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Case Study

Atypical Presentation of a Tick Paralysis in a Dog

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ABSTRACT

An 11-month-old Guregh dog was admitted to the hospital with a history of vomiting and regurgitation, gait disorder, and unilateral thread-like hypersalivation for a few days. Clinical and radiographic examinations revealed quadriplegia, facial paralysis, grave Modified Glasgow Coma Scale/MGCS (5), visual analog scale/VAS (4) scores, and severe megaesophagus gas-filled distended intestines. In hematochemical analysis, leukocytosis due to granulocytosis with polycythemia, elevated blood urea nitrogen/BUN, creatinine, creatine phosphokinase/CPK, and aspartate transaminase/AST levels were determined. During careful clinical examination, engorged ticks were found in the head and neck region of the dog. After excluding diseases that may cause similar symptoms, diagnosis of atypical tick paralysis was made based on clinical findings such as a history of vomiting and regurgitation before the onset of gait abnormalities and the presence of megaesophagus. However, the patient was less than one year old. The clinical appearance, MGCS, and VAS scores improved after five days of hospitalization. It was concluded that the presence of megaesophagus in young dogs with vomiting and/or regurgitation before the onset of neurological findings is observed in atypical tick paralysis, patient hospitalization, tick removal, supportive treatment administration, and MGCS and VAS score assessments provide successful clinical results.
Keywords: Atypical, dog, modified Glasgow coma scale, tick paralysis, visual analog scale

ABSTRAK

Seekor anjing Guregh berusia 11 bulan dirawat di rumah sakit dengan riwayat muntah dan regurgitasi, gangguan cara berjalan, dan hipersalivasi unilateral selama beberapa hari. Pemeriksaan klinis dan radiografi menunjukkan quadriplegia, kelumpuhan wajah, skor Modified Glasgow Coma Scale/MGCS (5), skor visual analog scale/VAS (4), dan usus besar berisi gas (megaesophagus). Analisis kimia darah dan hematologi menunjukkan leukositosis karena granulositosis dengan polisitemia, peningkatan kadar blood urea nitrogen/BUN, creatinine, creatine phosphokinase/CPK, dan aspartate transaminase/AST. Pemeriksaan klinis menemukan adanya caplak yang membesar yang ditemukan di daerah kepala dan leher anjing. Setelah mengecualikan penyakit yang dapat menyebabkan gejala serupa, diagnosis kelumpuhan caplak atipikal dibuat berdasarkan temuan klinis seperti riwayat muntah dan regurgitasi sebelum timbulnya kelainan gaya berjalan dan adanya megaesophagus. Namun, pasien berusia kurang dari satu tahun. Penampilan klinis, skor MGCS, dan skor VAS membaik setelah lima hari dirawat di rumah sakit. Disimpulkan bahwa kehadiran megaesophagus pada anjing muda dengan muntah dan/atau regurgitasi sebelum timbulnya temuan neurologis diamati pada kelumpuhan caplak atipikal, rawat inap pasien, eliminasi caplak, dan pemberian terapi suportif. Penilaian skor MGCS dan skor VAS memberikan hasil klinis yang baik.
Kata kunci: anjing, atipikal, lumpuh caplak, *modified Glasgow coma scale*, *visual analog scale*

INTRODUCTION

Although many animals such as cats, dogs, horses, cattle, sheep, and poultry are affected by ticks, the most affected species are domestic dogs and, less frequently, cats and livestock (Padula, 2016). The life cycle of ticks is well defined, but the molecular structure of the neurotoxin that causes neurological findings were not fully explained until 1992 (Thurn *et al.,* 1992). After the tick adheres to the host, it goes into a latent period of 3-6 days, and during this period, the tick becomes engorged, the salivary glands enlarge and produce neurotoxins. These neurotoxins inhibit acetylcholine at the neuromuscular junctions (Ceylan *et al.,* 2019). A single engorged tick usually causes symptoms of paralysis, but more rarely, multiple engorged ticks have been reported (Padula *et al.,* 2020).

