




PHYSIOTHERAPY SUPPORT FOR TREATMENT OF ACUTE POLYNEUROPATHY IN THREE YORKSHIRE TERRIER DOGS: CASE REPORT

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ABSTRACT

Polyneuropathy in dogs is an often-diagnosed neurological disorder characterized by the impairment of peripheral nerves. In this case report, we describe clinical cases of acute polyneuropathy in three Yorkshire Terrier dogs. These Yorkshire Terriers consist of 1 female and 2 males and range from 2 to 7 years in age, and 3–6 kg in body weight. The animals were subjected to the rehabilitation treatment consisting of physical therapy, kinesiotherapy and manual therapy. On average, the therapeutic sessions took place every 2–3 days, in total 15–20 sessions were held. In addition, each dog received an individually tailored set of home exercises. This report determines the impact of physiotherapy on the course and duration of treatment, and on the level of patient's regained mobility. The physiotherapeutic regimen was prescribed for this disease entity. The detailed neurological tests and other examinations, including blood tests were performed prior to commencing rehabilitation sessions. During the physiotherapy treatment, all three dogs showed marked clinical improvement although the pace of their recovery was different. Duration of therapy was extended in particular for one subject dog due to complications caused by an acute gastrointestinal infection. This work's findings based on analysis of three clinical cases strongly suggest the necessity to adjust the physiotherapy program to the current health status of an individual dog in order to provide safe therapy while avoiding complications. Rehabilitation plays a key role in the treatment of patients with neurological diseases, including those with acute polyneuropathy. Physiotherapy has made it possible to significantly shorten the duration of the illness while accelerating nervous system regeneration and reducing the risk of complications.

Key words: neurological diseases, endocrinopathies, physical therapy, kinesiotherapy, manual therapy

INTRODUCTION

Polyneuropathy in animals is a neurological disorder characterized by the impairment of multiple peripheral nerves [Tsuboi et al. 2013]. The aetiology of the disease can be very diverse. It may occur in infectious or immune-system-dependent diseases, be inherited or concurrent with endocrinopathy, malignancy, or chemical poisoning. It is often difficult to determine its aetiology on the basis of clinical symptoms. Acquired peripheral neuropathies occur in acute and chronic forms. The most common initial symptoms of the disease are: lack of coordination and stability, progressive weakening of reflexes, and a decrease in muscle tension, as well as

paralysis and the impairment of sensory functions. The above symptoms are likely related to a denervation and decline in the nerve conduction velocity (NCV) of the nerves affected by the disease [Taylor 2009]. The most severe dysfunctions involve somatic nerves, although the function of autonomic nerves can also be significantly impaired. Because dysfunction of the autonomic nerves may cause laryngoparalysis or pharyngoplegia, aspiration pneumonia leading to the death of dogs with polyneuropathy is often a complication of the disease [Braund et al. 1989, MacPhail and Monnet 2001, Gabriel et al. 2006, Jeffery et al. 2006, Thieman et al. 2010]. The most common acquired neuropathies include an acute idiopathic polyradiculoneuropathy (ACP), otherwise known

as Coonhound syndrome (CHF) [Cuddon 2002]. As the condition primarily affects the nerve roots and proximal nerve segments, it is reasonable to describe it as “acute idiopathic inflammation of multiple roots and nerves” (*Polyradiculoneuritis idiopathica acuta*). The lesions are more frequently visible in the ventral roots rather than in the dorsal roots, as well as in the proximal nerve sections, leading to nerve demyelination and degeneration [Jaggy 2010].

Although factors favouring this type of neuropathy include contact with raccoon saliva (*Procyon lotor*), this disease is also present in areas where this species does not inhabit. Other predisposing factors include recent upper respiratory tract viral infections, digestive tract infections of viral and bacterial origin, and recent vaccination, in particular against rabies [Cuddon 2002]. It is believed that polyneuropathy is likely related to the immune system diseases of unknown etiology [Jaggy 2010]. When making a diagnosis, a clinician must be able to distinguish polyneuropathy from other disorders that cause paresis or tetraplegia, for example, from tick paralysis, botulism and fulminating myasthenia gravis [Cuddon 2002].

