J. Comp. Path. 2018, Vol. 158, 12–16

Available online at www.sciencedirect.com

ScienceDirect

ELSEVIER

www.elsevier.com/locate/jcpa

NEOPLASTIC DISEASE

Multifocal Spinal Cord Nephroblastoma in a Dog

L. C. Henker*, R. M. Bianchi*, T. P. Vargas*, E. C. de Oliveira†, D. Driemeier* and S. P. Pavarini*

** Department of Veterinary Pathology, Universidade Federal do Rio Grande do Sul, Av. Bento Gonçalves, 9090 Pr. 42505, Porto Alegre and † Universidade de Caxias do Sul, Rua Francisco Getúlio Vargas, 1130, Caxias do Sul, Brazil*

Summary

A 1-year-old male American pit bull terrier was presented with a history of proprioceptive deficits and mild lameness of the right hindlimb, which progressed after 5 months to paraparesis, culminating in tetraparesis after 2 weeks. Necropsy findings were limited to the spinal cord and consisted of multiple, intradural, extramedullary, slightly red masses which produced segmental areas of medullary swelling located in the cervical intumescence, thoracolumbar column, sacral segment and cauda equina. Histological evaluation revealed a tumour, composed of epithelial, stromal and blastemal cells, with structures resembling tubules, acini and embryonic glomeruli. Immunohistochemical labelling for vimentin, cytokeratin and S100 was positive for the stromal, epithelial and blastemal cells, respectively. A final diagnosis of multifocal spinal cord nephroblastoma was established. This is the first report of such a tumour showing concomitant involvement of the cervicothoracic, thoracolumbar, sacral and cauda equina areas of the spinal cord.

Keywords: dog; immunohistochemistry; spinal cord; Wilms tumour

Ectopic nephroblastoma of the spinal cord in the dog is a well recognized entity (Higgins *et al.*, 2016), which usually occurs between the 10th thoracic and 3rd lumbar spinal cord segments, generally presenting as an intradural–extramedullary solitary mass (Summers *et al.*, 1988; Brewer *et al.*, 2011). In the past, spinal cord nephroblastomas were mistakenly diagnosed as ependymomas, medulloepitheliomas or neuroepitheliomas (Summers *et al.*, 1988). The first report of ectopic nephroblastoma was published in 1984 (Bridges *et al.*, 1984). A subsequent case series corroborated this hypothesis (Summers *et al.*, 1988), followed by immunohistochemical confirmation of its origin, which was achieved using the *WT1* gene product, replacing earlier nomenclature (Pearson *et al.*, 1997).

It is believed that the spinal cord nephroblastoma originates from ectopic metanephric blastemal remnants trapped between the dura mater and the spinal cord during embryogenesis, which undergo neoplastic transformation (Higgins *et al.*, 2016). This tumour usually affects young dogs (Liebel *et al.*, 2011), mostly between 5 months and 4 years of age (Brewer *et al.*, 2011). The condition has been reported in small and large sized-breeds and no sex predisposition is known (Nakade *et al.*, 2006; Brewer *et al.*, 2011). There is only one report of multifocal spinal cord nephroblastoma in which metastasis was suspected, but not confirmed histologically (Terrell *et al.*, 2000).

A 1-year-old male American pit bull terrier was presented with a history of proprioceptive deficits and mild lameness of the right hindlimb, which progressed after 5 months to paraparesis. Clinical evaluation revealed poor body condition, apathy, a normal level of consciousness and paresis of the hindlimbs leading to permanent sternal decubitus. Blood analysis did not show any abnormality in complete blood count or in the concentrations of serum urea, creatinine, aspartate transaminase or alanine transaminase.

Correspondence to: L. C. Henker (e-mail: henkerluan@hotmail.com).

0021-9975/$ - see front matter
https://doi.org/10.1016/j.jcpa.2017.10.176

Due to the owner's financial situation, imaging examination was not performed. Palliative treatment was given with glucocorticoids and ampicillin; however, neurological deficits worsened and after 2 weeks complete tetraparesis developed. Due to the poor prognosis, the dog was humanely destroyed and submitted for necropsy examination.

The main gross lesions were restricted to the spinal cord and consisted of multiple intradural and extramedullary, slightly red masses, which produced segmental areas of medullary swelling (Fig. 1). One of these masses was located between the 10th thoracic and the 2nd lumbar spinal cord segments (T10–L2) and measured 3 cm in length. On the cut surface, the mass was soft, pale to tan in colour, with an homogeneous appearance; it compressed approximately 75% of the spinal cord parenchyma. A second swelling was noted in the cervical intumescence, between the 5th cervical and the 1st thoracic spinal segments (C5–T1). This segment included four similar masses, which ranged from 0.5 to 1.5 cm in diameter. Additionally, similar multiple masses ranging from 0.5 cm to 1.5 cm in diameter were observed in the sacral segment and in the cauda equina, frequently compressing nerve roots. The urinary bladder was markedly distended, but the remaining organs did not show any gross changes.