Tick paralysis is an acute, progressive ascending motor paralysis caused by a salivary neurotoxin produced by certain species of ticks. *Rhipicephalus sanguineous*, a common vector of several pathogens (Mans *et al.,* 2004), prefers feeding dogs (Ceylan *et al.,* 2019). Although the diagnosis of typical cases in geographical regions where ticks are endemic and seasonal is usually easy, the diagnosis of cases defined as atypical, which are characterized by an atypical history of vomiting or regurgitation and no apparent neuromuscular weakness, can be extremely challenging (Malik *et al.,* 1988; Atwell *et al.,* 2001; Westwood *et al.,* 2013). The easily recognizable signs of ascending flaccid lower motor neuron paralysis with varying onset time, often accompanied or preceded by dysphonia, gait abnormality, vomiting, and/or regurgitation along with ataxia in the hind limbs resulting in quadriplegia, are pathognomonic (Westwood *et al.,* 2013; Leister *et al.,* 2017). Careful veterinary diagnostic evaluation to exclude other conditions that cause similar clinical manifestations such as myasthenia gravis, acute polyradiculoneuritis, spinal pathology, and botulism is essential, along with regular and repeated whole-body searches for ticks (Padula, 2016). Megaesophagus, defined as esophageal dilation, was found in 70 % (28/40) of dogs with atypical tick paralysis (Malik *et al.,* 1988; Atwell *et al.,* 2001; Padula *et al.,* 2020). Even though the development of megaesophagus was not significantly associated with the tick location being on the neck or throat region, the high frequency of megaesophagus in dogs with tick paralysis would suggest that this may be a useful diagnostic screening test in atypical cases (Malik *et al.,* 1988).

There are no specific diagnostic tests for diagnosing tick paralysis. A rapid patient-side test would greatly facilitate the diagnosis of tick paralysis in suspect patients where no tick can be found until such time diagnosis is based on the exclusion of other more readily diagnosed differential diagnostic conditions such as hypo/hyperglycemia, kidney failure, and primary brain damage (Atwell *et al.,* 2001; Platt *et al.,* 2001). In situations such as hypoglycemia, hypotension, trauma, and severe tick infestation where the loss of consciousness is present (Atwell *et al.,* 2001; Westwood *et al.,* 2013), the Modified Glasgow Coma Scale (MGCS) is useful in observing the progression of neurological disorders, the effects of therapeutic interventions and general prognosis by evaluating the patient's motor activity and brainstem reflexes (Platt *et al.,* 2001). Also, some pain findings (vocalization or agitation with increased heart rate, blood pressure, or respiratory rate) can be observed in tick paralysis cases (Atwell *et al.,* 2001). These signs can be described using a pain scale, such as a visual analog scale (VAS). Any score greater than 0 indicates a need for varying degrees of analgesia. Patients scoring one may be manageable on NSAIDs alone, whereas patients with higher scores are likely to need additional therapy, such as opioids, CRI, epidural, and anti-windup drugs (Shaffran, 2008).

In this case report, clinical, hematochemical, and radiographic findings along with MGCS and VAS score changes of tick paralysis in an 11-month-old dog are presented. The diagnosis of atypical tick paralysis was made based on clinical results such as a history of vomiting and regurgitation before the onset of gait abnormalities and the presence of megaesophagus, which is more common in older dogs.

CASE DESCRIPTION

The animal material of this report consisted of an 11-month-old male, non-neutered Guregh dog, weighing 55 kg, which was admitted to the Animal Hospital of Veterinary Faculty, Harran University. The anamnestic data revealed an increased unilateral thread-like hypersalivation, vomiting, and regurgitation at first, and gait disorder lasted a few days. An abundant amount of ticks were observed during the physical examination in the head and neck region. It was determined that the dog had significant facial asymmetry, had partial facial paralysis, and was fully quadriplegic (Figure 1). As a result of physical examination, high body temperature (39.7 °C), hyperpnea (60 breaths/minute), tachycardia (160 bpm), shortened capillary refill time (<2 sec), cherry red mucous membranes, and

approximately 150-200 ticks were detected on the body of the dog. After the physical examination, 10 mL of venous blood sample was taken for complete blood count (CBC), serum biochemistry, and blood smear examination for further diagnosis.

