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Diagnosis and therapeutic management of spinal nerve root tumors: case report

[*Diagnóstico e manejo terapêutico de tumores radiculares do nervo espinhal – relato de caso*]

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ABSTRACT

Spinal nerve root tumors are a group of neoplasms with a low incidence in the canine population. Clinical and paraclinical examinations can be difficult because the symptoms are non-specific, with a chronic and progressive course. The aim of the study was to describe the diagnostic and treatment protocol in three geriatric patients with spinal nerve root tumors. Paraclinical examinations were routine blood tests and imaging investigations: radiography, ultrasonography, and computed tomography of the spinal segment of interest. Magnetic resonance imaging and surgery were declined in all three cases, the owners opting for drug management or euthanasia.

Keywords: dog, spinal nerve root tumors, computed tomography, therapeutic management

RESUMO

Os tumores da raiz do nervo espinhal são um grupo de neoplasias com uma baixa incidência na população canina. Os exames clínicos e paraclínicos podem ser difíceis porque os sintomas não são específicos, com um curso crônico e progressivo. O objetivo do estudo foi descrever o protocolo de diagnóstico e tratamento em três pacientes geriátricos com tumores da raiz do nervo espinhal. Os exames paraclínicos foram exames de sangue de rotina e investigações de imagem: radiografia, ultra-sonografia e tomografia computadorizada do segmento espinhal de interesse. A ressonância magnética e a cirurgia foram recusadas nos três casos, optando os proprietários pelo manejo de medicamentos ou eutanásia.

Palavras-chave: cão, tumores da raiz do nervo espinhal, tomografia computadorizada, manejo terapêutico

INTRODUCTION

Spinal tumor processes are structural formations located in the spinal cord, meningeal sheet, peripheral nerve roots or paraspinal tissue (e.g. ligaments, vertebral body). They can be classified as primary, originating in the medullary meninges and paraspinal tissue, and secondary, i.e. metastasizing to other tissue. Depending on the anatomical site, spinal tumor processes can be classified in correlation with adjacent structures of the spinal cord (Koestner and Higgins, 2017).

Advanced imaging methods such as magnetic resonance imaging (MRI) provide higher resolution in terms of topography of neoplastic masses in the spinal cord (extradural, intradural-extramedullary, or intramedullary). Extradural tumors are the most common forms of neoplastic development in pets (dog, cat), including osteosarcoma, fibrosarcoma, chondrosarcoma, hemangiosarcoma, myeloma, liposarcoma, lymphosarcoma. Extramedullary intradural tumors include meningioma (with increased incidence in the cervical and lumbar regions), medullary blastoma, neuroepithelioma, and peripheral neoplastic processes of nerve roots.

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Intradural intramedullary tumors are represented by astrocytoma, oligodendroglioma and neuroblastoma, the cellular origin being the spinal cord parenchyma (Brehm *et al*., 1995).

Medical management of spinal neoplastic pathologies includes surgery, chemotherapy, and radiotherapy. Factors influencing patient prognosis are tumor type, degree of neoplastic infiltration in the spinal cord parenchyma, local pre- and post-operative lesions, and the type of tumor resection chosen (Van Stee *et al*., 2017). The aim of this study is to describe the clinical and paraclinical diagnostic protocol and therapeutic management of three patients with spinal nerve root tumors.

MATERIALS AND METHODS

The study was conducted retrospectively using data from the electronic archive of the Veterinary Hospital for Pet Animals, Faculty of Veterinary Medicine Iasi. Canine patients were selected regardless of age, sex, or breed, diagnosed with tumor process or suspected tumor process of the spinal roots of the spinal nerves, registered between October 2021 and October 2022.

Inclusion criteria were clinical presentation characterized by gradual onset of paresis (mono/para/tetra), chronic progressive course, hyperalgesia on paravertebral palpation, muscle weakness.

