CHAPTER
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Meningocele and procephalic hypoplasia in a calf in the Sertão da Paraíba

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Artefio Martins de Oliveira
Master's Degree in Animal Science, Graduate Program in Animal Science.
Institution: Federal University of Campina Grande.
Address: Avenida Universitária, s/n - Santa Cecilia, Patos - PB, 58708-110.

Erick Platiní Ferreira Souto
Post-doctoral internship in Veterinary Medicine.
Institution: Federal Rural University of Pernambuco.
Address: Rua Dom Manuel de Medeiros, s/n - Dois Irmãos, Recife - PE, 52171-900.

Dlean da Silva Garcia
Master's student in Animal Science and Health, Graduate Program in Animal Science and Health.
Institution: Federal University of Campina Grande.
Address: Avenida Universitária, s/n - Santa Cecilia, Patos - PB, 58708-110.

Antonio Flávio Medeiros Dantas
PhD in Veterinary Science.
Institution: Federal University of Campina Grande.
Address: Avenida Universitária, s/n - Santa Cecilia, Patos - PB, 58708-110.

ABSTRACT
We describe a case of meningocele, cranioschisis, and procephalic hypoplasia in a calf in the semi-arid region of Paraíba, Northeastern Brazil. A three-day-old male calf with no defined racial pattern was referred for clinical evaluation at the Veterinary Hospital of the Federal University of Campina Grande with an increase in fluctuating volume, completely covered by intact skin located in the frontal region of the head. Due to the unfavorable prognosis, the animal was euthanized. At necropsy, herniation of the meninges was observed through an opening in the midline of the frontal bone of the skull containing approximately 1300 ml of reddish fluid. The brain presented incomplete formation, with the absence of the telencephalic hemispheres, but with a well-formed brainstem, a condition consistent with procephalic hypoplasia. Histologically, congestion was observed in the ventral part of the telencephalon and caudate nuclei, and areas of hemorrhage, corpora amylacea, discrete mineralization, and axonal spheroids in the neuropile. Meningocele and cranioschisis are rare malformations, which are always associated, and have an unclear etiology in most cases.

Keywords: Malformations, Dystrophy, Bifid skull, Brain.

1 INTRODUCTION

One of the most important malformations of the nervous system is dystrophy, which consists of failures in ossification (Cantile & Youssef 2016), resulting from defects in neural tube closure during the early stages of development (Zachary 2013). It can occur in the midline of the skull, a condition called cranioschisis or bifid skull, or on the dorsal surface of vertebral arches, a condition called spina bifida (Graça et al. 2014). These failures in ossification can result in herniation of the cerebrospinal fluid-filled meninge, which may be accompanied by part of the brain (meningoencephalocele) or spinal cord (meningomyelocele) (Zachary 2013). A herniation is commonly covered by skin and can vary in size, but it is usually 2-10 cm in diameter and is always larger than that of the opening in the skull (Cantile & Youssef 2016). Meningocele and congenital meningoencephalocele can affect several animal species, including pigs, cattle, sheep, dogs, cats, horses, goats, and humans (Cho et al., 2015). The incidence is higher in large white and landrace pigs

(Cho et al. 2015). Another important but infrequent malformation of the central nervous system of cattle is procephalic hypoplasia. The term anencephaly means the absence of the brain, but in many cases, only the rostral part of the brain (the telencephalic hemispheres) is absent or very rudimentary, with the cerebellum and brainstem variably formed. Thus, this malformation is better termed prosencephalic hypoplasia or cerebral aplasia (Zachary 2013). The objective of this study is to describe a case of meningocele, cranioschisis, and procephalic hypoplasia in a calf in the semi-arid region of Paraíba, Northeastern Brazil.

2 MATERIAL AND METHODS

We reviewed a case of meningocele in cattle that occurred in June 2012 at the Animal Pathology Laboratory of the Veterinary Hospital of the Federal University of Campina Grande, Patos campus, Paraíba. From the clinical and necropsy protocols, information was collected regarding epidemiological data (sex, breed, age, and origin of the animal), clinical signs, and pathological findings. For microscopic analysis, the collected tissues were fixed in 10% buffered formaldehyde, routinely processed, and stained with hematoxylin and eosin (HE).