In CBC (MS4e Melet Schloesing Laboratoires, France) leukocytosis (30.81 m/mm^3) due to granulocytosis (19.34 m/mm^3) with polycythemia (RBC: 9.22 M/mm^3, Hct: 59.2 %, Hb: 16.1 g/dl); in serum biochemistry (BT 3000 plus Biotecnica Instruments SpA autoanalyzer, Italy) elevated BUN (26.7 mg/dl), creatinine (2.7 mg/dl), CPK (477 U/L) and AST (92 U/L) levels were determined (Table 1). Other parameters were within normal reference ranges. Blood smear examination (x100 magnification with immersion oil, light microscope, Olympus®) revealed neutrophilia with no intracellular pathogens (Figure 2). After blood analysis, cervical, thoracic and abdominal laterolateral radiographs were performed to exclude pulmonary edema, cardiac hypertrophy, renomegaly secondary to kidney disorders, orthopedic or spinal pathologies in the differential diagnosis. Severe megaesophagus in cervical radiography (Figure 3A), gas-filled distended intestines in abdominal radiography (Figure 3B), and normal thoracic radiographs were determined. MGCS (5, at first admission) and VAS scores (4, at first admission) were obtained at the patient-side (Table 2a, 2b), and the patient was hospitalized.

A diagnosis of tick paralysis was made based on the exclusion of diseases that cause similar findings and the presence of engorged ticks and clinical findings such as facial paralysis, quadriplegia, megaesophagus, vomiting, and regurgitation.

As previously described, ticks were defined as *Rhipicephalus sanguineus* in terms of morphological features (Soulsby, 2005). It was considered that the paralysis was atypical because of the age of the dog (11-month-old) and the presence of the atypical history of vomiting and regurgitation before the onset

Table 1 Complete blood count and serum biochemistry findings

Parameter	Values	Reference	Parameter	Values	Reference
WBC	**30.81 m/mm^3**	**6-17 m/mm^3**	**BUN**	**26.7 mg/dl**	**4.70-7.30 mg/dl**
Lym	8.59 m/mm^3	0.6-5.1 m/mm^3	**Creatinine**	**2.7 mg/dl**	**0.8-1.8 mg/dl**
Mon	2.88 m/mm^3	0.1-1.7 m/mm^3	**AST**	**92 U/L**	**10-80 U/L**
Gra	**19.34 m/mm^3**	**3-13.6 m/mm^3**	ALT	15 U/L	10-80 U/L
RBC	**9.22 M/mm^3**	**5.5-8.5 M/mm^3**	ALP	69 U/L	10-80 U/L
MCV	75.2 fl	58-73 fl	Glucose	106 mg/dl	70-150 mg/dl
Hct	**59.2 %**	**35-55 %**	Albumin	2.7 g/dl	2.1-3.9 g/dl
MCH	21.2 pg	19.5-24.5 pg	Calcium	9.1 mg/dl	8-10.7 mg/dl
MCHC	28.3 g/dl	28-40 g/dL	Protein	6.3 g/dL	5.4-7.8 g/dl
RDW	11	8-12	GGT	6 U/L	1-10 U/L
Hb	16.1 g/dl	10-18 g/dL	**CPK**	**477 U/L**	**50-450 U/L**

WBC: leukocyte, Lym: lymphocyte, Mon: monocyte, Gra: granulocyte, RBC: red blood cells, MCV: mean corpuscular volume, MCH: mean corpuscular hemoglobin, MCHC: mean corpuscular hemoglobin concentration, Hct: hematocrit, RDW: reticulocyte distribution width, Hb: hemoglobin, BUN: Blood urea nitrogen, AST: aspartate aminotransferase, ALT: alanine transaminase, ALP: alkaline phosphatase, GGT: gamma-glutamyl transferase, CPK: creatine phosphokinase.

