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CANINE ECTRODACTYLY - CASE REPORT

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Abstract: Ectrodactyly is defined as a separation of two bony tissues due to a rare malformation described as a longitudinal paraxial deformity of one or more individual components of the most distal region of two thoracic limbs. Such alteration may be accompanied by other anomalies, being them aplasia and hypoplasia of the carpal and metacarpal bones, polydactyly, metacarpal fusion and dislocation of the umero-radio-ulnar joint (FREY & WILLIAMS, 1995), separation of the medial and lateral portions of the limb thoracic, being able to occur below two metacarpus bones at the radio and ulna bones (FERREIRA et al., 2007). Affected animals develop a mild disability with total loss of limb function. It was observed only in the thoracic limbs, unilaterally, with no gender or race predisposition, and it has been described in cats, cattle, humans and less frequently in cattle (MONTGOMERY et al., 1989). The development occurs due to a specific deficiency involving embryonic precursors in two thoracic limb bones (AUDÍSIO et al., 2013). The anomaly is the result of non-development of the mesenchymal bone tissue, the transformation of the mesenchymal bone into cartilage, or the conversion of cartilage into the bone (TOWLE & BREUR, 2004). The reported clinical case was observed in the shelter of Francisco de Assis Park, Lavras-MG, where a male dog, SRD, approximately 2 years old, medium size, aged fur, neck presenting distal malformation and claudication of the right thoracic limb. On clinical and radiographic examination, the incomplete anatomical formation of the leg can be highlighted, observing the absence of two fingers 3 and 1, besides adjacent structures two corresponding fingers.

Keywords: Ectrodactyly, Malformation, Canine, Anomaly, Bone malformation.

INTRODUCTION

Frey & Williams (1995) defined ectrodactyly as a longitudinal paraxial deficiency of one or more two individual elements of the distal portion of the limb of a developing embryo, therefore, a rare malformation, generally associated with a congenital dislocation of the cotovelo and retraction of two tissue moles and digits of the animal shaved.

It is known that the population increase of pigs associated with the high rates of abandonment in Brazil has led to the uncontrolled hoarding of animals, increasing the possibilities of inbreeding and the appearance of malformations from allelic combinations unfavorable to animal health (Figuera et al., 2008). The present report reveals such an affection in an animal from a shelter of cattle collected from the road for castration surgery, in the same way or history of the same is not known, neither is two parents known, there was any similar malformation, or it was Alteration came from a cross between animals of the same lineage.

Genetic malformations in domestic animals, especially small animals, are rarely reported. It is known that genetic alterations diversify according to factors inherent to species, race, sex, environment among others, as individuals and regions. According to Sinowatz (2012), the constitution of two non-embryonic genes and the medium in which it develops is directly related to the origin of genetic abnormalities. In the reported case, the dead hair of the animal has been collected from streets in the municipality of Lavras - MG, it is not possible to determine precisely what the relationship is between the genetic anomaly and the mean in which the animal lived.

The defects of abnormality and malformation occur in the embryonic and fetal phases, having an intrinsic origin, which are, for example, alterations in two genes

and chromosomes or an extrinsic origin, in which there is an action of infectious, physical and chemical agents. Abnormalities such as aplasia, “clubfoot” or tortoiseshell, phocomelia and their own ectrodactyly are malformations of genetic origin (Mann, Wiercinska & Scheffrahn, 1992). The development of fundamental ectrodactyly is a specific deficiency of the ectodermal apical crest of the primordial limb contour, which involves the embryonic precursors of two thoracic limb bones (AUDÍSIO et al., 2013). Few reports have been made in Brazil of ectrodactyly in the thoracic limb of cattle, despite the fact that the condition has been observed in felines, cattle, humans and canines, being infrequent in the latter.

The phase during which each tissue or organ in development is more susceptible to a disturbance is called a critical period. For most of the structures of the organism, this stage occurs at the embryonic moment of development during the 3rd and 5th weeks of gestation. Meanwhile, at the end of a critical period, it is not established that a structure is free from being affected by some disturbance, but with decreased sensitivity to malformations and abnormalities, they are more likely to be more concentrated in a certain region. It is the phase in which the characteristic alterations that ectrodactyly causes in the thoracic limbs of the animal occur; separation of tissue moles and bone portions distant from the medial and lateral region of the thoracic limb, which may occur below two metacarpus bones, extending to the radius and ulna (FERREIRA et al., 2007).