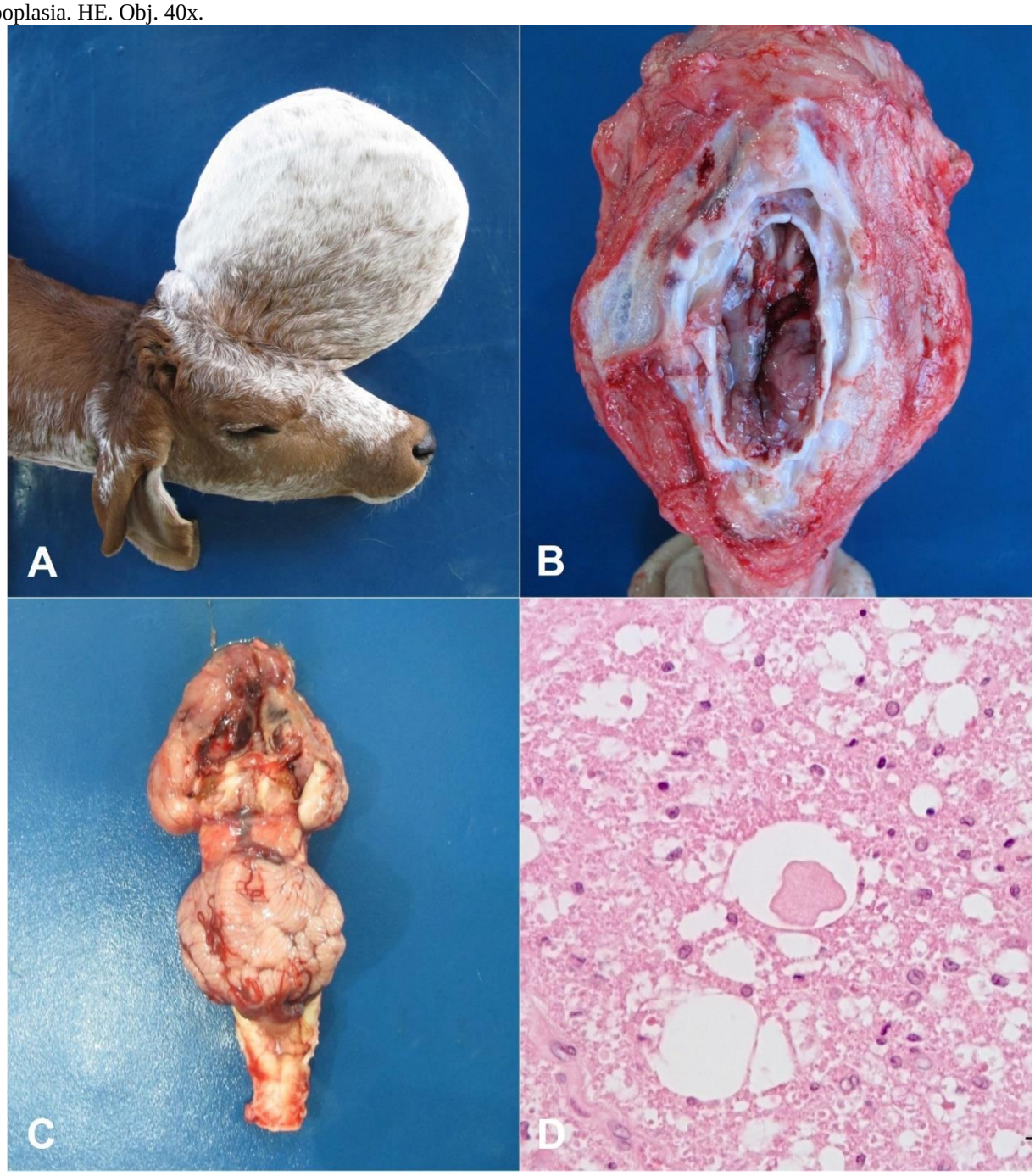
3 FINDINGS

A three-day-old male calf, with no defined racial pattern, from the rural area of the municipality of Patos, Paraíba, was referred for clinical evaluation at the Veterinary Hospital of UFCG with an increase in fluctuating volume, completely covered by intact skin, located in the frontal region of the head. The animal remained in persistent lateral decubitus, had difficulty feeding, and, due to the unfavorable prognosis, was euthanized.

