion of spindle cells into the spinal cord. EVG staining showed the presence of intracellular and stromal collagen fibers in the masses. LFB-stained sections showed an abundance of dense, interlacing axonal clusters. The axons were surrounded by thin myelin sheaths that were thinner than those of an intact nerve on the right side (Figs. 5 and 6).

Immunohistochemically, spindle-shaped cells in the fascicles were positive for vimentin, S-100 (Fig. 7), and NF (Fig. 8) proteins but were negative for MBP and GFAP.

Ultrastructurally, variably sized myelinated fibers and swollen axons were observed (Fig. 9). Myelin thickness varied and was thinner than that in the right-side spinal fibers. Occasionally, onion bulb-like structures (Fig. 10) were found in the peripheral areas of the masses. These onion bulb-like structures comprised thinly myelinated and unmyelinated axons, Schwann cell processes, and collagen fibers.

Traumatic neuroma usually results from the traumatic interruption of peripheral nerves in which a large gap between the proximal and distal nerve stumps precludes effective axonal regeneration [13]. If the regeneration of the denervated axons is thwarted by some obstacle that prevents the proximal sprouting axons from finding the distal stump, the axons proliferate into a mass known as a traumatic neuroma.

Fig. 1. An enlarged image showing the left C6 and C7 segments on the ventral surface of the spinal cord. Bar=1 cm.

Fig. 2. Intradural extramedullary mass surrounded by connective tissue in a transverse section of the C7 segment of the spinal cord. Dura mater (large arrows) and pia mater (small arrows). EVG. Bar=0.1 cm.

Fig. 3. The lesions composed of variable sized fascicles and abundant fibrous stroma. HE. Bar=25 µm.

Fig. 4. Numerous single axons surrounded by Schwann cells are observed in the peripheral areas of a mass. HE. Bar=25 µm.

Figs. 5 and 6. Axons surrounded by thin myelin sheaths (Fig. 5) compared with those in an intact nerve on the right side (Fig. 6). LFB. Bars=20 µm.
Microscopically, the hallmark of traumatic neuroma is a haphazard arrangement of regenerating axons in a background of Schwann cells, perineural cells, and connective tissue elements. Compared with an intact nerve, the myelination of these axons is generally scant [1, 5, 6, 12, 14].

The histologically based differential diagnosis of the present lesion would include schwannoma because of the abundant Schwann cell component. Generally, schwannomas display the classic pattern of variability in cellularity between densely cellular Antoni A and loosely cellular Antoni B regions. Schwannomas are usually devoid of axons in the tumor cells [2, 9, 12]. These features support the diagnosis of present spinal cord lesions as traumatic neuromas rather than schwannomas.

In the present case, onion bulb-like structures were observed in the microfascicles of the peripheral areas of the masses. Onion bulb-like structures are concentric arrangements of several layers comprised of Schwann cell cytoplasm and myelinated and/or naked axons [10]. This structure can be observed in neumomas and in various hereditary and acquired neuropathies, including Charcot-Marie-Tooth disease [7], intraneural perineurioma [15], and demyelinating polyradiculoneuropathy [8]. These findings are considered as hypertrophic changes caused by repeated injury to peripheral nerves [10].

The cause of the traumatic neuroma in the cervical spinal cord was not identified in the present case. However, we conclude that a motor vehicle accident 10 years previously were probably associated with the formation of the traumatic neuromas because the dog showed intermittent neurological signs in the left forelimb after the accidents, the lesions were restricted to the left side of the spinal cord at the level of the sixth and seventh cervical vertebrae, and the pathological findings indicated that the lesions were chronic. Although rare human cases of traumatic neuromas in the spinal cord have been described [11, 14], to our knowledge, this is the first report of a traumatic neuroma in the cervical spinal cord of a dog.

ACKNOWLEDGMENT. This work was supported by a Grant for Research Fellow of the Japan Society for the Promotion of Science.
REFERENCES