Intrinsic malformations, such as interruption of bone cell development between 23 and 35 days of gestation, can result in appendicular alterations such as ectrodactyly (EVANS, 1993). This reason is why the disorder is associated with hypoplasias, aplasias and malformations of

one or more bones of the forearm, carpus, metacarpus and digits (CARRIG et al., 1981; TOWLE & BREUR, 2012).

The etiology of the disease, but little reported in the literature, is as much controversial as the malformation it presents as a hereditary one. Second Jubb et al. (1988) may be genetic through a dominant gene in dogs and, mainly, in cats, but it has not been shown that ectrodactyly is hereditary in felines due to an autosomal gene (SCHNECK, 1974). Montgomery, Milton and Mansfield (1989), Frey and Williams (1995) report the existence of a hereditary possibility regarding the origin of the teaching, in contrast, Innes et al. (2001) emphasizes that there is not enough evidence that this condition is hereditary in children.

It aims, therefore, to report a case of a case affected by ectrodactyly, kept in the Francisco de Assis Park shelter, in the municipality of Lavras - MG, diagnosed clinically and radiographically, in the Diagnostic Imaging Sector of the Federal University of Lavras - UFLA, demonstrating its radiographic particularities and presentations compared to a picture of a rare condition in veterinary clinical routine.

CASUISTRY

He was sent to the Francisco de Assis Park farm shelter, in the city of Lavras - MG for castration, a puppy retired from the street, available historically, male, SRD, approximately 2 years old, medium-sized, aged fur showing claudication and alteration in the distal portion of the direct thoracic limb. Such a condition causes the animal to present difficulties in supporting its limb, being easily observed when it either walks or stays in the station. On clinical examination, malformation was observed with alteration in the conformation of two metacarpals (image 1), being clear in the absence of finger 3 and 1 (image 2).



Image 1: Photograph of the distal region of the direct thoracic limb showing anatomical alteration.

Source: Personal file



Image 2: Photograph of two right (lower) and left (upper) thoracic limbs, being clear the conformational difference due to malformation of the limb.

Source: Personal file.



Image 3: Photograph of the lateral view of the direct thoracic limb, evidencing the anatomical alteration.

Source: Personal file.

No radiographic examination was possible to carry out a comparative study of two limbs of the animal, evidencing the anatomical differences of the right hand, affected by the ectrodactyly and the anatomically normal left hand (Image 5). With the radiography of the direct limb, it can be noted the absence of bony structures such as the 1st and 3rd carpal and metacarpal bones, proximal, middle and distal phalanges of digits I and III. We also observed a medial dislocation of two carpal bones, due to the malformation of the joint and the absence of structures that are anatomically usual. In addition, it was possible to observe laterally a decrease in radiopacity in the distal diaphysis of the radius and ulna, which was excluded as the possibility of being a positional alteration, however, it was not possible to diagnose the cause of this alteration (Image 7).

The animal underwent orchietomy surgery, a standard shelter procedure,

once we had the objective of reducing the uncontrolled reproduction of street animals and, finally, mitigating the problems involved such as accidents, the proliferation of zoonoses and the high number of abandoned animals, a recurring problem in majority of two Brazilian municipalities. Montgomery et al. (1989) and Frey & Williams (1995) recommend orchietomy or ovariosalpingohysterectomy surgeries in dogs and ectrodactyl cats as prevention of the propagation of the malformation, due to the hereditary nature of the hairs themselves. This way, or the standard sterilization procedure adopted by the Francisco de Assis Park shelter also contributed to avoid the spread of the deformity among the animals in a situation of abandonment, which in turn did not have the necessary support for accompanying and correct handling of the casuistry.



Image 4: Photograph of the patient presenting conformational and positional alteration of the right thoracic limb. Source: Personal file.

METHODOLOGY

When the deformity was observed in the limb of the animal, it was decided to carry out a radiology exam in order to diagnose such alteration, ruling out the possibility of having been some alteration caused by an accident, once the animals were collected from the street, generally, historical aftermath of abuse or other treatment involving physical injuries. The radiographic examination is an important diagnostic tool to complement the cases of ectrodactyly, this way in the case of the Diagnostic Imaging sector of the Federal University of Lavras - UFLA, where the radiographic examination was carried out using the radiographic technique to bone tissue, which was recommended by mA in 125, mAs in 32 and KV in 57, performing the dorsoplantar projections of the distal medial third of two limbs, the medial and craniocaudal projections of all the articulations of the thoracic limb.