In each patient, data obtained from the general physical examination, neurological examination, routine blood tests (CBC - VetScan HM5 Haematology Analyser, Abaxis UK; biochemestry - VetScan VS2 Chemistry Analyzer, Abaxis, UK, and Abaxis VetScan VS2 Comprehensive Rotors) were analyzed, radiological examination of the thorax for the exclusion of pulmonary metastases (Neologis Maxivet 400 HF, Italy 2020) and spine of the region of interest, ultrasound examination of the abdomen (General Electric, Logiq V5Expert, Wuxi China 2017), and advanced imaging examination - contrast-enhanced computed tomography (General Electric Lightspeed 16, GE Medical Systems, Milwaukee Wisconsin). Patients with cranial nerve deficits and orthopedic or musculoskeletal pathologies were excluded from the study.

RESULTS

Following analysis of the data, three dogs met the criteria for inclusion in the study. The patients were Labrador (2/3) and crossbreeds (1/3), 2 males and 1 female, with an average age of 144±12 months, and a weight of 24±6kg.

Case 1. Canine patient, male, Labrador, 11 years old, with a history of muscle weakness and hyperalgesia in the right forelimb for about 6 months. Concomitant with the progression of monoparesis, the owners noted hyperalgesia in the cervicothoracic region refractory to nonsteroidal anti-inflammatory drugs. Subsequently, the patient developed a decubital ulcer on that limb.

Neurological examination revealed monoplegia and hyperalgesia for the right forelimb, i.e., lack of conscious and unconscious proprioception and hyporeflexia, with preservation of pain sensitivity. Additionally, the patient presented hyperalgesia on paravertebral spinal cord palpation on the cervicothoracic segment. Cranial nerve examination as well as behavior showed no changes.

Routine blood tests (haemoleucogram, biochemical profile, C-reactive protein dosage) were within physiological limits.

Radiological examination for C1-C5 and C6-T2 segments (Fig. 1) in lateral-lateral incidence did not identify any changes in bone structure, alignment and intervertebral spacing were unchanged (Figure 1).
For the two segments, computed tomography (CT) examination revealed an ovoid, well-demarcated, uniformly iodophilic, 1.6x1 cm diameter mass located intramedullary caudal to the C5 vertebra and an amorphous, iodophilic intradural and extramedullary mass along the unilateral (right) C5-C6 nerve root pathway, C5-C6 supravertebral foramen and continued dorsally on the articular apophysis. Structural lesions were consistent with the diagnosis of neoplastic radicular process (Figure 2, Figure 3).

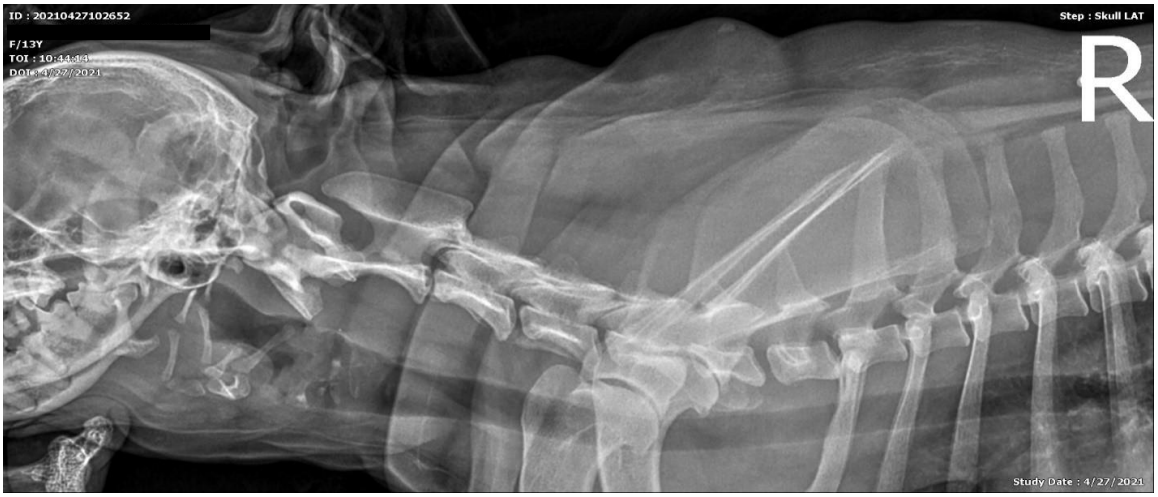

Figure 1. Radiography right LL exposure cervical+ cervico-thoracic spinal segment.