The first symptoms of the disease appear within 7–14 days after the incident that triggers the illness [Cuddon 2002]. The initial symptoms of the disease include instability and lack of coordination, which then transform into decline of muscle strength and spinal reflexes, paralysis and sensory deficits [Tsuboi et al. 2013]. The severity of the condition determines the degree of neurological changes [Kornegay and Lorenz 2004]. It is a disorder characterized by the progressive dysfunction of the lower motor neuron. At first, this condition affects the pelvic limbs, and then the thoracic limbs [Platt and Olby 2014].

Occasionally, disorders of the forelimbs are more severe than those of the hind limbs. Paresis occurs within 12 to 24 hours [Chrisman et al. 2003]. Some animals may maintain the quadruped position and be able to conduct voluntary movements, while others may suffer from paralysis of the four limbs and inability to hold up the head and neck. As a result of paralysis of the intercostal muscles and diaphragm, they suffer from respiratory insufficiency [Cuddon 2002]. There is always significant neurogenic muscle atrophy that is not evident in the early stages of the disease. Despite the severe paresis or paralysis that occurs in this type of neuropathy, most dogs are still alert and responsive to the environment, are able to vigorously wag their tails, continue to eat and drink normally, and voluntarily urinate and defecate. During the first few days of the disease some dogs do not urinate, which leads to urinary catheterisation. Abdominal breathing, hypoventilation and tissue hypoxia are observed in cases of severe respiratory insufficiency [Chrisman et al. 2003]. Owners often report a change in the voice emitted by an animal, which is associated with a partial laryn-

goparalysis. After the progressive phase is over, the animal's condition stabilizes although it still experiences some paresis or paralysis, and its condition remains at this level for 2 to 3 weeks, sometimes even to 4–6 months. In polyneuropathy the following correlation has been established: the more severe the paresis or paralysis in the acute phase of the disease, the longer the recovery time.

Apart from the acute forms of polyneuropathy, we also distinguish its chronic forms. It is caused by endocrinopathies (hypothyroidism, adrenocortical hyperfunction, diabetes, immune-mediated diseases (e.g. systemic lupus erythematosus), infections (neosporosis, toxoplasmosis), drugs and toxins (vincristine, cisplatin, vinblastine), neoplasia, or is idiopathic [Hanks et al. 2015]. Peripheral neuropathy is the most common neurological symptom of hypothyroidism in dogs. Unfortunately, electrodiagnostic tests in polyneuropathy caused by hypothyroidism are very rarely performed, and they are not repeated after hormonal treatment [Giza et al. 2016].

Diagnostic management in polyneuropathy commences with a detailed neurological examination, and comprehensive blood and urine tests. A blood test may help diagnose hypothyroidism or immune system-related thrombocytopenia.

Tests of the level of total and free thyroxine (t^{-4}) and the level of TSH allow assessing thyroid gland function. To evaluate adrenal function the urine cortisol/creatinine ratio should be determined and the ACTH stimulation test or the dexamethasone inhibition test and cortisol measurement should be performed. These tests will detect both cases of overactive adrenal glands and adrenal insufficiency that may cause polyneuropathy.

If the above tests do not explain the aetiology of peripheral neuropathy, radiography of the chest and abdomen, as well as an ultrasound examination of the abdomen should be performed in order to find a malignant tumour as a cause of neuropathy, the so-called paraneoplastic polyneuropathy. The electrophysiological evaluation of peripheral nerves and nerve roots combined with biopsy of the muscle tissue and nerve bundles is a decisive examination [Cuddon 2002].

Despite many toxicological, biochemical, histochemical, histopathological and electrophysiological examinations, as well as biopsy of the muscle tissue and nerves [Cuddon 2002], the clinician is often unable to determine a specific factor causing the disorder [Kornegay and Lorenz 2004, Tsuboi et al. 2013]. However, most importantly, with proper care, normal lung function and correct rehabilitation, the majority of animals recover within 3–6 months [Platt and Olby 2014].