An X-ray of the joints of both the affected limb and the liver was carried out, due to other studies on the anomaly, it will be evident that anatomical and morphological alterations characteristic of ectrodactyly can cause serious alterations in the stability of the limb joints. This way, in order to carry out a more detailed study of the case, the imaging tests were carried out with the aim of observing and identifying any possible alteration compatible with a picture of joint instability or another alteration developed secondary to ectrodactyly. Radiographs must be performed in two orthogonal projections and must include the entire thoracic limb, once orthopedic complications are very frequent in the shoulder, hip and forearm (FERREIRA et al., 2007).

To perform the radiography of the scapulo-umeral articulation, we opted to use a technique in which the animal was positioned for ventrodorsal projection with the thoracic

limbs stretched and the x-ray feixe obliquely incising at an angle of 45°.

DISCUSSION

Ectrodactyly is an alteration reported infrequently to us, usually involving only one limb and because it is a rare malformation, the reports are of unique casuistry and little detail in relation to etiology. Many of the case reports involving these fazem references to etiology, however, in ectrodactylic cats, it is known that the inheritance of the malformation is associated with an autosomal dominant gene (Schneck, 1974). In canines, it is not possible to establish this relationship, but there is little to correlate ectrodactyly with other congenital alterations (Innes et al., 2001). In humans, it has been observed that malformations have teratogenic causes, including substances such as cadmium (AULHOUSE & HITT, 1994; Chen et al., 2008), valproic acid-based anticonvulsants, dimethadione, sodium valproate, and diphenyldantoin (Collins et al., 1991; AULHOUSE & HITT, 1994), cocaine (FANTELE et al., 1992) and association between aspirin and alcohol (PADMANABHAN & PALLOT, 1995) are important predisposing factors in the occurrence of ectrodactyly in humans.

In the area of veterinary medicine, based on the low casuistry reported, it is conditioned that there is no heredity involved in the development of ectrodactyly, but also a racial predisposition (Carrig et al., 1981). However, it is possible to speculate at what time the embryonic development of the animal does not occur during the initial processes of it. The phase during which each tissue or organ in development is more sensitive to any disturbance is called a critical period. For most of the structures, this period occurs in the embryonic stage of development, during the 3rd and 5th weeks of gestation, we fall. In the meantime, the end of this period does not

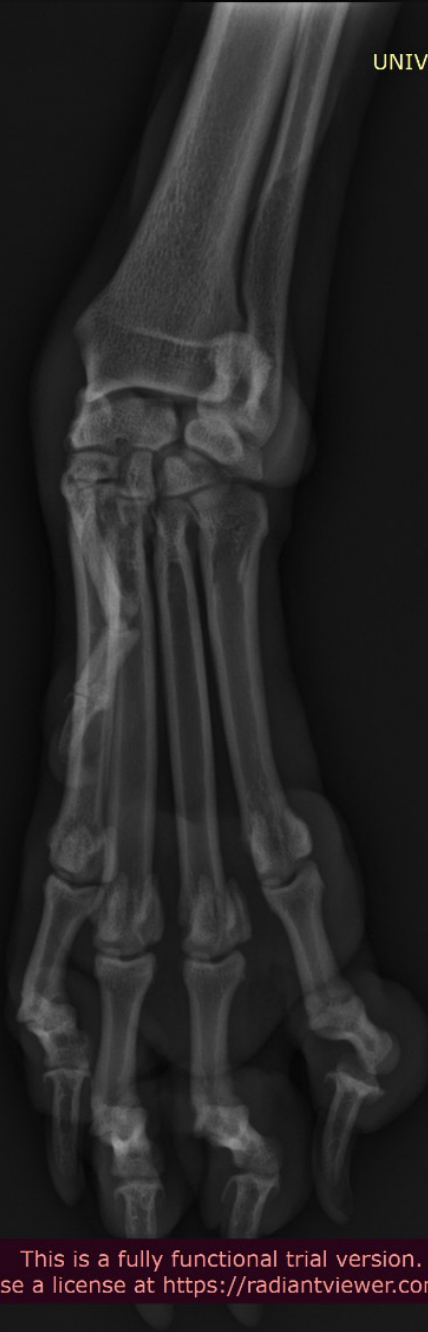
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Image 5: Dorsoplantar radiographic image of the left thoracic limb, not affected by ectrodactyly. Only a subluxation of the articulation of the distal phalanx of the 5th finger with the nail process is observed.

Source: Personal file / Diagnosis by imaging - UFLA, Lavras 2021.



Image 6: Mediolateral radiographic image of the left thoracic limb, not affected by ectrodactyly, showing the radiocarpic and carpometacarpic joints. Source: Personal file / Diagnostic imaging - UFLA, Lavras 2021.



