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CASE REPORT
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Congenital Internal Hydrocephalus in a Swine

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ABSTRACT

***Background*:** An active distension of the brain's ventricular system related to the inadequate passage of cerebrospinal fluid (CSF) characterizes hydrocephalus, with usually occurs due to an interruption in the flow or absorption of CSF. Congenital hydrocephalus occurs in several animal species, being rare in pigs. Farm animals generally show clinical signs at birth, while pet animals after a few months. The imaging tests normally used are ultrasound, magnetic resonance imaging, and computed tomography. This report aims to describe the clinical, radiographic, ultrasound and pathological features of 1 case of congenital hydrocephalus in a pig.

***Case*:** A case of congenital internal hydrocephalus in a male pig, 8-hour-old, weighing 1,800 kg, presented in the physical examination, an enlarged skull, motor incoordination and permanent lateral decubitus. On physical examination, the physiological parameters were within normal limits, however, he was in lateral decubitus, unable to maintain himself in sternal decubitus or station, and did not present a sucking reflex. In the neurological examination, it was observed that the animal was alert, but had muscle tremors and ataxia of all four limbs. Imaging exams were also performed, on simple radiographic examination an increase in volume of the cranial vault is noted, with a homogeneous appearance of the brain, with predominantly liquid/soft tissue radiopacity, with the absence of markings of the cerebral convolutions and bone cortical thinning in the calvaria region. The radiographic findings of the contrast examination (myelography) did not demonstrate progression of the contrast medium into the subarachnoid space of the spinal cord, however, there was reflux of the contrast towards the brain, demarcating the lateral ventricles. In the transcranial ultrasound examination, the right and left lateral cerebral ventricles were dilated with homogeneous anechoic liquid content, confirming the diagnosis of congenital internal hydrocephalus. As the pig showed neurological changes, absence of the sucking reflex and inability to stand up, making its maintenance unfeasible and reducing the possibility of survival, the animal was euthanized. The male pig was referred for necropsy, where had cranial vault bones enlarged and thin, cerebral hemispheres that collapsed when removed from the skull, accentuated dilation of the lateral ventricles and atrofia of the cortical white matter. The histological exam revealed atrophy of the white matter and reduced number of the gray matter glial cells, associated to marked dilation of the lateral ventricles. The mesencephalic aqueduct was covered by a layer of ependymal cells that were abruptly discontinuous, forming several ependymal canalicules (stenosis). The final diagnosis was severe internal hydrocephalus. The diagnosis of congenital internal hydrocephalus was based on clinical findings, imaging exams, necropsy and histopathological findings.

***Discussion*:** In the pig studied, clinical signs of congenital hydrocephalus occurred in the 1st days of life. The specific cause of hydrocephalus in the case report, was the stenotic mesencephalic aqueduct that gave rise to illness were seen in microscopic examination. In the case reported, ultrasound examinations, in persistent fontanelles, and plain and contrast x-rays were performed, the findings of radiographs were consistent for the diagnosis of hydrocephalus. On ultrasound, enlarged lateral ventricles filled with anechoic fluid were observed, corroborating findings by literature. The necropsy macro and microscopic findings, corroborate with findings of other species with congenital hydrocephalus. More studies regarding clinical signs and parameters of complementary exams, such as ultrasound and radiography, are necessary to characterize and detail hydrocephalus in pigs.

Keywords: pig, neurology, cerebrospinal fluid, ultrasound, myelography.

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INTRODUCTION

Hydrocephalus can be defined as an active distension of the brain's ventricular system related to the inadequate passage of cerebrospinal fluid (CSF) [3,8]. Hydrocephalus usually occurs due to an interruption in the flow or absorption of CSF [9].

Hydrocephalus can be classified as congenital and acquired. It can also be classified in relation to the location of CSF accumulation, which may be internal or non-communicating (CSF accumulation in the ventricular system) or external (CSF accumulation within the subarachnoid space) [4]. Internal hydrocephalus occurs more frequently, resulting in ventricular dilation due to an obstruction of CSF flow before entering the subarachnoid space [2,9,10].

