Treating house-soiling behavior in a dog with pachygyria, hydrocephalus and cerebellar hypoplasia

G. Riggio[1*], A. De Cesare[2]

[1] *Medicina Comportamentale Veterinaria, Rome, Italy*
[2] *Clinica Veterinaria Cassia, Rome, Italy*

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Abstract: A 1-year-old female mongrel dog was evaluated for house-soiling behavior. The dog had a diagnosis of cerebellar hypoplasia, pachygyria and hydrocephalus. In addition, she had been suffering from epileptic seizures for which she was being treated pharmacologically. Blood tests and abdominal ultrasound examination ruled out portosystemic shunt or other possible organic causes of seizure, lethargy and dullness. The patient's behavioral history revealed an extremely high daily frequency of urination (20-30/day) and defecation (6-8/day), most of which occurred inside the house and far from the potty-pads. Behavioral observation revealed increased locomotor activity and agitation right before the elimination events. Urinalysis were within normal range. Water intake was normal. A behavioral diagnosis of lack of housetraining was made. A housetraining program based on positive reinforcement was implemented alongside with an environmental enrichment program involving the use of feeding balls, social interactions and adequate environmental exploration. Despite the owner's compliance, the high frequency of elimination episodes rendered the therapeutic intervention very difficult. Surprisingly, after neutering urination frequency dropped to 3-5 times a day. However, after 3 months from the beginning of the treatment, while clinical improvements were evident, no improvement could be observed in housetraining. At this point, a decision was made to introduce a soft carpet beneath the potty-pad in order to facilitate the patient's associative learning processes. After 3 months, episodes of house-soiling decreased from 60% to 30%. After 3 more months the owner reported that the dog would only eliminate on the potty-pad except when left alone. Implications of this behavior were explained to the owner, but she decided to avoid further behavioral evaluation.

Key Words: house-soiling; dog; pachygyria; hydrocephalus and cerebellar hypoplasia.

* *Corresponding Author*: giacomoriggio@gmail.com

Presentation

A 1-year-old 11. 1 Kg female mongrel dog was evaluated for house soiling behavior. The dog had a diagnosis of cerebellar hypoplasia, pachygyria and hydrocephalus.

History and presenting signs

The patient was part of a litter in which four puppies deceased during the perinatal period. Her parents were siblings. From the moment she was born, the patient showed difficulty in feeding. Her body growth appeared slower than that of her remaining siblings. Within the first week of lactation the mother started to refuse her, and the owner decided to hand-raise her with artificial milk. At 45 days of age the patient was adopted by her current owner. Sensory depression and ambulation problems were immediately noticed. After a few frequent episodes of generalized seizures with no loss of consciousness the dog underwent a complete neurological examination and was diagnosed with cerebellar hypoplasia, internal and external hydrocephalus and pachygyria.

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Levetiracetam and, at a later stage, Phenobarbital were prescribed as a treatment for epilepsy and the seizures were successfully kept under control. Only one or two episodes a month would occur in situations of emotional arousal. At 1 year of age, the neurologist of reference recommended a behavioral consultation as the dog would still urinate and defecate inside the house and this seemed not to be related to her neurological condition. Frequency of elimination had always been higher than normal, although it slightly decreased over time, ranging from 20 to 30 urination episodes/day and 6 to 8 defecation episodes/day at the time of the behavioral evaluation. Eliminations mainly, but not always, occurred inside the house. In addition, stools were often moist and with no distinct shape. Night sleep was usually interrupted in order to urinate. However, this would only occur once throughout the night. A few episodes of nicturia were also reported. Apart from that, sleep/wake cycle appeared to be normal. Both urination and defecation were always preceded by a state of agitation that lasted a few seconds and terminated once the dog assumed a stable posture to eliminate. The owner made several attempts to teach the dog to use the potty-pad or eliminate outside through a mix of positive reinforcement and punishment-based techniques. The dog would be scolded for house-soiling and praised for eliminating on the potty-pad or outdoor. Possibilities to eliminate outdoor was also very limited as the dog would be taken for a walk only 5-6 times a week, on average.