CASE DESCRIPTION

Three Yorkshire Terrier dogs were examined, diagnosed and rehabilitated: No. 1: 7-year and 3-month-old male,

No. 2: 2-year and 6-month-old female, No. 3: 4-year and 9-month-old male. At the initial diagnostic stage, all dogs had a general blood, urine, and hormonal tests to exclude abnormalities in the thyroid gland and adrenal glands. All results were within reference ranges. Infectious and poisoning factors were also eliminated. As a result, the analysed cases were diagnosed as acute idiopathic polyneuropathy, and the animals underwent the rehabilitation with simultaneous medical-veterinary care. The treatment of early-stage disease was based on controlling and supporting proper defecation and combating complications, which included respiratory infection in one dog, gastrointestinal problems in another dog, and urinary tract infection in two dogs. During the treatment, the animals underwent similar physiotherapeutic procedures: physiotherapy, kinesiotherapy and manual therapy. On average, the therapeutic sessions were held every 2–3 days; from 15 to 20 sessions for each patient. In addition, each dog received an individually tailored set of home exercises (including passive exercises for the thoracic and pelvic limbs, stimulation of the fingers to exercise the withdrawal reflex, at a further stage, active exercises with the use of sensorimotor cushions and mats). These sets of exercises were performed twice a day.

Dog No. 1 “ENTER”

A 7-year and 3-month-old Yorkshire Terrier dog was admitted to The Small Animal Rehabilitation Center in Bydgoszcz, Poland on 23rd January 2015, about a week after the first symptoms of the disease appeared. With no proper diagnosis, it was previously treated in other treatment centres and received mainly steroidal anti-inflammatory drugs and antibiotics.

The dog's medical history obtained from the owners revealed that the animal stopped walking, constantly stayed in a lying position, and had difficulty in raising its head four days after displaying the first signs of the disease. It also suffered from generalized muscle pain. The owners, on their own initiative and based on information obtained on the Internet, started rehabilitation using exercises performed in water, and passive exercises.

During the initial examination the patient was diagnosed with flaccid tetraplegia. The dog was able to raise its head freely and had muscular hyperalgesia. It had problems with passing urine and stools, showed the features of generalized muscle atrophy of the medium degree, and distinct features of dysphonia.

The implemented rehabilitation program included the use of low-frequency magnetic field utilizing multi-disks (quadruple disks) with the parameters of 5–6 mT, 60 Hz, time 30 minutes. A total of 15 such procedures were performed. During the magnetotherapy treatment the dog was in a sternal recumbent position with the discs positioned paraspinally. Then, passive exercises of all joints were repeated 10 to 20 times, 2–3 times a day, compres-

sion of the pads of the forelimbs and hind limbs – 20 compressions, 2 times a day, along with strengthening exercises based on learning how to take sternal recumbent position from the lateral recumbency. As muscle strength increased, the exercises using a “peanut” type rehabilitation ball were introduced. At the beginning, the dog was placed on the ball in the sternal recumbency, then its position was changed to sitting and standing. The ball was moved in all possible directions. The exercises using the ball lasted up to 10 minutes, depending on the condition of the dog. The final stage of the rehabilitation consisted of performing proprioception exercises using Cavalletti hurdles, sensorimotor cushions, balance pods and balance discs. The hurdles were initially laid on the ground and spaced wide enough for the dog to pass freely. Next, the level of difficulty was adjusted by changing the height and width of the hurdles. In the first week of rehabilitation the sessions were held every day, then every 2–3 days. From the second week, exercises in the water treadmill (15 therapeutic sessions) were also included. Initially, the sessions lasted about 4–5 minutes, and in the final stage they were extended to 10 minutes. Dog No. 1 participated in a total of 20 therapeutic sessions. In addition to the clinic-based treatments, the pet owners conducted intensive rehabilitation at home, in accordance with the developed exercise program, including active and passive exercises as well as water activities, which consisted of regular baths and water massage in a tub.

Dog No. 2 “TOSIA”

On 25th March 2015, a 2 years and 6 month – old female Yorkshire Terrier with symptoms of diagnosed polyneuropathy was admitted to The Small Animal Rehabilitation Center in Bydgoszcz, Poland. The diagnosis had been made a few days earlier by a neurosurgeon in another veterinary hospital and was based on a clinical examination as well as the CT myelogram procedure. The general diagnostic test performed at the veterinary office, revealed that the patient's general condition was fair; tetraplegia and dysphonia were diagnosed. The rehabilitation began on the same day.

The physiotherapeutic procedures included magnetotherapy (15 procedures) with the use of multidisks (quadruple disks) with parameters of 5–6 mT, 60 Hz, time 30 minutes. During the procedure the dog was placed in the sternal recumbent position, while the disks were put paraspinally, just like in dog No. 1. Kinesiotherapy consisted of: passive exercises of all joints, repeated 20–30 times, attempts to maintain the sternal recumbency independently, and 20 repetitions of pads compressions. Next, verticalization with the use of a harness was introduced. The duration of verticalization lasted 5–10 minutes. Exercises in water were not included in the rehabilitation program due to the dog's fear of water.