The causes most commonly associated with congenital hydrocephalus may be related to genetic factors, uterine exposure to infectious agents and teratogenic chemicals, stenosis of the mesencephalic aqueduct associated with fusion of the rostral colliculi or obstruction without an obvious location [12].

The main clinical signs in congenital hydrocephalus include an enlarged dome-shaped head, which may present persistent fontanelles and open cranial sutures, ventrolateral strabismus, animals may be born smaller than normal and generally present neurological deficits, such as abnormal behavior, ataxia, blindness, seizures and vestibular dysfunction [13].

Diagnosis is based on clinical signs, brain imaging to assess ventricular size, and absence of other causes of encephalopathy [5].

Congenital hydrocephalus occurs rarely in cattle, horses and pigs and, more frequently, in dogs [12,15]. The treatment is not carried out on production animals, due to the animals being born with severe neurological impairment that requires euthanasia of the animal with congenital hydrocephalus [15].

CASE

A 8-hour-old male pig, weighing 1,800 kg, was treated in the Large Animal Sector of Veterinary Hospital, Brazil. The animal presented an enlarged skull (Figure 1) and motor incoordination. On physical examination, the physiological parameters were within normal limits, however, he was in lateral decubitus, unable to maintain himself in sternal decubitus or station, and also did not present a sucking reflex.

In the neurological examination, it was observed that the animal was alert, but had muscle tremors and ataxia of all 4 limbs. Plain radiography, contrast radiography and ultrasound of the skull were performed as complementary imaging tests. On simple radiographic examination, an increase in volume of the cranial vault is noted, with a homogeneous appearance of the brain, with predominantly liquid/soft tissue radiopacity, with the absence of markings of the cerebral convolutions and bone cortical thinning in the calvaria region (Figure 2A).

Contrast radiography was performed after anesthesia the animal with isoflurane[1] [Isoforine® - inhalation anesthesia], and administration of contrast Ioexol[2] [Omnipaque®- 0.5 mg/kg] in the subarchanoid space in the region of the foramen magnum (myelography). The radiographic findings of the contrast examination did not demonstrate progression of the contrast medium into the subarachnoid space of the spinal cord, however, there was reflux of the contrast towards the brain, demarcating the lateral ventricles (Figure 2B & C).

Transcranial ultrasound images demonstrate enlarged right and left lateral cerebral ventricles filled with homogeneous anechoic liquid content (Figure 3)

Based on the clinical signs presented by the animal and the results of the tests carried out, it was found that the animal had congenital hydrocephalus. Given the diagnosis made, considering that it was a production pig that already showed neurological changes, making its maintenance unfeasible and reducing the possibility of survival, the animal was euthanized.

The male pig was referred for necropsy at the Veterinary Pathology Sector of UFLA. The animal had cranial vault bones enlarged and thin, cerebral

Figure 1. Pig with hydrocephalus showing enlarged skull.