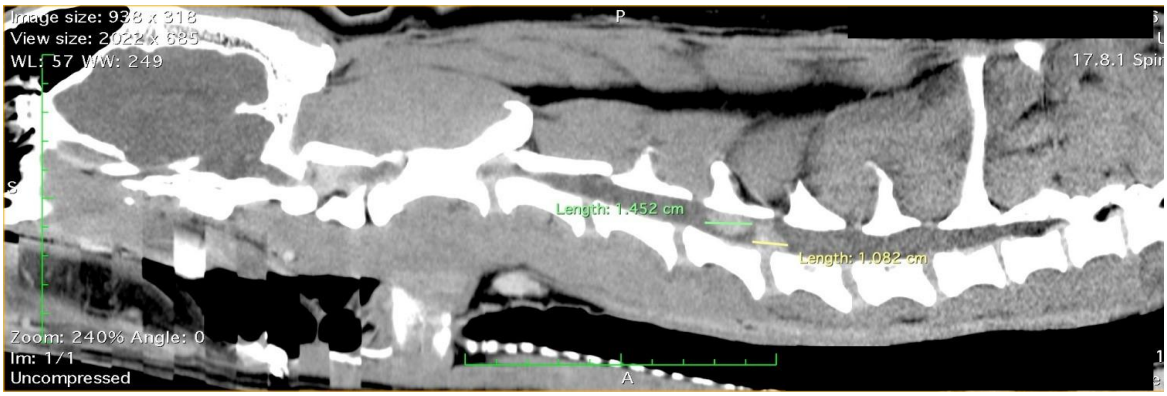

Figure 2. Sagittal CT image- structure with a neoformation character at the medullary level of the C5-C6 segment (green and yellow lines).

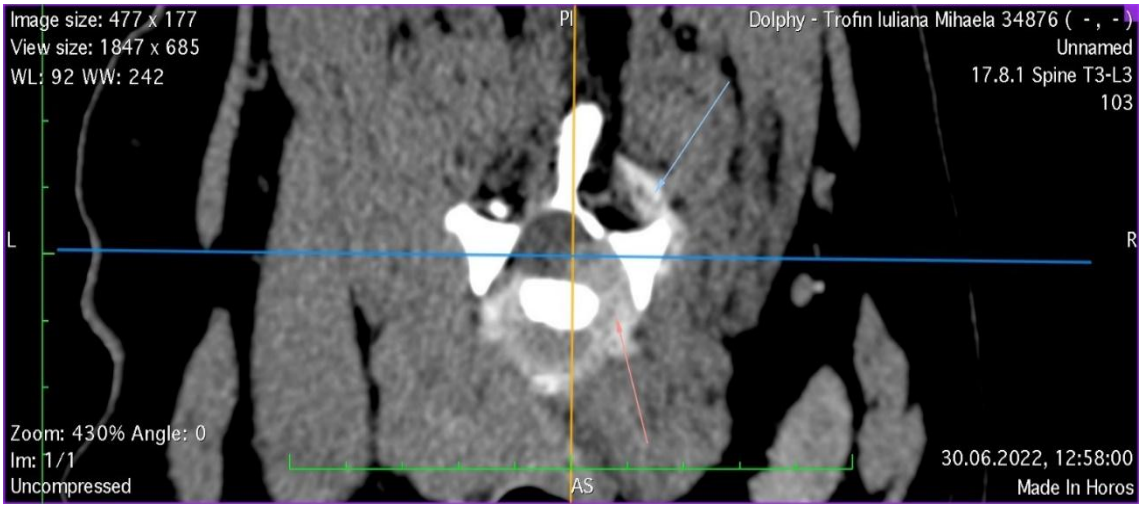

Figure 3 Transverse CT image- structure with neoformation character with invasion of the right side at C5-C6 level (arrows).