Therapeutic sessions were held every day or every other day, depending on the time commitments of the owners. It is worth noting that the owners diligently performed scheduled rehabilitation at home, including passive exercises of all joints (20–30 repetitions, 2–3 times a day), compression of the pads (20 times, 2–3 times a day), and attempts at independent standing. Since this particular dog had contracture of the wrist joints, it was recommended to straighten the wrists with plastic joint stabilizers fastened with self-adhesive plasters. In total, this dog received 20 in-clinic therapeutic sessions.

Dog No. 3 “EVER”

On 30th December 2016, a 4-year and 9-month male Yorkshire Terrier was admitted to the clinic. The medical history gathered from the owner revealed that the day before the medical consultation, the dog stopped jumping onto the couch and started to bark “weirdly”. In addition, it gave the impression of being weak. While walking, it involuntarily threw the back of its body. The dog lost its appetite and had diarrhoea.

The neurological examination of this animal revealed significant ataxia and exhibited symptoms of a proprioceptive deficit (the paw replacement test- 2 second instead of less than 1 second). At the same time, other neurological reflexes were normal. Polyneuropathy was presumed to be the preliminary diagnosis. In the following days the neurological condition of the dog deteriorated. The complete tetraplegia and an inability to hold the head were observed. The patient received pharmacological treatment for urinary and digestive tract infections. The dog was given antibiotics, NSAID and intravenous fluid therapy. The treatment time was 10 days. Two days after the end of drug treatment, the dog started the rehabilitation.

Among physical treatments low-frequency magnetic field was used with multidiscs (quadruple discs) with parameters of 5–6 mT, 60 Hz, time 30 minutes. The discs were placed paraspinally while the dog was in a lateral recumbent position. Kinesitherapy included passive exercises of all joints (10–20 movements, 2–3 times a day), full body massage, and compression of the pads (20 compressions, 2–3 times a day). On day 7 there was a slight neurological improvement, and the dog began to keep its head up. In the following days further improvement of the health was observed. According to the owners, “Ever” became more mobile, but there was still a problem with maintaining the sternal position and while performing postural test.

At the beginning of February 2017 the health of the dog deteriorated, which was manifested by lack of appetite, diarrhoea, fever, and reluctance to drink. Therefore, the rehabilitation was discontinued until the clinical condition of the dog improved. The patient was again treated with antibiotics and intravenous rehydration

fluids. In the following days, the choice of exercises was adjusted to the variable state of the dog’s health condition.

The pet owners performed the recommended manual exercises and water exercises at home. These included passive exercises of all joints and compression of the pads (20 repetitions, at least once a day). It was also advised to try to place the dog in the sternal recumbent position. The neurological condition of the animal systematically improved. Since the health condition of dog No. 3 was unstable, the rehabilitation comprised of 20 therapeutic sessions in total, including 15 with a magnetic field as in patients 1 and 2.

The implemented rehabilitation plan for the dogs included treatments using manual therapy, kinesitherapy and physical therapy. The combination of these rehabilitation techniques helps reach the optimal treatment outcomes. Despite the acute, often severe course of the disease, the majority of ACP patients have a good prognosis, though the time of their complete recovery varies [Cuddon 2002, Platt and Olby 2014].

The improvement of the neurological condition of dog No.1 was noted after just one week of physiotherapy. At first, the dog began to regain its voice and raise its head. After about two weeks it began to raise its body, first on the forelimbs and then on the hind legs; after 3 weeks it started to walk on its own. The gait was unsteady and uncoordinated, and sometimes the dog fell down and had problems with maintaining balance. After another week of treatment, its mobility improved; the animal started climbing stairs on its own. At this stage the rehabilitation of dog No. 1 at the clinic was completed, and it was recommended to continue physiotherapy at home. After another month the dog regained complete neurological and motor efficiency. The total duration of treatment was 9 weeks. As in other patients, muscle strength and efficiency increased significantly after the introduction of active exercises, initially assisted, and then performed by the animals on their own. In order to evaluate the degree of muscle atrophy, and then its rebuilding, morphometric measurements of the peripheral muscles of the limbs were performed.

