The Relevance and Limitations of the Imaging Diagnosis in Dogs' Neurological Disorders

Nicolae COLDEA, Cosmin PEȘTEAN, Loredana OLAR*, Ionel PAPUC

Faculty of Veterinary Medicine, University of Agricultural Sciences and Veterinary Medicine, Department III Paraclinici, Cluj Napoca, Romania

* Corresponding author: loredana.olar@usamvcluj.ro

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Abstract

The purpose of this paper is to emphasise the importance of the clinical exam in the evaluation of dogs with neurological disorders. A strict evaluation of this group of dogs during the clinical examination conduces to a more rapid diagnosis, reducing the risk of radiation and unnecessary costs by using the modern medical imaging techniques. Dogs from different breeds, of different ages and sex were examined. After the typical clinical procedures, for all the animals a neurological examination was performed. Once we have received the owner's consent, basic blood biochemistry and haematology was performed. The VITAMIND protocol was mandatory for each dog. In order to establish the final diagnosis, the dogs were examined by imaging techniques or by other tests (e.g. for endocrinopathies). Further the dogs were treated systematically with appropriate drugs. The results show that all the diagnoses of the examined dogs can be confirmed by imaging and/or other techniques (physical examination methods), depending on the disease' etiology. In order to have a correct and quick diagnosis of animals with neurological disorders, a certain examination protocol should be followed. The effectiveness of the treatments was different, according to the specific disease.

Taking everything into account, the diagnostic medical imaging techniques are very important but not always necessary. Precious time is saved when the examining physician is able to evaluate and interpret the clinical signs obtained by the animal inspection.

Keywords: *imaging diagnosis, neurology, VITAMIND*

INTRODUCTION

In the recent years, the development of the imaging technology promotes the easy diagnosis of the dogs affected by neurological disorders. The diagnosis of neurological disorders by using the medical imaging techniques has a tremendous impact on the quality of animal health care since it can provide valuable information that can determine the severity and the treatment of a certain disease (Gualtierio and D'Angelo, 2013). A multitude of diagnostic medical imaging techniques are commonly used in clinics due to its higher relevance, such as: radiology and

ultrasound, myelography, magnetic resonance (MRI) and computed tomography (CT) (Thomas *et al.*, 1990; Sande, 1994; Olby *et al.*, 2000; Lu *et al.*, 2002).

Nevertheless, the clinicians should be aware of the fact that neurological disorders could have a different etiology. Therefore, a certain part of these disorders show no suggestive changes on advanced imaging techniques examinations (Ettinger and Feldman, 2010; Ghergariu, 1995). Moreover, the clinicians should take into consideration the price of these investigations which includes both the anaesthesia and the transport of animals to

a specialised clinic. Of course, an X-ray machine is present in many clinics or hospitals, but only very few locations could hold more expensive tools such as the computed tomography scans or the magnetic resonance imaging machines. The clinicians' main duty should be the selection of the most appropriate imaging technique, in order to avoid excessive radiation of the patient (Thomas, 1998). Plat and Garosi (2012) declared that the only way to remove all these useless investigations and harmful manipulations for animals (e.g. the excessive manipulations of an animal with a spine fracture) is by achieving the following factors: the knowledge of the veterinary neurology and breed predisposition for diseases, and also the knowledge of the VITAMIND mnemonic (Tab. 1). A good physical examination of animals includes an adequate inspection. During the inspection, the clinician can differentiate between the orthopaedic and neurological problems, and also can appreciate the patient consciousness in order to incriminate or exclude the central nervous system as a location of the existing lesion (Granger *et al.*, 2010; Papuc, 2013).

As far as we are aware, there has been little discussion in the literature about the advantages and disadvantages of using medical imaging techniques in describing neurological lesions in animals. Therefore, in this paper, we suggest a

model for differentiating between neurological problems that need the use of imaging techniques and those in which the use of these techniques is useless.

MATERIALS AND METHODS

We examined a number of 20 dogs (representing different breeds) by different ages and sex. For all of the patients, after the typical clinical procedures, the clinician performed a neurological examination.

If the owner agreed, basic blood biochemistry and haematology was performed. In order to differentiate between the neurological and the orthopaedic problems, we used four-question sets, as it follows:

Do the clinical symptoms lead to a nervous system lesion?

Where is the lesion located?

What disease can explain the clinical signs?

Is it a severe problem?

In order to answer these questions hands-off and hands-on examination were carried out, each of them by specific tests. The VITAMIND protocol was mandatory for each dog. According to the results, the dogs were examined by imaging techniques or by other tests (e.g. for endocrinopathies) in order to establish the final diagnosis (Carwadine and Granger, 2013). Further,

Tab. 1. Evaluation of neurological pathology using VITAMIND (Lorenz *et al.*, 2011)

PATHOLOGICAL PROCESS	MODE OF ONSET	EVOLUTION	DISTRIBUTION
Vascular	Peracute/acute	Non-progressive/ regressive	Focal, often asymmetrical
Inflammatory/infectious	Acute, subacute or insidious	Progressive	Focal/multifocal, asymmetrical/symmetrical
Traumatic	Peracute/acute	Static or improve	Often focal, asymmetrical/ symmetrical
Toxic	Acute	Variable	Difuse, symmetrical
Anomalous	Chronic	Non-progressive	Variable
Metabolic	Variable	Wax and wane or progressive	Difuse, symmetrical
Idiopathic	Acute	Non-progressive or regressive	Syndrome specific
Neoplastic	Chronic	Progressive	Focal, symmetrical/ asymmetrical
Nutritional	Variable	Progressive	Diffuse and symmetrical
Degenerative	Chronic	Progressive	Diffuse and symmetrical

we applied the appropriate treatment for every examined dog.