The brain, spinal cord and samples of lungs, heart, spleen, liver, kidneys, intestines, stomach, urinary bladder, adrenal gland, thyroid and skeletal muscle as well as mesenteric, superficial cervical and popliteal lymph nodes were collected and fixed in 10% neutral buffered formalin. Tissues were processed routinely and embedded in paraffin wax. Sections (3–5 μm) were stained by haematoxylin and eosin (HE). Sections including the cervicothoracic, thoracolumbar, sacral and cauda equina masses were submitted for immunohistochemistry (IHC) using reagents specific for vimentin (1 in 200 dilution; Zymed, Carlsbad, California, USA), S100 (1 in 200 dilution; Dako, Carpinteria, California, USA), cytokeratin (1 in 80 dilution; AE1/AE3, Dako), glial fibrillary acidic protein (GFAP; 1 in 500 dilution, Dako), neurofilament (1 in 500 dilution, AbD Serotec, Raleigh, North Carolina, USA), WT1 (Wilms tumour 1; 1 in 400 dilution, Menarini Diagnostics, Firenzi, Italy) and von Willebrand factor (1 in 200 dilution; Dako). Amplification was performed by using the LSAB-HRP Universal kit (Dako) and labelling was 'visualized' with 3,3′-diaminobenzidine (DAB; Sigma, St. Louis, Missouri, USA). Sections were counterstained with Mayer's haematoxylin.

Microscopically, the thoracolumbar and cervicothoracic masses were characterized as intradural, extramedullary, expansile and non-encapsulated neoplastic proliferations composed of a disorganized mixture of epithelial, stromal and mesenchymal blastemal cells, frequently invading and occupying a significant portion of the medullary parenchyma (Fig. 2). The sacral spinal cord and cauda equina had multiple similar neoplastic proliferations, which did not show any medullary invasion; however, in these areas, nerve root fibres were dissected and separated by neoplastic cells. In all masses, the solid component of the tumour was arranged in amorphous sheets, characterized by oval to polygonal cells, with scant cytoplasm, indistinct cell borders, single nuclei, finely granular chromatin and less prominent nucleoli. The epithelial population consisted of cells arranged in tubules and acini lined by an irregular columnar to pseudostratified epithelium; furthermore, epithelial cells frequently formed glomerulus-

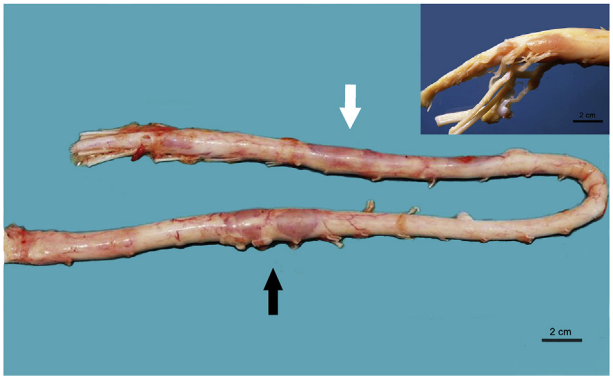

Fig. 1. Spinal cord nephroblastoma. Slightly red areas of medullary swelling are observed in the thoracolumbar segment (white arrow) and cervical intumescence (black arrow). Bar, 2 cm. Inset: mass in the cauda equina. Bar, 2 cm.

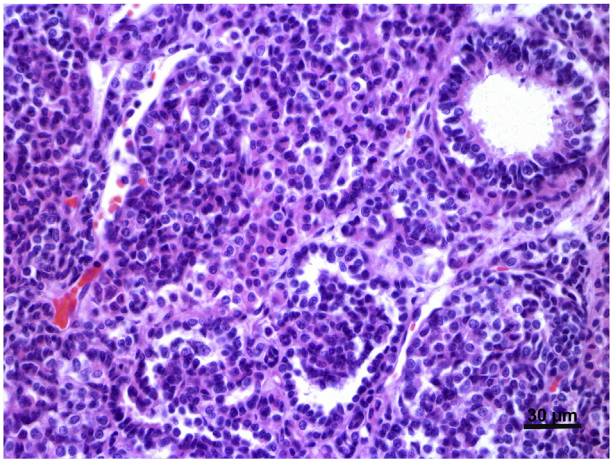

Fig. 2. Microscopical appearance of the tumour showing two neoplastic cell populations: blastemal cells and epithelial cells arranged in tubules and glomerulus-like structures. HE. Bar, 30 μm.