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Alterations in neurology and behavior: a case of aggression related to epileptic seizures

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Abstract: Yoda was a dog who suddenly began to exhibit aggressive behaviors towards its owners. While these behaviors initially presented as sudden onset, over time they progressively worsened (increased frequency and intensity). Blood tests did not reveal any abnormalities; however, brain MRI indicated a state of cortical distress. The dog was subsequently euthanized, and histopathological examination of the brain tissue revealed the presence of ischemic neurons, compatible with a potential epileptic condition in life that could be responsible for aggressive behavior.

Key Words: Dog, aggressive behavior, epilepsy

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Signaling

Yoda is a small mixed-breed puppy, approximately 7-8 months old, intact male.

Reason for visit

Yoda bites the owners when playing, during walks, while defending an object, and sometimes without apparent motivation. When in the throes of these "attacks," he is unable to self-control.

History

Yoda was found by the couple during a vacation in Bosnia, near a trash bin; the owner reports hearing him cry after being mistreated by people trying to drive him away. At the time, he was about 3-4 months old; he was a very fearful puppy, to the point that when the owner tried to pet him and pick him up, he would whine and urinate on himself. Brought to Italy, he adapted very well to his new home: an apartment on the fifth floor, where Yoda occupies the kitchen and terrace, as the couple's two cats live in the other rooms. At night, he sleeps on the terrace, where he has his bed, while during the day he has free access to both areas. During the week, Yoda spends several hours alone because the owner works all day, and the owner is able to schedule her commitments to return home multiple times. He goes for walks every day, morning and evening (about 1 hour per walk); on weekends, he is taken out more often and allowed to run and play in parks or along the river. Yoda eats twice a day (kibble) and is quite voracious; during the owners' mealtimes, he begs for food but receives nothing, and in response, he constantly nibbles at the owners' legs. The owners play with him several times a day, throwing a ball or Frisbee, playing tug-of-war with a rope, and offering mental stimulation games (in which he excels!!). He does not eliminate feces or urine in the house but does so during walks with the owners. Yoda does not show any particular fears (strangers, noises, other dogs, cars, or scooters). He has begun a training course with a dog trainer who visits twice a week. After about 3-4 weeks of working with the dog, the trainer realizes that Yoda's behavior is becoming increasingly aggressive, prompting him, in agreement with the owners, to seek behavioral consultation.

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Evolution of the problem

Initially, Yoda would only nibble at hands, ankles, or pants during cuddles or when the owners were not paying attention to him. Subsequently, this behavior became more frequent (during play and with strangers) and more intense (barking, growling, tugging at clothes). It is a behavior that does not manifest every day, but on the worst days, the "attacks" occur even without apparent reason: Yoda jumps on the owners growling, biting, and pulling. During walks, Yoda has never shown aggressive tendencies, neither towards people nor other dogs; he has always demonstrated a marked interest in black trash bags, to the point that if the owners tried to take them from his mouth, he would growl and attempt to bite. The behavioral problem worsens at home, leading the owners to conflict with Yoda: they reprimand him, remove him from the room (confined to the terrace), ignore him, but the result is an intensification of Yoda's aggressive response. The owners feel that Yoda is trying to manage situations and does not accept that someone else does it for him. He no longer allows the harness or muzzle to be put on: he growls and bites anyone who tries. The situation also worsens during walks: while initially, only the defense of trash bags triggered his aggression, Yoda subsequently began to bark aggressively at cars, bicycles, motorcycles, children, dogs, and cats. Another behavior emerges during walks on a leash: suddenly, Yoda turns towards the owners and bites their legs, tugging at their pants and growling without a plausible reason. The deterioration continues: he starts biting when attempts are made to get him out of the kitchen and at the front door upon returning from a walk (things he had never done before); he administers restrained bites alternating with pinches using his incisors. The attacks at home become increasingly frequent and intense (the owner had to seek emergency care); they occur even when the owner tries to take objects that he has acquired during play or accidentally (a dishcloth that fell from the kitchen counter). During the visit to the veterinary behaviorist, Yoda shows curiosity and sociability (although shortly after he starts jumping on the veterinarian, pinching his sleeves with his incisors); he attempts to chew the consulting room sofa (a behavior that stops when pieces of treat are thrown on the floor); at one point during the visit, he falls asleep on the sofa.