Examination

The behavioral evaluation took place at the owner's house. The dog showed normal inspection behavior as well as greeting behavior toward the author. No signs of fear toward an unfamiliar person were observed. The evaluation lasted approximately 2 hours during which the dog urinated 3 times and defecated once. Feces were very moist and did not have a defined shape (Score 4 of the Waltham Faeces Scoring System). Both urination and defecation were preceded by whining and hypermotility. One potty-pad was available in one of the rooms. However, the owner reported that the dog would indistinctly eliminate in other areas of the house. Balance and coordination problems were evident both when standing and moving, especially on irregular surfaces. Outside the dog appeared excited but yet able to focus on environmental smells. No fear of environmental stimuli nor intense noises was observed. Interactions with other dogs were behaviorally appropriate. Learning capabilities could not be quickly tested with simple commands that require a static posture such as "sit" because of her severe incoordination problem. Instead, a feeding ball filled with palatable food was offered to the dog in order to see whether she was able to interact with the object and to what extent. During the "test" the dog would remain in proximity of the feeding ball but would not voluntarily interact with it.

Physical evaluation and laboratory findings

Because of her serious medical condition, the patient underwent several diagnostic tests during her first year of life. Thyroid function test was performed at 45 days because congenital hypothyroidism was suspected as a cause for the patient's delayed growth, lethargy and dullness. However, thyroid levels were unremarkable. For the same reason levels of ammonia in blood were tested but they also were unremarkable. Normal biliary acid levels and abdomen ultrasonography ruled out portosystemic shunt as a possible cause for epilepsy. Neurological examination performed at 2 months of age revealed cerebellar ataxia, absent response to the menace reflex and to the cotton drop test, but no apparent severe visual deficit. Contrast-enhanced Magnetic Resonance Imaging (MRI) analysis revealed a severe volumetric reduction of the brain, absence of cortical sulci in the cerebral hemispheres, severe bilateral dilatation of the lateral ventricles, dilatation of the third,

the fourth ventricle and quadrigeminal cistern, as well as a marked ectasia of the subarachnoid space for the all length of the brainstem until C2-C3 intervertebral disc space. Imaging of the cerebellum revealed deep sulci and absence of the inferior portion of the vermis. Short before the behavioral evaluation CBC, serum biochemistry, urinalysis, fecal flotation and Giardia test were performed. Results were unremarkable except for a mild anemia. Water intake was also assessed because of the patient's polyuria, but it was within normal range.

Diagnosis

A behavioral diagnosis of inappropriate elimination due to inadequate housetraining was made (Landsberg et al., 2013). However, as it has been observed in similar neurological conditions in which brain parenchyma is structurally altered, the patient's reduced learning capabilities may have played a key role in the failure of housetraining (Lee et al., 2011). The extremely high frequency of elimination was not considered to be of behavioral origin, although it surely affected the education process. On the contrary, signs of agitation immediately before elimination may have had a behavioral basis as they would not appear or would be much less intense when elimination occurred outdoor, either on the balcony or during walks. Symptoms of anxiety, in this specific situation, may have developed as a result of scolding when no clear alternative was offered to perform the correct behavior or from contrasting the innate tendency of the dog to eliminate far from the daily living space. Furthermore, a sense of urgency to eliminate may have also been present as a result of the primary central nervous system lesions, affecting the patient's capability to adequately process and respond to stimuli generated by the filling of the bladder and the presence of stools in the anorectal portion of the intestine.