At necropsy, it was observed that the increase in volume measured approximately 20cm in diameter (Fig. 1A) and was partially filled with reddish liquid, harvesting approximately 1,300 ml. It was found that there was herniation of the meninges through an opening in the midline of the frontal bone of the skull (Fig. 1B), characterizing a cranioschisis and a meningocele. The brain presented incomplete formation. There was the absence of the telencephalic hemispheres, the cerebellum was flattened off the dorsal surface of the worm and deviation to the left, while the brainstem was well formed (Fig. 1C), a condition consistent with prosencephalic hypoplasia.

Histologically, the ventral part of the telencephalon and caudate nuclei presented congestion, areas of hemorrhage, corpora amylacea, discrete mineralization, and axonal spheroids in the neuropile (Fig. 1D).

Figure.1. A) Calf with increased volume in the frontal region of the head measuring approximately 20 cm in diameter and completely covered by intact skin. B) Opening in the midline of the frontal bone of the calf skull with meningocele, cranioschisis, and procephalic hypoplasia, demonstrating herniation of the meninges. C) Proencephalic hypoplasia in the calf. The absence of the telencephalic hemispheres and the formation of the cerebellum and brainstem are observed. D) Axonal spheroid in the ventral portion of the telencephalon in a calf with meningocele, cranioschisis, and procephalic hypoplasia. HE. Obj. 40x.



4 DISCUSSION

The diagnosis was made based on the anatomopathological findings. The usual causes of central nervous system (CNS) malformations can be grouped into genetic, environmental, or the interaction of both. In domestic animals, congenital CNS changes are more frequent, and their variations more numerous than malformations in other systems (Schild 2007), possibly due to the high

degree of differentiation and complexity of the CNS, which increases its susceptibility to the development of anomalies (Cantile & Youssef 2016). Meningocele and meningoencephalocele usually occur in the frontal region of the skull, particularly in the midline, but sometimes in the occipital region (Cantile & Youssef 2007). In this case, the location of the opening in the skull was in the midline of the frontal bone, but the meningocele assumed a pendular posture due to the increased collection of fluids inside. This condition, by itself, in a newborn animal would hinder the season and locomotion. However, in this particular case, probably the procephalic hypoplasia observed played a more important role in the clinical picture of the calf. It is postulated that procephalic hypoplasia and cranioschisis are related and proportional. In severe degrees of procephalic hypoplasia, or even in true anencephaly, it is likely that there will be failures in the fusion of the bones of the skull (cranioschisis) or even the incomplete development of these (acrania). As a consequence of imperfect occlusion of the skull, nerve tissue is exposed to amniotic fluid, which promotes the degeneration of nerve cells (Cantile & Youssef 2016). Thus, the axonal spheroids observed in this case are probably a result of this intrauterine condition. The foci of mineralization and the corpora amylacea are nonspecific and unelucidated findings. Prosencephalic hypoplasia, cranioschisis, and the consequent meningocele can all be attributed to abnormal neural tube development during the early stages of development. As for the causes of these conditions, cranioschisis and meningocele in pigs and cats have a hereditary character and can also be caused in pregnant cats by treatment with griseofulvin, hydroxyurea, and diphenylhydantoin (Cantile & Youssef 2016), but in cattle, the etiology of these changes remains unclear (Cantile & Youssef 2016, Zachary 2013).

5 CONCLUSION

Meningocele and cranioschisis are rare malformations, which always occur associated with and affect humans and other animal species, but have an unclear etiology in most cases. These changes may also be associated with other malformations of the brain, such as proencephalic hypoplasia.

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