RESULTS AND DISCUSSION

We used both imaging techniques and the physical examination methods in order to diagnose every consulted dog. The effectiveness of the proposed treatments was different, according to the specific disease.

Further, we will present a few cases and will explain the investigations we carried out in order to have a final diagnosis.

Case I: Samoyed, 3 years, who has suffered a car accident (Fig. 1).

This was an easy case. We tried to find the etiology using the VITAMIND mnemonic (Lorenz

et al., 2011), but we already knew that the dog had a trauma base on the case history. In this case a plain radiography was enough for a definitive diagnosis. In our opinion the use of CT and/or MRI instead of radiography would not give us much more information. During the consultation we found out that the nervous system was intact and the dog was submitted to surgery. After a few days he was able to walk again (Fig. 2).

Case II: Street dog with hind limb paralysis.

Without any history it is very difficult to have a final diagnosis. The VITAMIND (Lorenz *et al.*, 2011) is useless because there is nobody who can answer to the first question: how was the onset? In this case we had to establish the level of the spine

Fig. 1. Fracture/luxation of L6

Fig. 2. Same case after surgery

lesion through a neurologic examination. The X-rays were relevant (Fig. 3, Fig. 4).

After the surgical removal of the pellet and a lot of physical therapy, the dog was able to partially use his hind legs (Fig. 5).

Case III: 3 years Teckel with hind legs paralysis and with lower motor neuron lesion.

The onset of the disease was acute, with intensive pain. The VITAMIND table (Lorenz *et al.*, 2011) showed us that there were only two possibilities: trauma or a vascular problem. Because of the fact that vascular accidents are not painful and also because there is a breed

predisposition for vascular accidents, the diagnosis was trauma caused by disk herniation. In this case, the X-ray plain or as a contrast study is not enough; in order to see the extent of the lesion, MRI is the best option (Fig. 6).

A T13-L1 disk extrusion was the final diagnosis and the dog was operated using a hemilaminectomy technique. Within days the dog was able to walk again (Fig. 7).

Case IV: Boxer, 9 years, with seizures.

In the history the seizures started only at this age. During the crisis the dog was conscious. As the onset of the disease was slow and the seizures

Fig. 3. Lateral view of T1 with an air gun pellet in the vertebral canal.

Fig. 4. Dorsal view of T1 with an air gun pellet in the vertebral canal

Fig. 5. Surgical removal of the pellet

more and more frequent, the most probable cause is an expansive process in the brain. If we are searching to see the breed predisposition of the boxers they are susceptible to brain tumors at this age. Another reason we did not consider that this is true epilepsy is that epilepsy occurs between the age of 6 month and 3 years. The only possibility to visualize a tumor within the brain is the MRI (Fig. 8). In the image a left frontal lobe lesion-probably astrocytoma – is present.

Case V: Masseter paralysis in a Golden Retriever, 5 years.

The disease had a slow onset, the dog was circling and had a left eye blindness with no PLR.

Again we need to apply the VITAMIND mnemonic (Lorenz *et al.*, 2011) in order to find the most probably cause of the problems. The only process that could produce these symptoms is a tumor in the cranial cavity, the spinal reflexes being normal. In order to explain all the symptoms the lesion should be in the neighborhood of the right optic nerve and of the trigeminal nerve (Fig. 10). The MRI is the best option to visualize the lesion (Fig. 9).

It was visible that the tumor was compressing the right root of the trigeminal nerve as well as the right optic nerve near the optic chiasm (Fig. 9).

Fig. 6. T13-L1 disk extrusion

Fig. 7. The dog after surgery

Fig. 8. Left frontal lobe tumor in a 9 year Boxer

Fig. 9. Extraaxial tumor in a Golden Retriever

Case VI: Facial paralysis in a 7 years cross-breed dog.

The problem was unilateral. The dog was a bit more “lazy” than usually, but still active and aggressive. The eye of the affected side was dry and without palpebral reflex. Other symptoms were drooping of the lip and excessive salivation on the affected side. Otherwise, the dog did not have altered consciousness, all the spinal reflexes were normal. In this case, the imaging techniques should not be the first option. Instead, thyroid gland hormones are to be determined, and these are the results:

serum total T4=1,16 mcg/dL (1,5-4,5)

serum T3<40 ng/dL (50-180)

After the treatment the level of T4 was normal: 3,72 mcg/dL (Kaneko *et al.*, 2008).

Step by step, the lip regained the normal position and the eye was normal again.

CONCLUSIONS

In order to have a correct and rapid diagnosis, a certain examination protocol should be followed. In our opinion the imaging diagnosis is very important but not always necessary. Furthermore, the clinicians have to take into consideration that

Fig. 10. Unilateral masseter paralysis

an advanced imaging facility may be at a distance of hundreds of kilometres, so they can be in danger to lose precious time.

The imaging techniques are of a tremendous value, but their use should be restricted to situations when the diagnosis is unclear. The last case presented in this paper is a good example for the fact that machines, no matter how performant they are, cannot replace the doctor.

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