Treatment

The dog was prescribed a balanced home-cooked diet with pork as only protein source in order to rule out food intolerance from the causes of diarrhea. Furthermore, the owner was asked to administer food three times a day always at the same hour in order to render time of defecation more predictable and training easier. Because of the high frequency of elimination, a decision was made to focus on teaching the dog to use the poddy-pad rather than eliminating outdoor. Four pads were taped together to increase the dogs' chances to urinate on them and prevent errors caused by incoordination. The owner was asked to keep the dog on leash when inside the house as no other alternatives to effectively predict such a high frequency of urination were found. In addition, she was taught to anticipate soiling behavior by taking the dog to the potty-pad every 20-30 minutes. If the dog soiled she would have to promptly reinforce her with her favorite toy, a plastic bottle. On the contrary, if the dog eliminated on the floor, she would have to ignore her. Plastic bottle as a reinforcer was chosen because the patient would immediately react to the sound of the crinkling plastic. If food treats were used, she would not be able to easily locate and grab them, making impossible for the owner to assess whether the timing of reinforcement was correct. Besides working on eliminations, the owner was required to daily provide the patient with the proper physical and mental stimulation. First, she would have to take the patient for three walks a day. During these walks she would have to pass through different types of terrain and surfaces with the objective of improving the patient's coordination. Second, she would have to provide her with enrichment toys and games, such as feeding balls and nose-working, when at home. In order to assess the progression of the training, the owner was asked to keep an elimination diary were she would report: 1) type (feces/urine), 2) place (on the potty-pad/inside the potty-pad room/outside the potty-pad room), 3) time of the day, 4) whether the patient was taken to the potty-pad or went there by herself.

Follow up

Within two weeks the owner reported that both consistency of stools and frequency of defecations improved. After one month the patient would actively interact with the feeding ball by hitting it with her nose. On the other hand, no real improvement was observed for the primary problem of house-soiling behavior during the first month of training. At about the same time, the patient underwent a neuter surgery for reasons not related to her behavior. An immediate dramatic drop in the number of urination events occurred after neutering. At the time of the surgery, urination frequency ranged from 15 to 25 episodes/day. From the day after the surgery it decreased to 3-5 episodes/day. The surgery revealed a hypertrophic uterus, which had not been observed during the previous ultrasonographic exam. However, two months after the neutering, house-soiling had barely improved. Although the owner reported a progressive improvement in the patient's clinical conditions, such as better coordination during walks and greater responsiveness to environmental stimuli, the dog would still eliminate out of the potty-pad 60% of times. At that point, a decision was made to place the four potty-pads on a thick soft carpet in order to more strongly differentiate the potty zone from the rest of the house floor. The possibility to teach the dog to eliminate outdoor was momentarily discarded because of the apparent sense of urgency the dog still showed right before elimination and because of her reluctance to urinate or defecate during walks. A neurological examination undertaken at 18 months revealed a noticeable improvement in balance and coordination during both standing and ambulation. A progressive improvement was also observed in house-soiling behavior. Three months after the introduction of the carpet under the pads the patient would inappropriately eliminate only 30% of times. However, some of these episodes of inappropriate elimination would occur right on the edge of the pads and were most likely ascribable to the patients' difficulty in coordination. Also, whining before elimination behavior finally stopped. Nine months from the behavioral evaluation and 6 months from the introduction of the carpet the owner reported that the dog stopped house-soiling except for some urination episodes occurred when left at home alone. Possible implications of such a behavior were explained to the owner, but she decided to avoid further behavioral evaluation.

Summary and discussion

Difficulty in housetraining has been described in scientific literature on dogs affected by central nervous system diseases (Lee et al., 2011). Such difficulty can be explained by both reduced learning abilities and abnormalities in processing and responding to visceral stimuli (Griffiths et al. 2005). Furthermore, other unrelated medical conditions may overlap and complicate the clinical behavioral picture. In this case, high frequency of defecation episodes was most likely caused by food intolerance, since the sole treatment with a monoprotein home-cooked diet led to the resolution of the symptoms. Similarly, high frequency of urination episodes seemed to be caused by a mechanical pressure by a hypertrophic uterus on the urinary tract. Unlike other cases of patients with similar neurological conditions, this dog did not show any signs of aggressive or compulsive behavior (Fraser et al., 2016). Nonetheless, even in the absence of these symptoms, simple training of dogs with such a serious neurological condition may be extremely long and complex. Affected individuals may have different degrees of cognitive impairment, which makes the prognosis absolutely reserved. The owner's compliance and will to not give up on the dog is therefore essential. In this specific case, the owner followed our instructions even after a three month-long treatment plan had given no satisfactory results. From the very beginning we implemented an environmental enrichment (EE) program based on data from human scientific literature (Voss et al., 2013; MacDonald et al., 2018) and on our clinical knowledge with patients suffering from more common neurological conditions such as elderly dogs diagnosed with Cognitive Dysfunction Syndrome

