



NOTE

Internal Medicine

Two cases of acute polyradiculoneuritis in dogs consuming a raw poultry diet

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ABSTRACT. A 9-year-old female mixed-breed dog presented with ascending flaccid tetraparesis, and a 5-year-old castrated male Poodle dog presented with ventroflexion of neck, dysphonia, and hindlimb weakness, which progressed to acute ascending tetraparesis. Both dogs were fed raw poultry for over 9 and 5 years, respectively. Blood examination and other test results were normal or unrelated to the present case. Fecal polymerase chain reaction analysis in the Poodle dog was positive for *Clostridium perfringens* and *Campylobacter jejuni*. Tetraparesis improved with supportive care in both dogs. Human IV immunoglobulin was only administered to the Poodle dog, which showed a shorter recovery (12 days compared to 34 days in the mixed-breed dog). Both dogs returned to normal conditions eventually.

KEY WORDS: acute polyradiculoneuritis, ascending low motor neuron tetraparesis, *Campylobacter*, Guillain-Barré syndrome, human intravenous immunoglobulin

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Acute canine polyradiculoneuritis (APN) is the only acute-onset polyneuropathy commonly diagnosed in dogs. This disorder was first recognized in dogs that were in contact with a raccoon approximately 7–10 days before the onset of symptoms, and was originally termed “coonhound paralysis”. It shows characteristics of lymphocytic radiculitis, and the ventral, or less commonly, dorsal nerve roots become demyelinated [8]. Dogs affected by APN are often unable to lift their heads, have vocal changes, and some react hyperesthetically to pressure on the distal limbs. The respiratory muscles may also be affected in severe cases [6]. Over the first few days, clinical signs typically progress rapidly, although progression may continue for up to 10 days. Identical signs have been recognized in animals with no exposure to raccoon saliva, although other precipitating causes, such as vaccination or infection, may be identified in these cases. However, the triggers of this disorder remain largely unknown [8].

APN has very similar clinical and histological features to human Guillain-Barré syndrome (GBS) [4]. Approximately two-thirds of patients with GBS show symptoms of infection within 3 weeks prior to the weakness onset, and most studies mention preceding symptoms of an upper respiratory tract or gastrointestinal tract infection. The most commonly identified cause of infection is *Campylobacter jejuni*, but other types of microorganisms have also been related to GBS (i.e., *Cytomegalovirus*, *Epstein-Barr virus*, *Mycoplasma pneumoniae*, and *Haemophilus influenza*) [1].

The diagnosis of APN is based on historical, clinical, and neurological findings. The most important and challenging aspect for diagnosing this disease is ruling out other neuromuscular joint disorders that cause acute lower motor neuron tetraparesis (e.g., tick paralysis, botulism, or acute fulminating myasthenia gravis). Electromyography (EMG) can be used to differentiate APN from other low motor neuron disorders, and lumbar cerebrospinal fluid (CSF) analysis in APN patients commonly reveals a normal cell count with increased CSF protein levels, especially at 7 days or more after the appearance of clinical symptoms. Nerve biopsy can be performed for a definitive diagnosis, but this is rarely necessary [8].

Therapy mainly relies on supportive care, and most clinical signs improve with sufficient time. However, the recovery times vary, and it can take a few weeks to up to 6 months in rare cases [4]. A recent study suggested that administration of human intravenous immunoglobulin might reduce the recovery time in dogs with APN [6].

A 9-year-old female mixed-breed dog presented with ascending flaccid tetraparesis (Fig. 1A). Clinical signs had deteriorated for 9 days and began with reluctance to step upstairs. At 6 days before the visit, ascending tetraparesis rapidly progressed to hindlimb paresis (in the morning) and forelimb paresis (at night, on the same day). Traumatic events were not identified. The owner had been feeding the patient a mixture of dry dog food (one-third) and raw duck meat (two-thirds) for over 9 years. The dog stayed outdoors during daytime and indoors during nighttime. The vital signs of the patient were within the normal reference range; however, muscle atrophy of the four limbs was identified. Although the patient was willing to move by itself, it was unable to

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Fig. 1. Tetraparesis and weight support on day 0 (A); tetraparesis on day 19 (B) (Case 1). Ventroflexion of the neck without tetraparesis on day 0 (C); acute tetraparesis on day 5 (D) (Case 2).