Dog No. 2 also recovered completely, but the process lasted longer, i.e. about 12 weeks. The first symptoms of improvement appeared after 3 weeks. Spasticity of the muscles that caused the joint stiffness was significant issue which required additional exercises and treatments. Generally, apart from the prevention of muscular atrophy which accompanies the disease, maintaining the full range of joint mobility is an important element of physiotherapeutic treatment of patients with polyneuropathy. A decrease in the muscle mass quickly progresses; it results from neurological paralysis of the muscles and the associated lack of muscle work. It applies to all patients with the same course of the disease. After 3 months of treatment,

the neurological examination of dog No. 2 showed no visible abnormalities. Its physical activity level returned to normal, and spasticity completely subsided. The effects of rehabilitation in dog No. 3 were similar to those obtained in dog No. 1, although in this case there were more complications due to paralysis as well as urinary and digestive infections which made regular rehabilitation impossible and required an individual physiotherapy plan and extended the dog's treatment time to 16 weeks.

The observations indicate that during the treatment of polyneuropathy the physiotherapist should cooperate with a veterinarian who will assess the clinical condition of the dog and the feasibility of the rehabilitation treatments ordered. The analysis of the 3 cases of dogs presented in this paper suggests the need to adjust the physiotherapy management plan to the current general condition of the dog so that the treatment is safe and does not cause unnecessary complications. As particular physiotherapy treatments have a certain group of contraindications (e.g. pregnancy, cancer, severe infections, fever, etc.), therefore before applying a given physical therapy the patient should be qualified accordingly. To sum up, the goals of physiotherapy set in the research for the 3 dogs with polyneuropathy have been achieved, and as a result the dogs completely recovered. The clinical features and treatment are presented in table 1.

Methods of rehabilitation recommended in dogs with ACP

Rehabilitation of animals with neurological diseases plays a vital role in veterinary medicine. The most important task of physiotherapy in neurological patients is to obtain the optimal functional results feasible at a given moment, and to improve the animal's quality of life [Lennon and Stokes 2009]. The rehabilitation programme primarily depends on the patient's condition, its functional needs, and the health goals we want to obtain [Owen 2006]. Prior to commencing rehabilitation, patients should be clinically stable. The key purpose, which is sometimes neglected in therapy, is the prevention or alleviation of secondary complications of the disease (bedsores, burns caused by urine, or infections) [Sims et al. 2015]. Rehabilitation should be multidirectional and include all available and possible techniques, such as physiotherapeutic treatments, elements of kinesitherapy, and massage.

The low-frequency magnetic field is one of the most common among the physical treatments used in veterinary medicine. It is applied because of its ease of performing and the lack of unpleasant sensations experienced by the patient. Experimental studies indicate the intensification of repair processes in the nervous tissue as a result of the magnetic field action [Shupak 2003].

Neurological patients with damage to the peripheral nervous system exhibit reduced electric excitability of the

muscles, which is why electrostimulation is useful in order to increase muscle strength [Pueyo 2012]. This type of procedure may bring benefits such as increased blood flow in the tissues and reduced risk of neurogenic muscle atrophy [Olby et al. 2005]. In most cases, electrostimulation is well tolerated by dogs. It happens, however, that when receiving unpleasant stimuli they try to escape or vocalize. Given the above, the current intensity should be increased very slowly during the procedure to give the patient an opportunity to get used to the new sensations [Hanks et al. 2015].

Cryotherapy may be another physical therapy procedure. Even though the use of cold is considered to decrease muscle strength, it can also be applied to increase muscle tone. The variety of cryotherapy applications may be associated with differences in intensity and depth of cooling. It is crucial to take into account the duration and the method of implementation while performing such a procedure [Robertson et al. 2006].

Apart from physical rehabilitation procedures, kinesitherapy including passive and stretching exercises, assisted exercises, free active exercises and sensorimotor exercises, plays an important role for patients suffering from paralysis or tetraplegia.