Veterinary visit and results of diagnostic tests

Yoda underwent a visit with his attending veterinarian: no alterations in the growth of the musculoskeletal system were noted (no pain was found upon palpation or following passive movements); no abdominal tenderness was detected, nor were there any issues found during the otological and ophthalmological examination. The report of the blood biochemistry and complete blood count showed normal values.

Given the young age at which behavioral problems first appeared, it is reasonable to hypothesize about a developmental disorder characterized by hypersensitivity-hyperactivity syndrome. Due to insufficient interaction with his mother and littermates, Yoda failed to develop essential skills such as controlling the intensity of his bite, respecting the rules of play—including the ability to shorten the consumptive phase in response to stop signals—and tolerating frustration (Pageat, 1999). This deficient early social experience likely set the stage for his behavioral difficulties. Compounding the issue, the owners' management of critical situations—through punishment, removal, shouting, physical wriggling and pulling to free themselves, or clapping—has inadvertently reinforced Yoda's strategy to gain attention. These responses have simultaneously heightened his level of arousal and increased his reliance on aggressive behavior.

Within this broader framework, several distinct forms of aggression can be observed. Yoda demonstrates irritation-related aggression, which typically emerges during petting or cuddling sessions, as well as possessiveness-related aggression, evident during play and particularly when

handling "stolen" objects or trash bags. Frustration-related aggression also plays a significant role, surfacing whenever he is prevented from doing something he desires, forced to move from a location, or denied access to food or objects held by his owners.

A further concern is the apparent presence of an impulse control disorder. Aggressive episodes often occur during walks, without any obvious external trigger, and are marked by the absence of an appetitive phase, an unusually prolonged consumptive phase, and a complete lack of a natural stopping point. In these moments, Yoda appears overwhelmed by an uncontrollable urge to bite, losing all ability to regulate his actions. Pallanti et al. (2003) describe impulsivity as a diminished capacity to inhibit motor responses following specific stimuli or emotional states, closely tied to immediate gratification mechanisms. They also note that, in human medicine, impulsivity is frequently associated with attention deficits, hyperactivity, manic episodes, eating and personality disorders, substance abuse, and neurological conditions such as epilepsy—all of which share a neurobiological foundation involving the prefrontal cortex and its modulation of hypothalamic and limbic activity. Moreover, disruptions in serotonergic, noradrenergic, dopaminergic, and GABAergic neurotransmitter systems have been implicated in impulsive and aggressive behaviors across various psychiatric disorders (Pallanti et al., 2003).

Yoda's behavioral profile also includes signs of hyperactivity, characterized by an inability to respond to environmental stimuli with appropriate behavioral adjustments, heightened vigilance, poor bite control, and a failure to interrupt the consumptive phase of behavioral sequences (Landsberg et al., 2013). This pattern suggests a pervasive dysregulation of arousal and self-control.

Finally, it is important to consider the role of primary dissocialization in shaping Yoda's behavioral profile. This condition often arises in dogs older than three months who were separated too early from their mother, typically around the fourth or fifth week of life, leading to a failure to acquire essential social behaviors such as affiliative tendencies, bite inhibition, and the capacity to interrupt aggressive sequences (Pierantoni, 2011). In Yoda's case, having been found alone near a trash bin in Bosnia at approximately three to four months of age, after likely experiencing significant deprivation and fear, it is plausible that critical early interactions with his mother and littermates were entirely missing or abruptly interrupted. This deficit would have prevented him from learning to modulate his bite intensity, understand social signals, and tolerate frustration—skills that normally develop through play and corrective feedback within the litter.