Figure 1 Clinical appearance of dog and quadriplegia

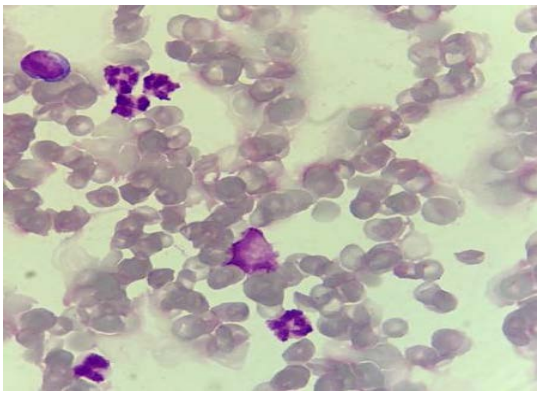

Figure 2 Blood smear examination (x100 magnification with immersion oil, light microscope)

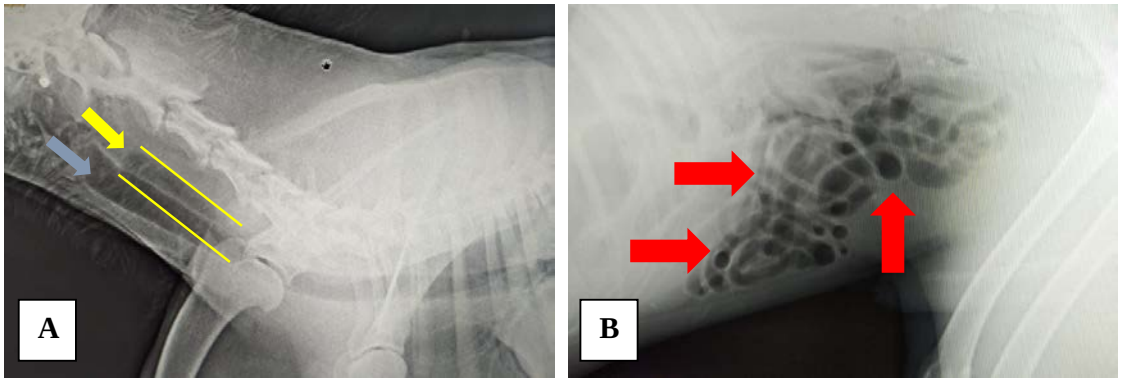

Figure 3 Megaesophagus (A) and gas-filled distended intestines (B). (A) Blue arrow indicates trachea, yellow arrows and lines indicate esophagus; (B) Red arrows indicate presence of gas in the intestine

of gait abnormalities and megaesophagus, which is generally reported in older dogs affected by tick paralysis.

TREATMENT AND OUTCOME

Approximately 150-200 ticks observed on the dog's body were removed manually (Figure 4). The injection of acaricidal bath (amitraz) and ectoparasitic (ivermectin, 0.006 mg/kg subcutaneous) was administered. Supportive therapy included intravenous fluid therapy (Lactated Ringer's solution, 60 ml/kg intravenous) to maintain hydration, proton pump inhibitor (omeprazole, 0.5 mg/kg intravenous) to reduce gastric secretion acidity, prokinetic (metoclopramide, 0.2 mg/kg intravenous) to stimulate the peristalsis of the gas-filled distended intestines, vitamin-mineral support (Duphalyte, Zoetis®, 10 ml/kg intravenous) and oxygen therapy (50 ml/kg/min) with nasal cannulae and dexamethasone (0.5 mg/kg subcutaneous) were administered. Unfortunately, tick antiserum could not be supplied. As a result of a 5-day hospitalization period, the clinical appearance, MGCS (14, before discharge), and VAS (1, before discharge) scores of the dog improved significantly (Table 2a, 2b).

DISCUSSION

Tick paralysis is most commonly reported in domestic dogs and less commonly cats and other farm animal species (Padula, 2016). *Rhipicephalus sanguineus* is the most widespread tick in dogs and a recognized vector of several pathogens causing diseases in dogs and humans (Ceylan *et al.*, 2019). Clinical signs of tick paralysis, including ascending flaccid paralysis, are seen 5-9 days after tick attachment and progress from hind limb weakness to quadriplegia over the next 24-72 hours. If ticks are not removed, death may occur from respiratory paralysis in 1-5 days. Removal of all ticks usually improves within 24 hours and complete recovery within 72 hours (Atwell *et al.*, 2001; Soulsby, 2005).