walk without support. Neurologic examination showed low motor neuron (LMN) tetraparesis with severely decreased spinal reflex responses and mildly decreased sensory response. Postural reaction was not evaluated because of the severe LMN tetraparesis. The mental status, cranial nerves, and tail movement were intact. Serum examination showed mildly increased levels of aspartate aminotransferase (46 U/l; reference interval [RI]: 15–43 U/l), alanine aminotransferase (90 U/l; RI: 19–70 U/l), and gamma-glutamyl transferase (7 U/l; RI: 0–6 U/l), and moderately increased levels of creatinine kinase (692 mg/dl; RI: 46–320 mg/dl). On radiological examination, cervical, thoracic, and abdominal views did not show abnormal features. Magnetic resonance imaging (MRI) showed mild intervertebral disc bulging in the C-spine 2–3, L-spine 1–2, and L-spine 2–3 (Fig. 2A, 2B). The bulging disc lesions were not severe, and they were determined not to directly correlate with the symptoms. In the CSF analysis, the total nucleated cell count was within the reference range, but elevated protein levels (2+, >100 mg/dl) were identified, with a urine dipstick test negative for blood. Bacterial culture and neurological polymerase chain reaction (PCR) tests to identify viral or protozoal infection yielded negative results for *Bartonella*, *Blastomyces*, *Coccidioides* spp, *Cryptococcus*, *Histoplasma capsulatum*, *Distemper virus*, *West Nile virus*, *Borrelia burgdorferi*, *Neospora* spp., and *Toxoplasma gondii*. The patient was tentatively diagnosed with APN because of clinical signs of acute ascending tetraparesis, greatly reduced spinal reflex with mildly decreased sensory response, and negative results for possible causes of neuromuscular junctional diseases. The dog was hospitalized for 3 days with respiratory monitoring. During hospitalization, the dog did not show respiratory distress. After discharge, supportive care at home was provided together with antibiotic therapy, vitamin B complex and vitamin C supplementation, and diet changes. Immunoglobulin treatment was recommended, but the owner declined because of the increased cost. The clinical signs improved during the following 2 weeks, and while the dog had not fully recovered, it was willing to move (Fig. 1B). On day 34 since the initial visit (43 days from the appearance of clinical signs), all clinical signs had improved, and the patient showed normal gait.

A 5-year-old castrated male miniature Poodle dog presented with ventroflexion of the neck, hindlimb weakness, and dysphonia (Fig. 1C). Intermittent hesitation to walk had worsened over 5 days. The dog had been treated with dexamethasone in a primary care animal hospital. The patient was referred to our hospital because of deterioration of clinical signs 3 days after the initial visit. The patient was fed raw meat, including raw duck, chicken, goat, and kangaroo meat, for over 5 years. The vital signs were within the normal range and the dog had normal urinary and bowel function in relation to its weight. The patient was alert, but bilateral hindlimb muscle atrophy was observed. Normal gait with intermittent hesitation while walking was observed. The neurological examination results were normal on the first visit. At 3 days after the initial visit to the hospital, tetraparesis was identified. Hindlimb weakness had evolved to the forelimbs and progressed to a non-ambulatory flaccid tetraparesis. Loss of a spinal reflex