Dogs affected by such dissocialization frequently show behaviors like food stealing, biting with excessive force while simultaneously exhibiting threat signals such as growling, and may even defecate or partially empty their anal sacs during aggressive outbursts (Landsberg et al., 2013). These patterns mirror Yoda's possessive behavior toward trash bags, his intense responses when attempts were made to remove objects from his mouth, and the escalation to unprovoked attacks.

Moreover, recent studies reinforce the notion that both early social experiences and subsequent environmental management are crucial in determining behavioral trajectories. Gazzano et al. (2025) demonstrated that high stress levels during routine handling can exacerbate fear and trigger aggressive reactions, highlighting how physiological arousal can influence behavior. Likewise, Gazzano & Ogi (2020) emphasized that insufficient early socialization may lead to persistent phobic responses, which in some cases evolve into defensive or offensive aggression. Iacopini & Gazzano (2023) further pointed out that kennel environments lacking in structured human interaction and enrichment can heighten arousal and undermine impulse control, fostering the emergence of problematic behaviors. This is consistent with findings from surveys on guide dogs raised by puppy walkers, showing that inadequate or inconsistent early social experiences are linked to increased hyper-reactivity, fearfulness, and aggressive tendencies (Gazzano, 2008).

Taken together, these observations strongly support the hypothesis that in Yoda's case, the lack of early social and maternal interactions, combined with a later environment that—despite the owners' best intentions—may not have sufficiently compensated for his early deficits, contributed to an incomplete acquisition of social competence, impulse regulation, and frustration tolerance.

These factors likely laid the groundwork for the hypersensitivity, hyperactivity, and poor self-control that ultimately evolved into the complex aggressive behaviors observed throughout his life.

Therapy (first phase)

Following the behavioral visit and after conducting a hematobiochemical examination (with normal results), pharmacological therapy (fluoxetine, ¾ of a 20 mg tablet daily) and behavioral therapy were prescribed, aimed, with the help of the dog trainer, at teaching Yoda self-control, relaxation, and the development of new skills. At the same time, the owners were advised not to enter into conflict with Yoda, avoiding positive punishments, not forcibly taking objects he had acquired, and not responding aggressively to attacks. They were advised to increase daily walks, providing Yoda with the opportunity to expend accumulated energy; to desensitize and counter-condition Yoda to cuddles; to attend dog communication classes; to provide Yoda with chew toys (Kong) to help him release energy from the chewing muscles.

Follow up (first phase)

Initially, Yoda responded positively to the therapy, decreasing the frequency of attacks; however, subsequently, during the second week, the reported problems resurfaced as they were before the start of therapy. It was decided to extend the fluoxetine therapy for one month. Not noticing any improvement, fluoxetine was discontinued, and a new protocol was decided: Androcur (cyproterone acetate) at a dosage of 3 mg/kg/day for the first 3 weeks and 2 mg/kg/day for the following 3 weeks, along with Tegretol (carbamazepine) at a dosage of 15 mg/kg every 12 hours after the first week of treatment. However, even with this protocol, the results proved insufficient.

At this point, the owners agreed to subject Yoda to a neurological examination and a brain MRI. Given the MRI results, differential diagnoses included idiopathic epilepsy and temporal lobe epilepsy.

1) Idiopathic epilepsy: epilepsy is defined by Fenner (1994) as the recurrence of convulsive seizures, irrespective of the causes that triggered them. Podell (1996) defines epileptic seizure as the clinical manifestation of abnormal neuronal activity in the cerebral cortex. A study by Shihab et al. (2011) showed that dogs suffering from epilepsy exhibit behavioral changes such as depression, anxiety, fear, aggression, and abnormal perception of environmental stimuli leading to exaggerated reactivity. Additionally, 1/3 of dogs with idiopathic epilepsy demonstrate pharmacoresistance to common antiepileptic drugs, likely due to changes in the permeability of the blood-brain barrier. The same study suggests that an important role in determining the link between epilepsy and psychiatric diseases may be attributed to alterations in serotonergic, noradrenergic, dopaminergic, and GABAergic systems (in line with what Pallanti and colleagues (2003) have stated regarding human medicine), along with changes affecting GABA receptors and the development of pathological functional and structural alterations in the brain seen in cases of epilepsy.