The therapeutic protocol in this patient was neuropathic analgesia (gabapentin) and steroidal anti-inflammatory drugs (prednisone) as well as gastric protectants (pantoprazole).

Case 2. A 12-year-old male Labrador canine patient with a history of locomotor dysfunction on the hindlimb, accentuated on the right hindlimb, undergoing 7 days of therapy with non-steroidal anti-inflammatory drugs without favorable results. The evolution of symptoms was chronic and progressive.

Neurological examination reported: flaccid paraparesis with inability to support the posterior train in gait and stance, accompanied by proprioceptive deficits and spinal hyporeflexia, but with preservation of pain sensitivity.

Computed tomographic examination was performed for the spinal segment of interest, i.e., the lumbosacral segment (L4-S3). Thus, an amorphous mass was identified, well defined, peripheral contrast uptake, located at the level of the medullary canal of the vertebrae L6, L7, S1; continued at the level of the supravertebral holes that structurally modified by an abnormal widening, accompanied by bone tissue atrophy and compression, up to the right of the spinous processes (Figure 4). The imaging description correlated with the diagnosis of neoplastic nerve root process with spinal canal invasion (Figure 5).

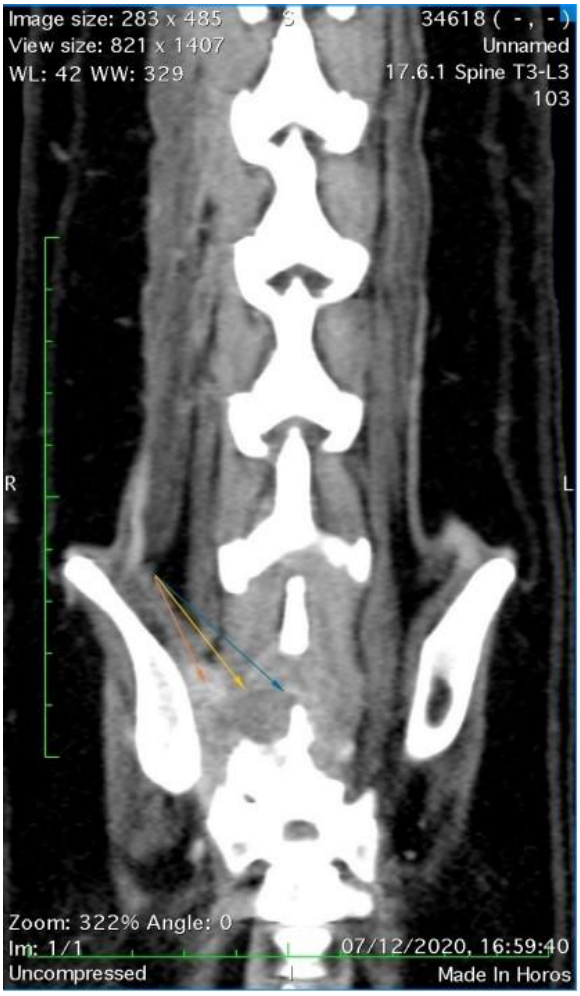

Figure 4. Coronal CT image, mass-light lesion, at L6-L7 level (arrows).

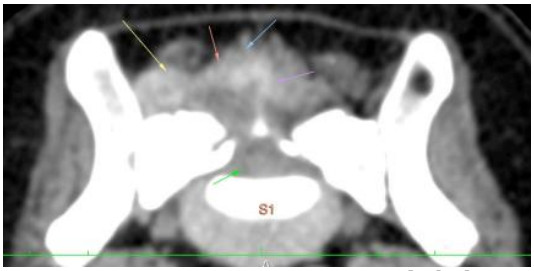

Figure 5. Transverse CT image mass-light lesion invasive to the right at S1 level (arrows).

The patient followed a therapeutic protocol based on neuropathic analgesia (gabapentin) and steroidal anti-inflammatory drugs (prednisone).