Passive exercises (PROM) are joint movements performed by the therapist within the available range of motion, without the involvement of the muscle tone. PROM exercises are always carried out in patients who are unable to move the joints independently [Millis et al. 2004]. The prevention of joint and muscle contractures, an increase in the blood and lymph flow, as well as the production of synovial fluid which reduces the destruction of the joint cartilage are some key benefits. It should also be mentioned that these exercises do not prevent muscular atrophy or increase muscle strength or endurance [Burnett and Wardlaw 2012]. It is worth remembering that when exercising in the lateral recumbent position, it is very important to maintain the neutral position of the limbs, and thus the proper muscular balance. For this purpose, we use, for example, cushions, which are placed between the thoracic and pelvic limbs [Carver 2016].

With reference to passive exercises, it is worth enriching them with the elements of stretching, which passively prolong the muscle tissue. Thanks to stretching, the contracted muscle returns to its original state. In order to ensure the safety of stretching, the following rules should be observed: warming up and loosening of the muscles, stabilization of the joints and the use of the straight plane of movements and tension [Foster and Foster 2009]. When exposed to heat, the tension of the muscle tissue decrease, whereas the elasticity of the connective tissue increases [Hanks et al. 2015]. In order to stabilize the joint, one hand is placed above and the other below the joint, and then the distal section of the limb is set in the maximum range, holding this position for 15–30 seconds [Pueyo

Table 1. Clinical features and treatment

| Case | Breed | Gender | Age | Major clinical signs | Physiotherapy Treatment | Time of recovery |
|----------|-------------------|--------|-------------------|--|--|------------------|
| Dog No.1 | Yorkshire Terrier | Male | 7 years, 3 months | Tetraplegia with inability to walk, muscular hyperalgesia, dysphonia, | Magnetotherapy, passive exercises, compression of the pads of the forelimbs and hind limbs exercises with a “peanut”, a ball, Cavalletti hurdles, sensorimotor cushions, balance pods and discs and exercises in the water treadmill, rehabilitation at home (passive and active exercises, regular baths and water massage in a tub). | 9 weeks |
| Dog No.2 | Yorkshire Terrier | Female | 2 years, 6 months | Tetraplegia and dysphonia, contracture of the wrist joints | Magnetotherapy, passive exercises of all joints, body massage, and compression of the pads, rehabilitation at home (compression of the pads, passive exercises, straighten the wrists with plastic joint stabilizers fastened with self-adhesive plasters), attempts at independent standing. | 12 weeks |
| Dog No.3 | Yorkshire Terrier | Male | 4 years, 9 months | Tetraplegia with inability to walk, inability to hold head, a proprioceptive deficit, muscular hyperalgesia, dysphonia, problems with passing urine and stools | Magnetotherapy, passive and active exercises, compression of the pads, body massage, rehabilitation at home (passive exercises of all joints and compression of the pads) | 16 weeks |

2012]. Bockstahler et al. [2004] state that the tension should be maintained from 30 to even 90 seconds, while Foster and Foster [2009] claim that stretching should last not shorter than 30 seconds, because both elastic and non-elastic muscle fibres must be targeted.

Assisted exercises in the standing position are performed to increase muscle strength, and improve the reception of external stimuli as well as neuromuscular transmission. In addition, they have a positive effect on the functioning of the cardiovascular and respiratory systems. These exercises are performed using, among others, slings, rollers and therapeutic balls [Millis et al. 2004]. When using a ball, we should always take into account its inflated level. The less inflated, the greater the contact surface with the ground and stability. Having this in mind, we can adjust the level of exercise difficulty by changing the air filling and choosing the right shape. The more inflated the ball, the more difficult the exercise, because of the greater possibility of free movements in all directions [Zink and Van Dyke 2013].

Exercises using the so-called “Cavalletti hurdles” are another improving element. The width between the hurdles and their height depends on the patient’s condition and the goal we want to achieve at a given stage of rehabilitation [Burnett and Wardlaw 2012]. The exercising animal has to move between hurdles, which improves proprioception, strengthens flexor muscles and increases the length of steps [Zink and Van Dyke 2013]. When performing this exercise, the patient is forced to raise the appropriate limb to pass over the subsequent hurdles. The degree of difficulty is regulated by placing the hurdles and

putting them at different heights [Robertson and Mead 2013].

Exercises with sensomotor cushions or equivalent boards also play an important role in the rehabilitation process of neurological patients. The use of this kind of device is aimed at stimulating the postural muscles of the pelvic and shoulder areas. The idea of using sensomotor discs is to strengthen weak muscles instead of stronger ones, and thus achieve muscle balance during the proper use of the device [Robertson and Mead 2013].