Contrary to typical cases, the diagnosis of tick paralysis is quite difficult in atypical cases (Kelers *et al.*, 2012). Vomiting and regurgitation without neurolo-

gical disturbances and presence of megaesophagus defined as esophageal dilatation on radiographs have been reported in atypical findings of dogs with tick paralysis (Atwell *et al.,* 2001; Padula, 2016, Ceylan *et al.,* 2019; Padula *et al.,* 2020). The neurotoxin's effect appears to be focused on the presynaptic surface of the motor endplate. It seems to block calcium influx, thereby preventing depolarization of nerve endings and propagation of signal across neuromuscular junction resulting in diffuse hypomotility (Herndon *et al.,* 2018). However, no significant association was reported between the development of the megaesophagus and the location of attached ticks.

Vomiting and regurgitation without conventional signs of paralysis were described in 3 cases (Malik *et al.,* 1988), and the difficulty of diagnosis was mentioned. Megaesophagus is mostly observed in old dogs (Padula *et al.,* 2020); there is no significant relationship between the megaesophagus development and the ticks' location (Atwell *et al.,* 2001). Although the esophageal disease occurs in most dogs, it does not usually present as a megaesophageal case (Atwell *et al.,* 2001; Webster *et al.,* 2013), especially in younger dogs. The high frequency of megaesophagus in dogs with tick paralysis and the radiographic visibility on plain views of this condition would suggest that this may be a useful diagnostic screening test in suspect cases (Padula, 2016).

Clinical examinations of dogs with tick paralysis include fever, altered mental status, increased respiration, and heart rate (Atwell *et al.,* 2001). Increase in hemoglobin concentration, RBC and WBC count (Diaz, 2015), elevated BUN and creatinine concentrations due to dehydration, and increased glucose and cholesterol levels due to sympathetic stimulation of the adrenal medulla have been reported in haematochemical analysis findings in dogs with tick paralysis (Ilkiw & Turner, 1987). It was reported that none of these changes are specific to tick paralysis or indicate severity or prognosis (Atwell *et al.,* 2001; Padula *et al.,* 2020). Findings such as elevated BUN and creatinine levels and polycythemia observed due to dehydration along with the high WBC level detected in the present case were consistent with previous reports (Ilkiw & Turner, 1987; Atwell et al., 2001). Moreover, increased AST and CPK levels were interpreted as muscle damage (Lim, 2020).

The Glasgow Coma Scale, modified for veterinary use in 1983, is a useful way to monitor the progression of neurological disturbances and level of consciousness (Shores, 1983). Therefore, the scale is a useful indicator of the severity and progression of neurological dysfunction in such patients and maybe a helpful prognostic indicator (Platt *et al.,* 2001). In humans and animals, pain triggers a series of physiological changes that increase stress. In addition to suppressing the immune system, increased sympathetic nervous system activity associated with unrelieved pain may result in increased catabolism and metabolic rate, anorexia, ileus, and atelectasis (Ilkiw & Turner, 1987).

The cardiovascular system is also adversely affected, resulting in increased heart rate and blood pressure, irregular heart rhythms, and coagulopathies (Shaffran, 2008). Cardiovascular, respiratory, and elevated catabolic and metabolic rates have been reported in dogs with tick paralysis due to tick neurotoxin (Padula, 2016). Therefore, all patients should be evaluated for painfulness on admission and throughout hospitalization. Thus, the visual analog scale was designed to assess the patient's pain scale (Shaffran, 2008). In our case, MGCS and VAS scores were used to obtain information about the prognosis of the disease during the hospitalization period, and both scores were improved before discharge (MGCS: 5, at first admission; 14, before discharge. VAS: 4, at first admission; 1, before discharge).