Case 3. Female canine patient, crossbreed, 13 years old, presented with a history of anterior train instability, which started in the right forelimb, with bilateral progression over a period of approximately 3 months. By the time of presentation, non-steroidal anti-inflammatory medication was initiated for a period of 7 days, with no clinical improvement.

Neurological examination revealed: ambulatory stage, proprioception deficits on all limbs, reflectivity present and unchanged, generalized hypertonus, and a hyperalgesia focus on paravertebral palpation of the cervical segment, accompanied by cervical dread on head manipulation.

Paraclinical examinations (haemoleucogram, blood biochemistry profile, C-reactive protein dosage) showed no changes of clinical significance.

Radiological examination of the cervical segment revealed changes in vertebral spacing, together with deviation of the longitudinal axis (Figure 6).

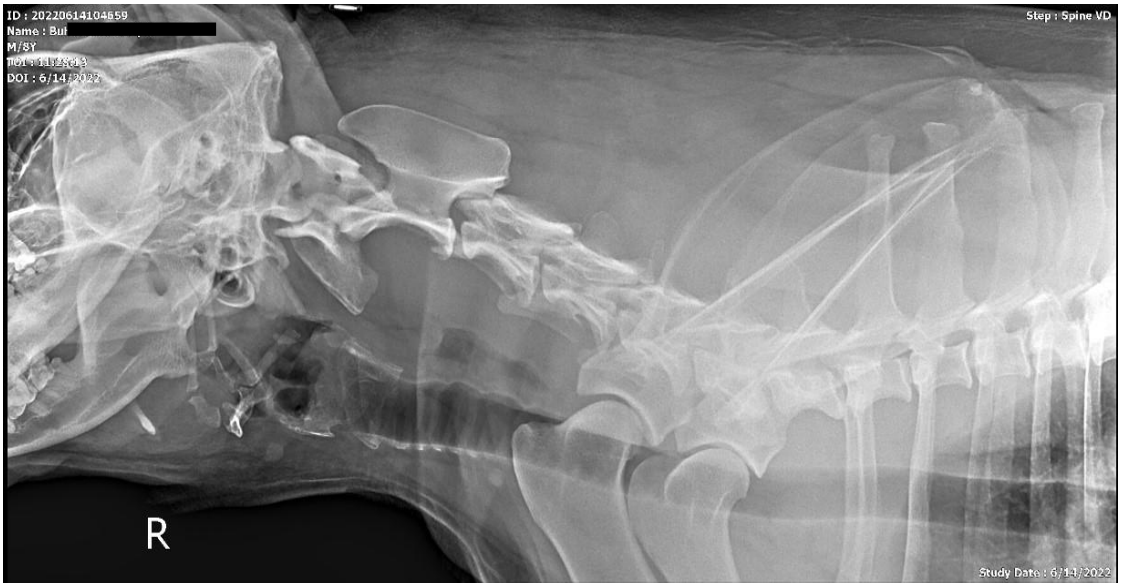

Figure 6. Radiography right LL exposure cervical+ cervico-thoracic spinal segment

Advanced imaging, i.e., computer tomography (CT) revealed the presence of an amorphous, intradural-extramedullary, ovoid, 10x7 mm, uniform contrast uptake, located at the right lateral C2 vertebral medullary canal, with extension into the right C1-C2 supravertebral foramen, and cord-like formation leaving the medullary canal (Figure 7). The C1-C2 supravertebral foramen had a widened and asymmetrical appearance compared to the left side. Imaging appearance compatible with spinal nerve root tumor with spinal canal invasion (Figure 8).