(Milgram et al., 2004). In general, human scientific literature supports the use of sensory stimulation as a form of EE to improve cognitive and motor functions in children with diseases that affect the central nervous system (Blauw-Hospers & Hadders-Algra, 2005), to prevent the development of cognitive and motor impairment in high risk individuals (Blauw-Hospers et al., 2007) and to stimulate the proper development of brain and sensory systems (Guzzetta et al., 2009, Alwis & Rajan, 2014). In relation to the neurological lesions found in our patient, experimental studies on animals suggest that sensory stimulation programs may be beneficial in the treatment of motor and learning impairment in hydrocephalic individuals by enhancing myelination and neurogenesis, by attenuating reactive astrogliosis and microglial response to the compression caused by ventricular dilatation (Catalao et al., 2017) and by affecting the expression of genes in neuronal structure, synaptic signaling, and plasticity (Rampon et al., 2000). Nevertheless, although the EE program was implemented from the beginning of the treatment, a dramatic change in our patient's response to housetraining was only observed after the introduction of the carpet under the potty-pad. It is possible that the carpet operated to facilitate the dog's process of sensory discrimination between the elimination zone and the rest of the apartment's floor. More data on clinical application of sensory stimulation and EE programs in patients with reduced cognitive abilities associated with neurological damages are required in veterinary medicine.

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Trattamento del comportamento di eliminazione inappropriata in un cane con pachigiria, idrocefalo e ipoplasia cerebellare

G. Riggio[1]*, A. De Cesare[2]

[1] *Medicina Comportamentale Veterinaria, Rome, Italy*
[2] *Clinica Veterinaria Cassia, Rome, Italy*

Sintesi

Una femmina meticcia di un anno di età è stata valutata per un problema di eliminazione inappropriata. Il cane aveva ricevuto una diagnosi di ipoplasia cerebellare, pachigiria ed idrocefalo. Inoltre, il cane soffriva di attacchi epilettici per i quali era trattata farmacologicamente. L'esame del sangue e l'esame ecografico addominale esclusero la presenza di uno shunt portosistemico o altre possibili cause di attacchi epilettici, letargia o ottundimento del sensorio.

L'anamnesi comportamentale del paziente rivelava una frequenza giornaliera molto alta di urinazioni (20-30/giorno) e defecazioni (6-8/ giorno), molte delle quali avvenivano all'interno della casa e lontane dalle traverse igieniche.

L'osservazione comportamentale rivelava un'aumentata attività locomotoria ed agitazione proprio prima delle eliminazioni.

Le analisi delle urine erano normali, come pure la quantità di acqua assunta giornalmente. Fu emessa una diagnosi di mancato apprendimento dell'eliminazione corretta. Fu quindi previsto un programma basato sul rinforzo positivo con un arricchimento ambientale, utilizzando giocattoli dispensatori di cibo, interazioni sociali ed adeguata esplorazione ambientale.

Nonostante la collaborazione del proprietario, l'alta frequenza degli episodi di eliminazione rendeva l'intervento terapeutico molto difficile.

Sorprendentemente dopo la castrazione, la frequenza di urinazione si ridusse a 3-5 volte al giorno. Comunque, dopo tre mesi dall'inizio del trattamento, mentre erano evidenti miglioramenti clinici, nessun progresso era osservato nella gestione delle eliminazioni. A questo punto fu presa la decisione di introdurre un tappeto soffice sotto la traversina igienica per facilitare i processi di apprendimento associativo del paziente.

Dopo tre mesi, gli episodi di eliminazioni incontrollate si ridussero dal 60 al 30%. Dopo ulteriori tre mesi il proprietario riferì che il cane voleva sporcare esclusivamente sulla traversina igienica, ad eccezione di quando era lasciato da solo. Le implicazioni di questo comportamento furono spiegate al proprietario che decise di evitare ulteriori valutazioni comportamentali.