Image 7: Radiographic image in dorsoplantar projection of the right thoracic limb, evidencing alteration caused by ectrodactyly, in which the absence of finger III and finger I is observed, along with structures adjacent to them. Source: Personal file / Diagnosis by imaging - UFLA, Lavras 2021.

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Image 8: Radiographic image in the médiolateral projection of the right thoracic limb, affected by ectrodactyly, highlighting the carpo-metacarpic, intertarsal and metacarpophalangeal joints. Source: Personal file / Diagnosis by imaging - UFLA, Lavras 2021.



Image 9: Radiographic image in craniocaudal projection of the scapulo-umeral articulation of the right thoracic limb, without alterations, using the ventrodorsal positioning of the animal with the 45° oblique incidence technique. Source: Personal file / Diagnosis by imaging - UFLA, Lavras 2021.



Image 9.1: Radiographic image in craniocaudal projection of the contralateral limb using the same imaging technique 8. Source: Personal file / Diagnosis by imaging - UFLA, Lavras 2021.



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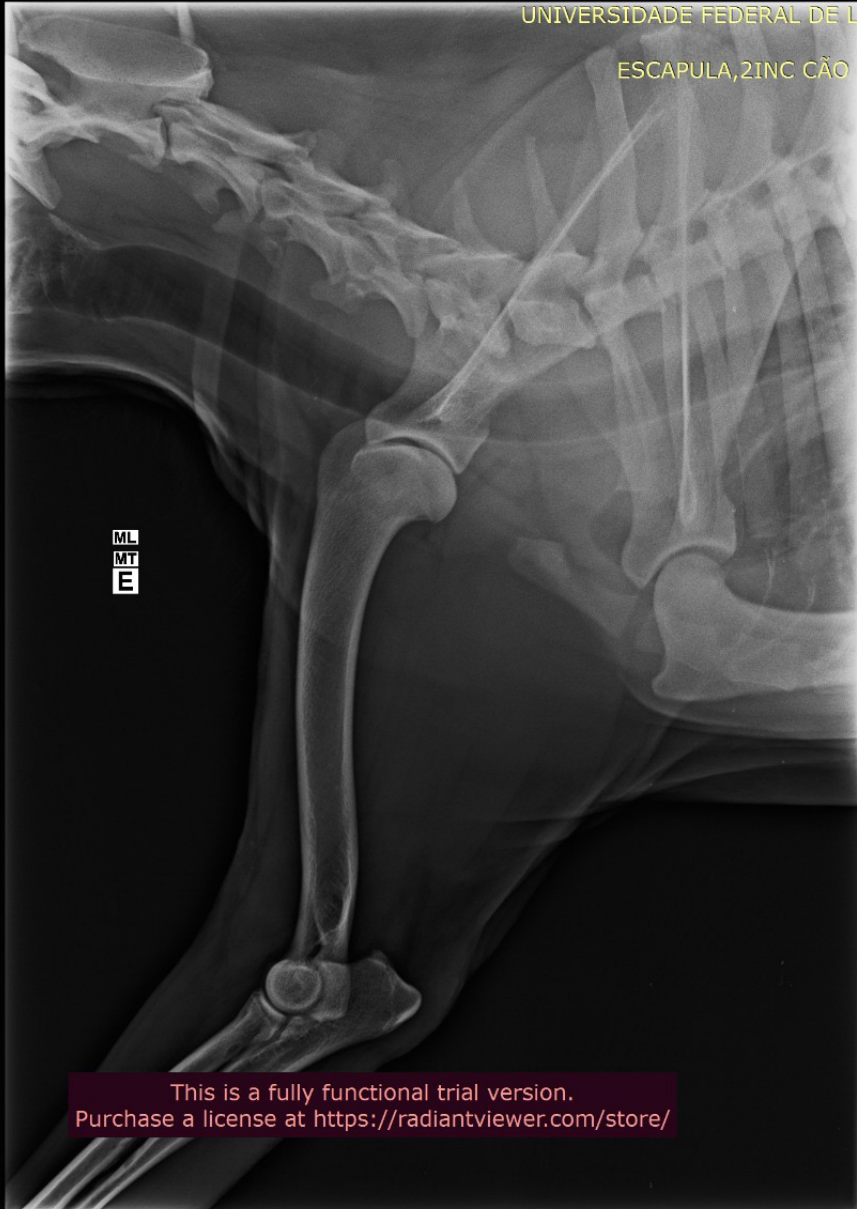
Image 10: Radiographic image of the umero-radio-ulnar joint of the right thoracic limb in mediolateral projection, showing no alteration or indication of instability secondary to the condition of ectrodactyly.