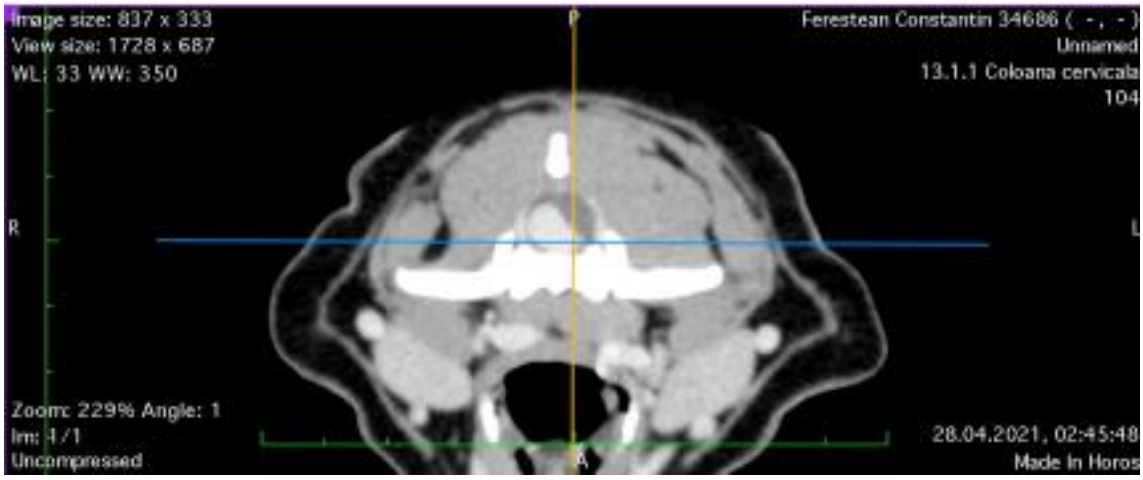

Figure 7. Axial CT image invasive lesion at the level of intramedullary canal with the appearance of a mass on the C2 segment;

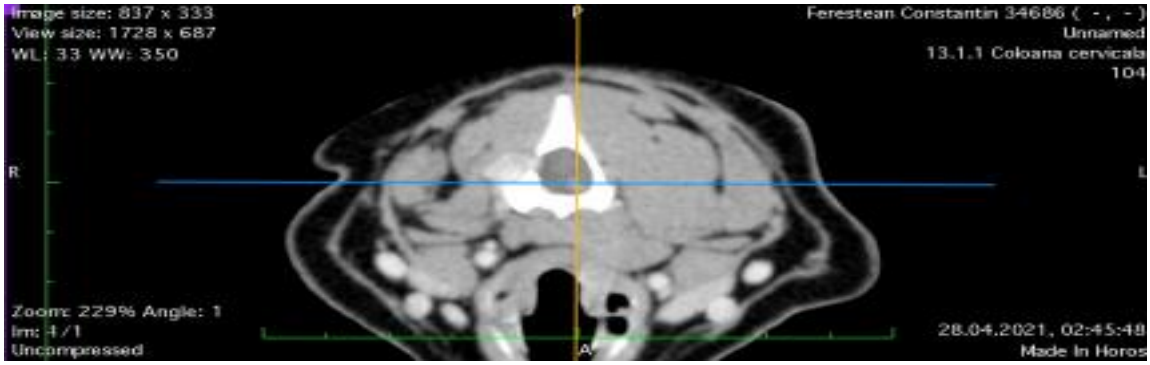

Figure 8. Axial CT image invasive mass-like lesion leaving the medullary canal to the right side through the supravertebral foramen on the C1-C2 segment.

In this case, the site of onset was the cervical spinal cord, with subsequent invasion of the right peripheral nerve root. Following corroboration of imaging data and those described in the literature, the major suspicion was meningioma (Huisinga *et al.*, 2008; Zaki *et al.*, 1975).

Regarding the therapeutic protocol, it was proposed to initiate therapy with analgesics and non-steroidal anti-inflammatory drugs. This was declined by the owners, who opted to euthanize the patient.

For 2/3 of the patients, the owners agreed to initiate therapy with analgesics and steroidal anti-inflammatory drugs for a period of 3 months. Initially, the general status as well as the locomotor capacity had a favorable evolution for about 50-60 days. Subsequently, both patients showed rapid deterioration of neurological status and the owners opted for euthanasia.

In patient number 3 the owners declined to initiate drug therapy and requested euthanasia of the patient, because of the occurrence of urinary tract infection and persistent bladder spasticity (urinary retention) responsible for chronic pain and worsening quality of life (Pegram *et al*., 2021).