“Flexorreflex”, or **compression of the pads**, is the exercise designed mainly for neurological patients with different types of deficits. It involves compressing the interdigital spaces in such a way as to trigger the limb bending reflex. The resistance used by the therapist causes active muscular contraction, which in turn prevents muscular atrophy. It is recommended to repeat the exercise from 3 to 5 times, several times a day [Bockstahler et al. 2004].

It is also possible to use **elements of sensomotor stimulation** while rehabilitating the neurological patients. It involves the processing of the information received by the senses by the brain [Horowitz and Röst 2007]. We can also use, for example, an electric toothbrush or ice cube as a method of stimulation. Their task is to improve the quality of sensations [McGowan et al. 2007].

The massage elements possible to be applied are **stroking, kneading, patting and vibration**. Stroking is the most common technique used at the beginning and end of the procedure. It is also applied between particular techniques. [Millis et al. 2004]. Kneading is used to increase muscle tone. Its beginning is gentle, then we

gradually increase the compression, because pain can appear when massaging deeper tissues. Kneading should not be performed until the patient is relaxed [Bockstahler et al. 2004]. It ought to be carried out when the tissue is warmed and should omit areas located over the bones and delicate places [Robertson and Mead 2013]. The other two techniques, i.e. patting and vibration, are also used to stimulate the muscle tissue.

The attitude of the owner, who must show both involvement and the skills of reliable and systematic implementation of the home exercise programme, is also important [McGowan et al. 2007].

DISCUSSION AND CONCLUSIONS

Polyneuropathy is a neurological condition commonly diagnosed in dogs. It is often secondary in nature to a primary disease, e.g. hypothyroidism, Cushing's syndrome or diabetes [Platt and Olby 2014, Giza et al. 2016]. There are many publications thoroughly describing the causes of the disease, its anatomopathological changes, diagnostic methods and pharmacological treatment [Cuddon 2002, Thieman et al. 2010, Tsuboi et al. 2013, Platt and Olby 2014, Giza et al. 2016]. No significant correlation between risk for disease occurrence and age of a dog has been observed. In addition, there is no gender-related predisposition to polyneuropathy. However, it has been showed that recovery time of young animals is relatively shorter compare to a recovery period of mature dogs due to the greater regenerative abilities of the body. Obesity negatively affects recovery time and plays a key role in hindering the treatment [Cuddon 2002, Thieman et al. 2010, Tsuboi et al. 2013, Platt and Olby 2014, Giza et al. 2016]. Giza et al. [2016] conducted an electrodiagnostic analysis of 24 dogs suffering from polyneuropathy caused by hypothyroidism. The objective of this study was to carry out a detailed, retrospective analysis of electromyography (EMG), motor nerve conduction velocity (MNCV), F-wave and brainstem auditory evoked response (BAER) in dogs with symptoms of polyneuropathy. The tests were performed before and after levothyroxine supplementation. The results confirmed impaired nerve conduction indicating the demyelinating and axonal character of polyneuropathy in dogs. Levothyroxine treatment has been shown to significantly improve the clinical condition of the patient but it only gives a partial improvement of the results of electrodiagnostic tests. Tsuboi et al. [2013] examined pathological changes in the nerves of three dogs with polyneuropathy. They demonstrated different histopathological changes, including axon oedema and the weakening of myelin. Large axons were found in one of the dogs, while the other one suffered from axonal atrophy and interstitial oedema. Generally, the types of pathological changes to a large extent depend on the factor causing the disease,

and illness duration. Another study conducted a detailed analysis of 10 cases of dogs displaying the symptoms of peripheral nerve dysfunction of undetermined aetiology. It was shown that paralytic symptoms intensified within 1 to 21 days after the first signs of the disease. The results of electromyography and nerve conduction examination confirmed nervous conduction impairment, typical of polyneuropathy and involving the proximal nerve segments. The outcomes of histological examinations of the nerve biopsies also proved the predominant demyelinating character of the lesions in the course of polyneuropathy; glucocorticoid therapy did not have an impact on the results of the research or the time of animals' recovery [Northington et al. 1981].