2) Temporal lobe epilepsy: the temporal cortex regulates both auditory function and behavioral activities. Epilepsy of this part of the cortex is clinically associated with aggressive behaviors that the animal cannot control, often triggered in response to minor environmental stimuli, perceived in an altered manner. Additionally, hyperactivity, excessive fear, and increased electroencephalogram activity are noted in association with aggressive behavior.

Therapy (second phase)

The previous therapeutic protocol was discontinued, and phenobarbital (Gardenale), 50 mg tablets: ½ tablet every 12 hours is administered.

Follow up (second phase)

The new therapy initially produces only mild improvement in Yoda's behavior. Three months after starting therapy, the unprovoked aggressive episodes, especially towards the owners, increase in both frequency and intensity: Yoda can no longer stop the behavioral sequence once it has been triggered!! Following the worsening of symptoms, cohabitation between the owners and their dog becomes impossible; it is also unfeasible to place Yoda with third parties or in shelters. Therefore, Yoda is euthanized. At the University of Bologna Veterinary School (Department of Pathological Anatomy), an autopsy and histological examination of Yoda's brain tissue are performed: the latter examination reveals a degenerative/necrotic pattern of individual neuronal elements in the cortex, consistent with the development of neurological signs and epileptiform seizures.

Conclusions

Yoda's aggressive manifestations may have initially found a "behavioral" explanation. His possessiveness, especially regarding trash bags, may be related to the deprivations experienced as a stray puppy (poor nutrition); his inability to appropriately manage frustration may be explained by the inability to interact adequately with his mother and siblings during the critical period of socialization between 2 and 3 months of age. However, the subsequently recorded aggressive attacks, characterized by being unjustified by apparent reasons, being inappropriate regarding contextual stimuli, and the dog's inability to manage them adequately, along with the disintegration of phases (progressive shortening of the appetitive phase, elongation of the consumptive phase until it becomes uncontrollable, replacing the satisfaction phase) are likely attributable to neurological alterations. Such alterations could underlie the behavioral changes observed in conjunction with epileptic seizures.

References

Allen B.D., Cummings J.F., De Lahunta A. "The effect of prefrontal lobotomy on aggressive behavior in dogs". Cornell Vet (1974) 64: 201-216.

De Lahunta A., Glass E., Kent M. "Non-olfactory rhinencephalon: limbic system" in: Veterinary neuroanatomy and clinical neurology (2015) 17: 470-475.

Duffy D., Hsu Y., Serpell J. A. "Bred differences in canine aggression". Applied Animal Behavior Science (2008) 114: 441 – 460.

Gazzano A. 2013, "Dog Ethology Manual". ETS Editions. Pp: 36-43.

Gazzano, A., Mariti, C., Sighieri, C., Ducci, M., Ciceroni, C., & McBride, E. A. (2008). Survey of undesirable behaviors displayed by potential guide dogs with puppy walkers. Journal of Veterinary Behavior: Clinical Applications and Research, 3(3), 104–113. https://doi.org/10.1016/j.jveb.2008.04.002

Gazzano, V., & Ogi, A. (2020). Canine phobia. Dog Behavior, 6(2). https://doi.org/10.4454/db.v6i2.121

Gazzano, V., Curadi, M. C., Baragli, P., Mariti, C., Cecchi, F., Cavallo, S., Sacchettino, L., & Gazzano, A. (2025). Physiological and Behavioral Evaluation of Shelter Dogs During Veterinary Routine Health Checks. Veterinary Sciences, 12(6), 583. https://doi.org/10.3390/vetsci12060583