Supportive therapy protocols and hospitalization are important parts of treating animals with tick paralysis (Atwell *et al.,* 2001). Intravenous fluid therapy

Figure 4 Some of the ticks (*Rhipicephalus sanguineus*) removed from the body of the dog

Table 2a Modified Glasgow Coma Scale score at first admission and before discharge

Modified Glasgow Coma Scale (MCGS) (Platt *et al.* 2001)		Score	First admission	Before discharge
Motor Activity	Normal gait, normal spinal reflexes	6		
	Hemiparesis, tetra paresis, or decerebrate rigidity	5		5
	Recumbent, intermittent extensor rigidity	4		
	Recumbent, constant extensor rigidity	3		
	Recumbent, constant extensor rigidity with opisthotonos	2		
	Recumbent, hypotonia of muscles, depressed or absent spinal reflexes	1	1	
Brainstem Reflexes	Normal PLR and oculocephalic reflexes	6		
	Slow PLR and normal to reduced oculocephalic reflexes	5		
	Bilateral unresponsive miosis with normal to reduced oculocephalic reflexes	4		4
	Pinpoint pupils with reduced to absent oculocephalic reflexes	3		
	Unilateral, unresponsive mydriasis with reduced to absent oculocephalic reflexes	2	2	
	Bilateral, unresponsive mydriasis with reduced to absent oculocephalic reflexes	1		
Level of Consciousness	Occasional periods of alertness and responsive to environment	6		
	Depression or delirium, capable of responding but response may be inappropriate	5		5
	Semi-comatose, responsive to visual stimuli	4		
	Semi-comatose, responsive to auditory stimuli	3		
	Semi-comatose, responsive only to repeated noxious stimuli	2	2	
	Comatose, unresponsive to repeated noxious stimuli	1		
MCGS Score	3-8: Grave, 9-14: Guarded, 15-18: Good		5 (Grave)	14 (Guarded)

Table 2b Visual Analogue Scale score at first admission and before discharge

Visual Analogue Scale (Shaffran 2008)	First admission	Before discharge
Psychological and Behavioral	Potentially unresponsive to surroundings	Content to slightly unsettled of restless
Response to Palpation	Cries at non-painful palpation	Reacts to palpation by looking around and flinching
Body Tension	May be rigid to avoid painful movement	Mild
Pain Score (0 to 4)	4	1

is indicated for patients who cannot be orally fed or take fluids (Padula *et al.,* 2020). Depending on the severity of the case, respiratory support may be required. Intranasal or tracheal oxygen therapy or mechanical ventilation, which have been reported to increase survival rate, may be used (Webster *et al.,* 2013). Esophageal dysfunction and megaesophagus can cause vomiting and regurgitation in a tick paralyzed dog. Cimetidine or omeprazole can be used to reduce the acidity of the gastric secretion in cases where secondary esophagitis develops with megaesophagus (Padula, 2016; Padula *et al.,* 2020).

Antiemetic drugs such as metoclopramide and maropitant are frequently used in dogs with tick paralysis, but their effectiveness in preventing aspiration pneumonia has not yet been proven (Webster *et al.,* 2013). Nevertheless, in the present case, clinical findings improved with the treatment protocol, including intravenous fluid therapy, proton pump inhibitor, prokinetic, vitamin-mineral supplement, oxygen therapy, and anti-inflammatory steroid administrations. MGCS and VAS score assessments confirmed it.

This study concluded that supportive therapy improves the survival rate in dogs with severe clinical signs. The response to treatment is good in dogs still in the early stages of the disease or with mild paralysis, and about 90% of the treated dogs recover. Although the prognosis was poor in dogs with severe respiratory compromise and quadriplegia despite intensive treatment (Padula, 2016), the dog's treatment with severe atypical tick paralysis in the present case was successful. As a result, it was observed that the evaluation of MGCS and VAS scores during the hospitalization period is important in predicting disease prognosis and animal welfare.

It was concluded that megaesophagus in young dogs with vomiting and/or regurgitation before the onset of neurological findings is observed in atypical tick paralysis cases as reported (Atwell *et al.,* 2001). In addition, patient hospitalization, tick removal, supportive treatment administration, and MGCS and VAS score assessments provide successful results even in severe cases of tick paralysis with findings such as respiratory compromise and quadriplegia.

"The author declares that there is no conflict of interest with the parties involved in this research".

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