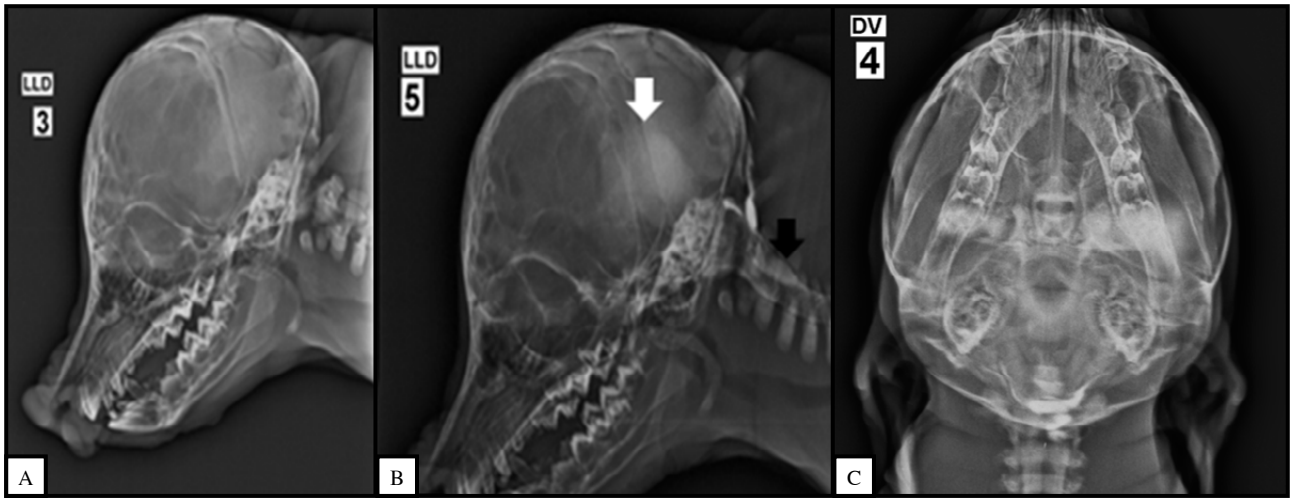

Figure 2. Radiographic image of a pig skull. A- Plain radiograph showing enlargement of the skull by a liquid radiopacity substance and marking of the cerebral convolutions. B- Myelography (contrast radiograph) 5 min after administration of iodinated contrast into the foramen magnum, observing dissolution of the contrast medium (white arrow) and its passage discrete to the spinal cord (black arrow), contrast did not progress to the spinal cord, with its reflux being observed into the cerebral ventricles, showing the accumulation of fluid characteristic of hydrocephalus. C- Myelography (contrast radiograph) 5 min after administration of iodinated contrast into the foramen magnum, observing presence of contrast in the lateral ventricles.

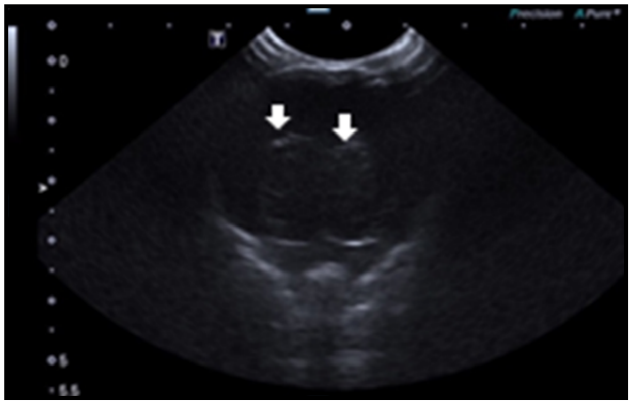

Figure 3. Transcranial ultrasound image (anterior fontanelle) mode B. Enlarged right and left lateral cerebral ventricles (arrows) and with the presence of liquid and homogeneous echogenicity inside and surround of cerebral.

hemispheres that collapsed when removed from the skull, accentuated dilation of the lateral ventricles and atrofia of the cortical white matter. Tissue samples were collected in 10% neutral-buffered formalin and routinely processed for histopathology. The histological exam revealed atrophy of the white matter and reduced number of the gray matter glial cells, associated to marked dilation of the lateral ventricles. The mesencephalic aqueduct was covered by a layer of ependymal cells that were abruptly discontinuous, forming several ependymal canalicules (stenosis) [Figure 4]. The final diagnosis was severe internal hydrocephalus.

DISCUSSION

Congenital hydrocephalus can produce clinical signs in animals in the 1st days of life, as occurred in the pig reported here. However, in dogs and cats, the most common thing is for signs to appear in the first months of life [15]. The most common etiology of