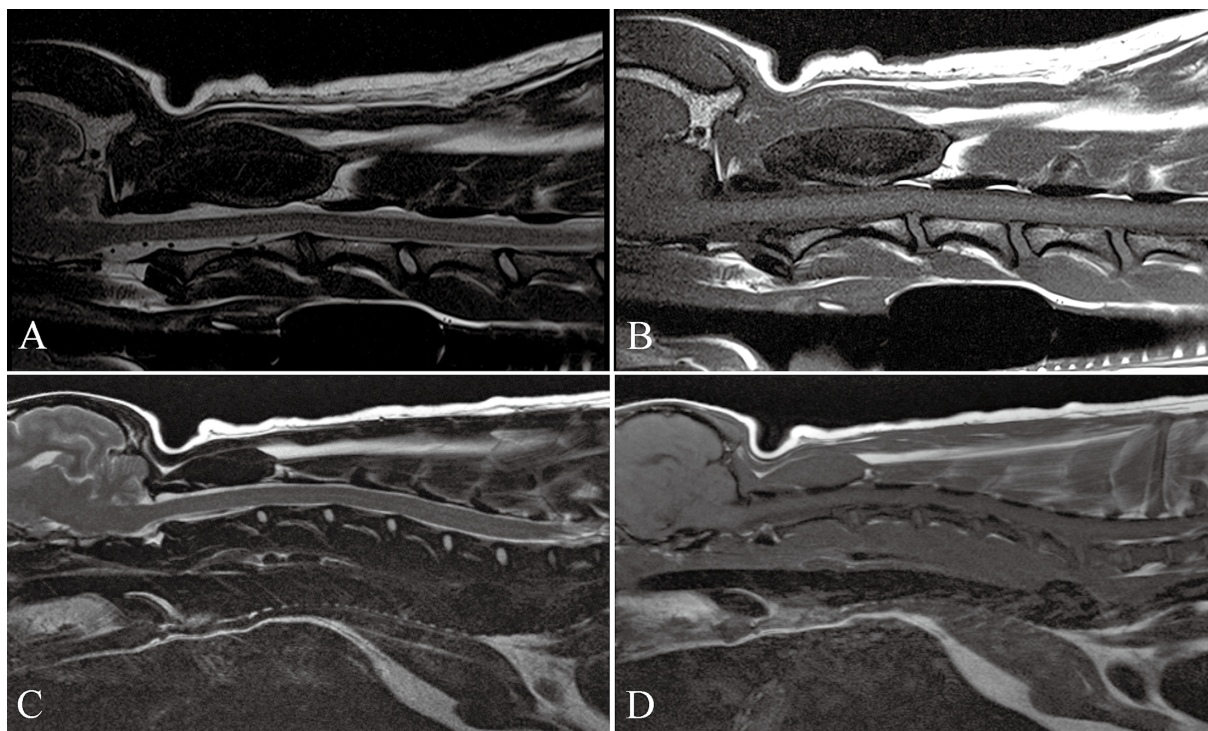


Fig. 2. Magnetic resonance imaging of the cervical region. Case 1 had mild disk bulging lesions, but they were not directly correlated with the patient's symptoms. A T2-weighted image of the mild disc bulging in the cervical spine 2–3 (A) and a T1-weighted image of the cervical spine (B) of Case 1 are presented. T2-weighted (C) and T1-weighted images of the cervical spine (D) of Case 2 are presented.

in the bilateral hindlimbs was identified, but the perineal reflex and tail movement were normal. The serum protein levels were within the reference range and urinalysis did not show any remarkable features. Radiography and MRI analyses had already been performed in the local hospital and showed no significant findings (Fig. 2C, 2D). Acetylcholine receptor antibody titer (0.03 mmol/l; RI: <0.6 mmol/l, IDEXX laboratories, Inc., Westbrook, ME, USA) and ionized calcium levels (1.26 nmol/l; RI: 1.24–1/43 nmol/l) were within the reference range. The 4Dx snap test was negative, and no history of tick exposure was identified. *T. gondii* antigen and the antibody test results were both negative. The fecal PCR tests for *Clostridium perfringens* and *C. jejuni* were positive. Based on the patient's clinical signs and history, the dog was tentatively diagnosed with APN. Supportive care and dietary changes were implemented. Intravenous human immunoglobulin (IVIg; LIV-gamma, SK plasma) was administered at a dose of 1.5 g/kg for 4 hr when the patient showed non-ambulatory tetraparesis 3 days after the initial visit (Fig. 1D). The clinical signs dramatically improved, and 7 days after IVIg administration, the patient had recovered.

In this study, we present two patients with acute flaccid non-ambulatory tetraparesis. This symptom is a characteristic feature of acute neuromuscular and spinal cord diseases [1]. Both cases were tentatively diagnosed by ruling out other acute LMN tetraparesis diseases, including polyradiculoneuritis (coonhound paralysis, protozoal, post-vaccine), botulism, tick paralysis, and acquired fulminant myasthenia gravis.