DISCUSSIONS

Spinal tumors, of the peripheral nerve roots, originate from Schwann cells (schwanomas), fibroblasts (neurofibromas) or neural cells. This category of neoplasms is evolutionarily classified as benign or malignant, the differentiation consisting of histopathological features and invasiveness (Koestner and Higgins, 2017). According to the literature, malignancy is rare, with sporadic reports of metastasis in dogs. The cervicothoracic and lumbosacral regions are the spinal segments of choice.

Patients included in the study presented neoplastic nerve root formations of peripheral nerves with unilateral spinal canal invasion in the cervicothoracic and lumbosacral regions. The average survival time in dogs with such pathologies, calculated from the time of diagnosis, is between 5 and 12 months (Brehm *et al*., 1995). In terms of therapeutic protocol, the main recommendation is surgery, i.e. tumor ablation. However, recurrence or metastasis may occur at 7-10 months post-surgery, predominantly because of tumor residue (Van Stee *et al*., 2017). A promising alternative to surgery is stereotactic radiotherapy (Dolera *et al*., 2016).

In the cases described above, the therapeutic protocol was based on the administration of corticosteroids (prednisone) with an initiation dose of 1 mg/kg/24h for 72 hours, thereafter the maintenance dose was tapered over 21 days to 0/5mg/kg/24h. This therapeutic approach is intended to improve quality of life as it does not favor stagnation of tumor progression (Jose-Lopez *et al*., 2013).

CONCLUSIONS

In the three cases described, geriatric canine patients presented a chronic, progressive evolution of symptoms, with the appearance of proprioception deficits, localized hyperalgesia,

and a certain degree of paresis, radiologically compatible with the diagnosis of peripheral nerve tumor. Taking into account the limitations of this study (computer tomography instead of magnetic resonance imaging, absence of cytological examination of the cerebrospinal fluid), in the case of the 3 patients, the metastasis of neoplastic processes located at the cervicothoracic and lumbosacral level can be taken into account, an aspect that has a major influence on the patient's management i.e. the choice of initiating corticosteroid medication with a delay in surgery.

REFERENCES

BREHM, D.M.; VITE, C.H.; STEINBERG, H.S. *et al*. A retrospective evaluation of 51 cases of peripheral nerve sheath tumours in the dog. *J. Am. Anim. Hosp. Assoc.*, v.31, p.349-359, 1995.

DOLERA, M.; MALFASSI, L.; BIANCHI, C. *et al*. Frameless stereotactic volumetric modulated arc radiotherapy of brachial plexus tumours in dogs: 10 cases. *Br. J. Radiol.*, v.90, p.1069, 2016.

HUISINGA, M.; HENRICH, M.; FRESE, K. *et al*. Extraventricular neurocytoma of the spinal cord in a dog. *Vet Pathol*., v.45, p.63-66, 2008.

JOSÉ-LÓPEZ, R.; DE LA FUENTE, C.; PUMAROLA, M.; AÑOR, S. Spinal meningiomas in dogs: description of 8 cases including a novel radiological and histopathological presentation. *Can. Vet. J*., v.54, p.948-954, 2013.

KOESTNER, A.; HIGGINS, R.J. Tumors of the nervous system. In: MEUTEN D.J. (Ed). *Tumors of domestic animals*. 5ed. Ames, IA: Wiley Blackwell, 2017. p.842-891.

PEGRAM, C.; GRAY, C.; PACKER, R.M.A. *et al*. Proportion and risk factors for death by euthanasia in dogs in the UK. *Sci. Rep.*, v.11, p.9145, 2021.

VAN STEE, L.; BOSTON, S.; TESKE, E.; MEIJ, B. Compartmental resection of peripheral nerve tumours with limb preservation in 16 dogs (1995–2011). *Vet. J*., v.226, p.40-45, 2017.

ZAKI F.A.; PRATA ,R.G.; HURVITZ, A.I.; KAY, W.J. *et al*. Primary tumors of the spinal cord and meninges in six dogs. *J. Am. Vet. Med. Assoc.*, v.166, p.511-517, 1975.