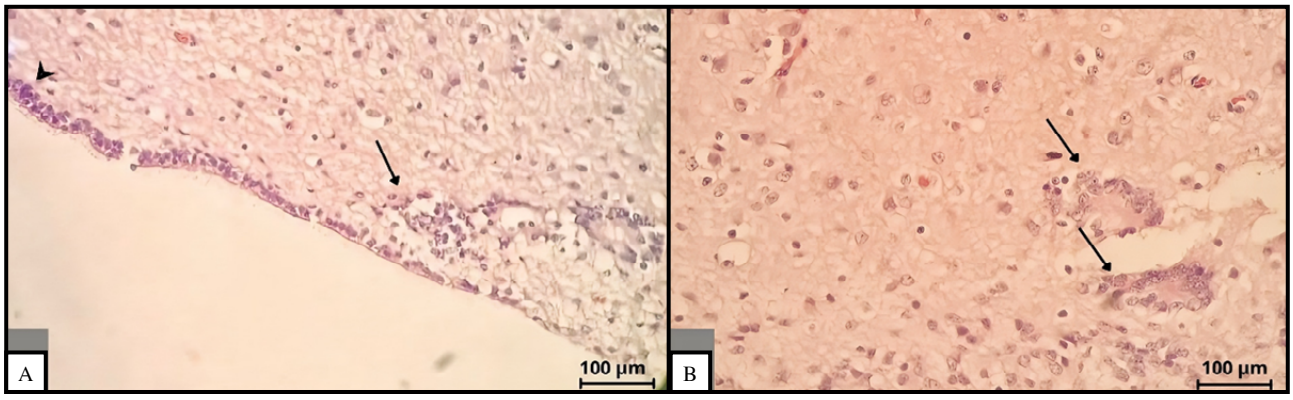

Figure 4. Congenital internal hydrocephalus in a pig. A & B- Mesencephalic aqueduct covered by a layer of ependymal cells (►) that were abruptly discontinuous, forming several stenosed ependymal canaliculi (←). [H.E.; Barr= 100 µm].

hydrocephalus is a malformation in the mesencephalic aqueduct, which appears stenotic [4]. The specific cause of hydrocephalus is generally not obvious at the time of initial assessment, only at necropsy or microscopy [13], as in this case report, in which, the stenotic mesencephalic aqueduct that gave rise to illness were seen in microscopic examination.

The physical characteristics and clinical and neurological signs presented by the pig in this case, such as enlarged skull, motor incoordination, ataxia and muscular tremors, are in line with what is found in cases reported in the same species [1,16] and also in other species, such as dogs, cats [5,6], horses [11] and sheep [13]. However, other signs or malformations in pigs with hydrocephalus, such as extremely light coats, short tails, ears reduced in size or having ears of different sizes were reported [1], characteristics not observed in the animal in the reported case.

The diagnosis of hydrocephalus is usually confirmed through imaging tests, such as ultrasound, computed tomography (CT), magnetic resonance imaging (MRI) [5] and electro diagnostics, such as electroencephalography [13]. Ultrasound is useful for assessing the size of the lateral ventricles and monitoring changes over time in patients with persistent fontanelles, but MRI and CT provide better results and can ensure a more complete examination and identify the cause of hydrocephalus [5]. In the case reported, ultrasound examinations and plain and contrast x-rays were performed. As mentioned in dogs and cats [7], the radiographic findings of plain radiographs were consistent for the diagnosis of hydrocephalus, demonstrating domination of the calvaria and cortical thinning and a homogeneous appearance to the brain, resulting from the loss of normal convolutional skull markings. On ultrasound, enlarged lateral ventricles filled with anechoic fluid were observed, corroborating findings [15].

Medical and surgical treatment is normally carried out in dogs and cats, mainly [6,14,15]. However, in other species, such as horses, sheep and pigs, animals are generally born with severe neurological impairment that requires euthanasia [13], as occurred in the reported case.

In the present case report, the necropsy findings, such as marked dilation of the lateral ventricles, enlarged skull bones and atrophy of the cerebral cortex, corroborate those found in feline, canine, bovine and equine hydrocephalus [15], and with the findings in sheep with congenital hydrocephalus [13].

The occurrence of congenital hydrocephalus in pigs is rare, with few reports in the literature. More studies regarding clinical signs and parameters of complementary exams, such as ultrasound and radiography, are necessary to characterize and detail hydrocephalus in pigs. Normally, euthanasia is indicated in cases of hydrocephalus in this species, as they are production animals and because they generally present neurological changes that make their maintenance unfeasible and reduce the possibility of survival.

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