APN is diagnosed based on historical, clinical, and neurologic findings to differentiate APN from other neuromuscular junction disorders. Electrophysiologic examinations, such as EMG, can reliably indicate diffuse denervation, which are not observed in other neuromuscular junction disorders [1, 8]. Denervation of potentials (fibrillations and positive sharp waves) and a greatly reduced amplitude in compound muscle action potentials after motor nerve stimulation are observed in affected dogs. In contrast, sensory nerve conduction shows no abnormalities or may show a mild reduction in the sensory nerve action potential. In addition, a nerve root biopsy can be performed for a definitive diagnosis, but it is rarely necessary [1]. In our cases, EMG and nerve biopsy were not performed because the owners refused the performance of further diagnostic tests. Therefore, a presumptive diagnosis was made.

C. jejuni infection is considered as a major risk factor (up to 40%) for GBS in humans [11, 12]. Human infection usually occurs because of consumption of raw or undercooked poultry, contaminated water, and unpasteurized milk, as well as via the fecal-oral route [10]. According to a study conducted in Australia, among 27 dogs that exhibited APN symptoms, 13 were positive for *Campylobacter* spp. (*C. upsaliensis* [60%] and *C. jejuni* [40%]). All *Campylobacter*-positive dogs with APN had consumed raw chicken (13/13). In addition, the ratio of consuming a raw chicken diet was 70.7 times higher in dogs with APN compared to the controls [7]. The two dogs described in this report were fed raw poultry for over 9 and 5 years, respectively. The latter was positive for *C. jejuni* and *C. perfringens* from a fecal sample; however, this was not confirmed in the first case. In light of previous reports from veterinary and human studies, *Campylobacter* infection from raw poultry meat could have triggered ascending LMN

tetraparesis in the present cases. Recently, many owners have been interested in feeding raw food to their companion animals for various reasons, such as satisfaction, nutrition, water consumption, and food allergies. Therefore, investigating the patient's diet for potential disease triggers may be the key for diagnosing acute ascending tetraparesis in dogs.

Although the exact pathogenesis of APN remains unknown, it is suspected to be caused by an autoimmune response against the peripheral nerves. Despite being considered an immune-mediated disease, corticosteroids are not effective against APN in humans or animals [3]. Currently, the treatment options for APN are limited to supportive care, including physical therapy, feeding the dog in a sternal position, soft bedding to avoid a decubital ulcer, and respiratory monitoring in severely affected cases. In humans, plasmapheresis and high-dose IV immunoglobulin administration have been evaluated as treatment strategies for GBS, and patients have shown rapid recovery in motor function and gait [9]. In veterinary medicine, treating patients with IVIg is considered effective for autoimmune diseases, including autoimmune hemolytic anemia and immune-mediated thrombocytopenia [2, 5]. Interestingly, one study in dogs analyzed the clinical course of APN following human IVIg administration. The recovery time was shorter in the treated than in the control group (median, 27.5 and 75.5 days, respectively) [6]. In the present cases, only the miniature Poodle dog was treated with human IVIg, which showed rapid recovery (7 days) compared to the other patient (34 days). No side effects associated with human IVIg (such as anaphylaxis) were observed in this patient [12].

The prognosis of APN is good in dogs. Once clinical signs stabilize and animals are able to eat and drink, supportive care can be provided at home. [8]. Most patients recover over 3–6 weeks, but severely affected dogs may need 4–6 months, and some dogs never recover completely [1, 8]. The affected animals may be prone to recurrence when they are re-exposed to the triggering antigen [8]. In the two cases in this report, supportive care was provided, as both dogs did not show hypoventilation during monitoring and recovered in 34 and 12 days from the initial visit, respectively. Both patients completely recovered, and no recurrence were observed to date.

This study suggested that the patient's history, clinical signs, neurological signs, clinical progression, and surveillance of possible causes, including *Campylobacter* spp. infection can aid in the presumptive diagnosis and treatment of APN. In both cases, patients were successfully treated with or without the intravenous administration of human IVIg.

The limitations of this study included the lack of EMG data and nerve biopsy results because of the owners' refusal. EMG data and nerve biopsies of patients with acute ascending tetraparesis could potentially provide more conclusive evidence of denervation.

CONFLICT OF INTEREST. The authors have no conflicts of interest to declare.

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