Iacopini, L., & Gazzano, V. (2023). Analysis of the management of a shelter dog kennel. Dog Behavior, 9(3), 41-45. https://doi.org/10.4454/db.v9i3.183

Landsberg G., Hunthausen W., Ackerman L. 2013, "Behavior Problems of the Dog and the Cat". Saunders Elsevier, pp: 124, 351, 355-356.
Mann J.J. "Violence and aggression" in: Bloom F.E., Kuppfer D.J. "Psychopharmacology: the fourth generation of progress" Raven Press, NY, 1919-1928.
Mariti C. "Dog breeds and aggression" Master Clinical Ethology, University of Pisa, 2016.
Mehlman P.T., Higley J.D., Faucher I., Lilly A.A., Taub D.M., Vickers J., Suomi S.J., Linnoila M. "Low CSF 5-HIAA concentrations and severe aggression and impaired impulse control in non-human primates". American Journal of Psychiatry (1994) 151 (10): 1485-1491.
Overall K.L., 2001, "The behavioral clinic of dogs and cats". C.G. Medical Scientific Editions, pp: 167, 181-184.
Pageat P., 1999, "Behavioral pathology of the dog". Point Veterinaire Italy, pp: 222-223, 261-265.
Pallanti S., Bruscoli M., Quercioli L., "Psychopathology of impulse control disorder not otherwise specified". Noos 2003; 9 (2): 107-123.
Pierantoni, L., Albertini, M., & Pirrone, F. (2011). Prevalence of owner-reported behaviours in dogs separated from the litter at two different ages. Veterinary record, 169(18), 468-468.
Podell M., "Seizures in dogs". Vet. Clin. North Am. Small Anim. Pract. 1996; 26 (4): 779-809.
Reisner I.R., Mann J.J., Stanley M., Huang Y.Y., Houpt K.A. "Comparison of cerebrospinal fluid monoamine metabolite levels in dominant-aggressive and non-aggressive dogs". Brain Research (1996) 714 (1-2): 57-64.
Riva J., Bondiolotti G., Trotti A., Verga M. "Possible relationships between anxiety-based behavioral disorders in dogs and neurotransmitters". Veterinary Praxis (2007) 28: 3-10.
Sheard M.H. "Clinical pharmacology of aggressive behavior". Clinical Neuropharmacology (1984) 7: 173-183.
Shihab N., Bowen J., Volk H.A. "Behavioral changes in dogs associated with the development of idiopathic epilepsy". Epilepsy and Behavior. 21 (2011); 160-167.
Soubrie P. "Serotonergic neurons and behavior". Journal of Pharmacological Sciences (1986) 17 (2): 107-112.
Svartberg K. "Individual differences in behavior – Dog personality" in: The behavioral biology of dogs. (2007) 11: 182-206.
Van Den Berg L., Schilder M.B.H., Knol B.W. "Behavior genetics of canine aggression: behavioral phenotyping of golden retrievers by means of an aggression test". Behavior Genetics (2003) 33: 469-483.

Alterazioni neurologiche e comportamentali: un caso di aggressività correlata a crisi epilettiche

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Sintesi

Yoda era un cane che ha iniziato improvvisamente a manifestare comportamenti aggressivi nei confronti dei suoi proprietari. Sebbene questi episodi si siano presentati inizialmente come improvvisi e isolati, nel tempo si sono progressivamente aggravati, aumentando sia in frequenza che in intensità. Gli esami del sangue non hanno evidenziato anomalie; tuttavia, la risonanza magnetica cerebrale ha indicato uno stato di sofferenza corticale. Il cane è stato successivamente sottoposto a eutanasia, e l'esame istopatologico del tessuto cerebrale ha rilevato la presenza di neuroni ischemici, compatibili con una possibile condizione epilettica manifestatasi durante la vita, che potrebbe essere stata responsabile del comportamento aggressivo.