The available works on polyneuropathy contain little information on the rehabilitation methods for this disease. However, there are many studies dealing with the general principles and rehabilitation techniques for neurological patients [Olby et al. 2005, Owen 2006, Ansari and Zama 2012, Sims et al. 2015]. Only some of the recommended methods of physical therapy were used in the clinical cases analysed in this work. The techniques used in the study are of the high practical value and can be implemented in most physiotherapeutic clinics. As mentioned earlier, a large proportion of dogs with acute polyneuropathy have a chance of self-healing, but properly conducted physiotherapy shortens the duration of recovery and reduces the risk of complications.

Concluding, polyneuropathy is a disease of the nervous system frequently diagnosed in dogs. It has a diverse aetiology, which often, despite many additional tests, cannot be determined. According to findings of our research, each patient should be subjected to thorough diagnostic procedures because only the determination of the primary cause of the disease gives the chance for the effective treatment of polyneuropathy. Therefore, the primary disease and secondary polyneuropathy should be treated in parallel. As in the acute form of ACP, the aetiology is often unexplained, and only symptomatic treatment is possible. The analysis of our three clinical cases described in this case report confirms that despite of the acute and often severe course of the disease, most dogs have a good prognosis. Rehabilitation in both acute and chronic polyneuropathy is a very important element of the treatment; proper physiotherapy usually results in a significant shortening of the time necessary to return to full mobility. In cases where complete recovery is impossible, rehabilitation considerably improves the patient's life comfort and reduces the number of complications caused by the impaired functioning of the neuromuscular system. Good cooperation between the animal's owner and the therapist is also a key aspect of effective physiotherapy. The role of the physiotherapist should be to involve owners in the implementation of the physiotherapy treatment plan as much as possible. Regular perfor-

mance of the recommended exercises and treatments by owners at home is a factor determining final therapeutic outcomes.

In this case report, we have demonstrated the effectiveness of physiotherapy in the treatment of polyneuropathy and have described the most recommended methods that could be used in practice by many veterinarians, as well as animal keepers.

ACKNOWLEDGEMENTS

This study was financed by the Educational Fund of the Faculty of Animal Breeding and Biology, Bydgoszcz University of Science and Technology.

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FIZJOTERAPIA JAKO WSPOMAGANIE LECZENIA OSTREJ POLINEUROPATII U TRZECH PSÓW RASY YORKSHIRE TERRIER: OPIS PRZYPADKU

STRESZCZENIE

Polineuropatia jest często diagnozowaną chorobą układu nerwowego u psów upośledzającą funkcje nerwów obwodowych. W pracy opisano przypadki kliniczne ostrej polineuropatii u trzech psów rasy Yorkshire Terrier (1 samiec i 2 samice, w wieku 2–7 lat i masie ciała 3–6 kg), które poddano leczeniu rehabilitacyjnemu (fizykoterapii, kinezyterapii i terapii manualnej). Sesje terapeutyczne odbywały się średnio co 2–3 dni, łącznie od 15 do 20 sesji. Dodatkowo dla każdego psa opracowano indywidualne zestawy ćwiczeń domowych. W pracy określono wpływ fizjoterapii na przebieg i czas leczenia, oraz na zakres powrotu do pełnej sprawności ruchowej. Zaproponowano schemat leczenia fizjoterapeutycznego dla tej jednostki chorobowej. Przed przystąpieniem do zabiegów wykonano szczegółowe badania neurologiczne i dodatkowe, w tym analizę krwi. Wszystkie trzy psy w trakcie leczenia fizjoterapeutycznego wykazywały wyraźną poprawę stanu klinicznego, chociaż ich tempo powrotu do zdrowia było zróżnicowane. Czas terapii uległ wydłużeniu, szczególnie u jednego z psów, ze względu na wystąpienie powikłań w postaci ostrej infekcji układu pokarmowego. Przedstawiona w pracy analiza 3 przypadków psów sugeruje konieczność korygowania planu fizjoterapeutycznego względem aktualnego stanu ogólnego psa, tak, aby terapia była bezpieczna i nie skutkowałą powikłaniami chorobowymi. Rehabilitacja jest bardzo ważnym elementem leczenia pacjentów z chorobami neurologicznymi, w tym z ostrą polineuropatią. Dzięki fizjoterapii można znacząco skrócić czas choroby i jednocześnie zwiększyć stopień oraz zmniejszyć ryzyko wystąpienia powikłań chorobowych.

Słowa kluczowe: choroby neurologiczne, endokrynopatie, fizykoterapia, kinezyterapia, terapia manualna