Source: Personal file / Diagnosis by imaging - UFLA, Lavras 2021.



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Image 10.1: Radiographic image in mediolateral projection of the contralateral limb of the articulation of the covelo of the thoracic limb, being this or the left limb, not affected by the ectrodactyly. Source: Personal file / Diagnosis by imaging - UFLA, Lavras 2021.



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Image 11: Radiographic image in mediolateral projection of the scapulo-umeral and umero-radio-ulnar joint of the left limb. Source: Personal file / Diagnosis by imaging - UFLA, Lavras 2021.

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Image 11.1: Radiographic image in mediolateral projection of the scapulo-umeral joint, not right thoracic limb, affected by ectrodactyly, no indication of alteration due to instability was observed. However, it is observed an undated discontinuity of the physal line of the number, and it is not possible to determine the reason for this in its relationship with the ectrodactyly present in the distal portion of the member. Source: Personal file / Diagnosis by imaging - UFLA, Lavras 2021.

mean that a structure is not more at risk of some disturbance occurring, but the sensitivity to it is decreased and the abnormalities present a greater probability of being located in a specific structure. This way, intrinsic malformations, such as the interruption of bone cell development between 23 and 35 days of gestation, can result in appendicular abnormalities such as ectrodactyly (EVANS, 1993).

Macroscopically, no reported case can visualize limb claudication due to the absence of structures such as fingers I and III, separation of bone and tissue adjacent to the absent bones, causing alterations in the stability and functionality of the carpo-metacarpica joint. There are few information on the surgical treatment of ectrodactyly for veterinary medicine (Innes et al., 2001; Pisoni et al., 2014). The objective of surgical intervention in these cases can be palliative, in which total or partial amputation of severely affected limbs is opted for, or reconstructive in which the aim is to restore the functionality of the limb through limb realignment through a partial or pancarpal arthrodesis (KERRIGAN & ROBINSON, 2016). The surgical decision in cases such as the one reported, will be made by surgery based on the gravity of the malformation and the involved bone structures, since it manifests itself in different ways despite affecting only the hind or thoracic limb in the distal region. However, pancarpal arthrodesis is a surgical technique of choice for the case presented since it involves a fusion of a joint to form a bone ankylosis (PIERMATTEI & FLO, 1999). The arthrodesis can be used to treat hyperextension and collapse of the carpal joint (FOSSUM, 2009), with several advantages being reported for two external fixators in veterinary orthopedics as it is a minimally invasive and distant method from the fracture focus (PISTANI, 1994), contributing to promote an early start

of member mobility and use. The use of the technique must take into consideration factors such as size, animal size and other factors that will contribute positively to a satisfactory recovery. For patients of medium to large size, as reported in this study, the use of plates that surround the radius or third metacarpal is recommended (DEE, 1992)

In the case presented, it is a mild ectrodactyly, once the orthopedic alterations presented by the thoracic limb directly do not affect the quality of life of the reported animal. This way, I opted to perform or accompany the case, without performing non-animal orthopedic surgical intervention due to difficulties related to the management of it. Because it is an animal that resides in a shelter, only castration surgery was performed with the objective of reducing the reproduction of street animals and mitigating problems associated with abandonment, zoonoses and accidents. The orthopedic correction surgery of the member opted for not being performed because in a context of shelter there are certain difficulties of limitation of space and movement, due to the number of beds by bay and not having an adequate structure that privileges animals with motor difficulties. Important factors for a post-surgical and recovery from orthopedic surgery.

CONCLUSION

It was concluded, therefore, that, despite two few reports of pathology in cats and low frequency with which it is diagnosed in routine veterinary clinic, more extensive genetic studies are needed for specific knowledge regarding the same etiology. However, despite being possible to diagnose ectrodactyly only with a physical examination, other forms of diagnosis can be used in a practical and minimally invasive way, emphasizing the radiographic examination, which was fundamental for a more in-depth study of

the case, allowing to visualize more clarity to the malformation of the carpo-metacarpica articulation of the animal and the absence of structures as previously reported. In addition, periodic clinical follow-up is suggested in order to observe possible secondary bone alterations that may occur due to ectrodactyly in the limb, so that, if necessary, an orthopedic surgical intervention is carried out with the intention of correcting or diverting the limb or providing better quality of life to animal and guardian. Finally, it is important that the animal undergoes elective castration surgery to prevent the spread of the defect, due to its possible hereditary nature.

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