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Open spina bifida in a newborn mix-breed puppy

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Abstract: Spina bifida, one type of spinal dysraphism, is a rare and severe congenital malformation of the nervous system. Spinal dysraphisms are considered neural tube defects (NTDs). NTDs are defined as incomplete closure of the neural tube during embryonic development. This uncommon disorder has been observed in various species, including dogs. Considering the uncommon appearance of open spinal dysraphism, this paper aims to present through clinical, computed tomography (CT) examination and dissection, a case of open spina bifida in a newborn female mix-breed puppy. The puppy belonged to a litter of 13 puppies deliverd through C-section from a primiparous bitch. Clinically, the puppy presented a dorsal, linear midline cutaneous defect with a length of 5.5 cm in the lumbo-sacral region. On the CT scan, it was seen that the dorsal arches of the lumbar and sacral vertebrae were completely missing. Similar, the dorsal arches of the coccygeal vertebrae were not completley closed. Due to spina bifida, a retroflexion of the spine was present. At dissection it was noticed that the spinal cord's integrity was altered from the thoraco-lumbar region all the way to the coccygeal region. The encephalus and spinal cord in the cervical region showed softening with a gelatinous appearance, except for the thoracic region. Cardiomegaly with a lack of pericardial fluid was observed upon opening the thoracic cavity. No visible organ modifications were observed in the abdominal cavity. This report describes a rare case of open spina bifida in a newborn puppy, emphasizes the significance of advanced imaging modalities in accurate diagnosis of neural tube defects, and aims to enhance the literature data in this field.

Keywords: spina bifida, neural tube defects, congenital malformation, mix-breed dog

• Introduction

NTDs (neural tube defects) are a group of severe congenital malformations of the nervous system that arise from the incorrect or incomplete closure of the neural tube during embryonic development. (1). There are two main ways in which the neural tube is formed from the neural plate during embryonic development: *primary neurulation* and *secondary neurulation.* In *primary neurulation*, the cells surrounding the neural plate invaginate inward, and finally detach from the outer surface. This process of invagination and separation gives rise to a hollow tube, the neural tube, which extends along the longitudinal axis of the embryo. Through primary neurulation, the brain and most of the spinal cord are formed (2). In *secondary neurulation*, the surrounding mesenchymal cells aggregate and unite to form a solid cord along the longitudinal axis of the embryo. Subsequently, this solid cord undergoes a cavity process, in which the centre of the cord empties to form a hollow tube, the neural tube. Through secondary neurulation, the tail bud is formed. These two separately formed segments later join together at the future upper sacral level to form the entire neural tube (2,3).

• Material and method

The case study was performed on a puppy, the result of a natural mating between a Visla female and a German Brack male. Due to antepartum complications, gestational edema, it was decided to do cessarian intervention (Fig1a). The case was in a veterinary clinic (SC.SANROVET-DUO.SRL) in Sânmihaiu Român. Out of the 13 puppies, only the one presented here was with visible congenital abnormalities. After the anesthesia protocol was carried out with Xylazine 1-1.5 mg/kg body weight IM, Ketamine 10-15 mg/kg body weight IM and Propofol 1-2 mg/kg body weight IV the Cessarian surgical procedure was done. The female puppy with spina bifida presented also urinary incontinence. Due to the severe malformations it was decided to euthanize it and to send it to the Genetics Discipline, Faculty of Veterinary Medicine Timișoara for teaching and research purposes. The case study involved clinical examination, computer tomography (CT) investigation and dissection.

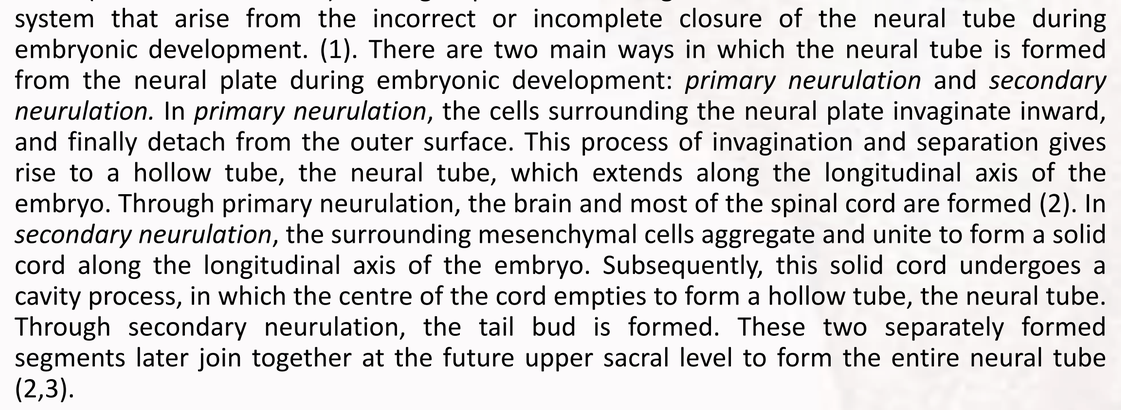
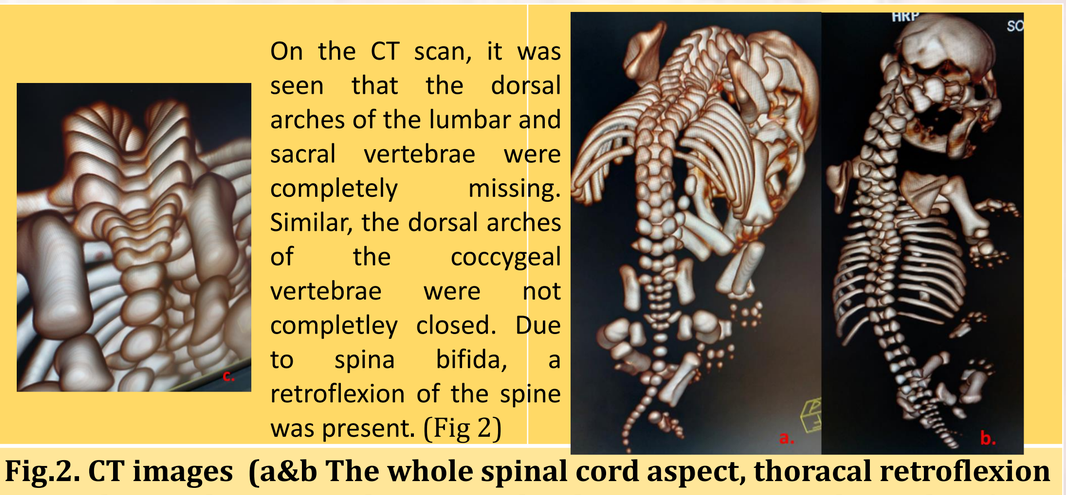


Fig.1. Clinically aspects with the case studied (a. Uterine horns during C-section, b&c. Dorsal and ventral image of the puppy, d. Focused image with the open spinal cord)

• Results and discussions

Clinically, the puppy presented a dorsal, linear midline cutaneous defect with a length of 5.5 cm in the lumbo-sacral region (Fig.1.b,c&d)



On the CT scan, it was seen that the dorsal arches of the lumbar and sacral vertebrae were completely missing. Similar, the dorsal arches of the coccygeal vertebrae were not completley closed. Due to spina bifida, a retroflexion of the spine was present. (Fig 2)

Fig.2. CT images (a&b The whole spinal cord aspect, thoracal retroflexion is observed, c. Focused image on lumbo-sacro-coccygeal vertebrae)

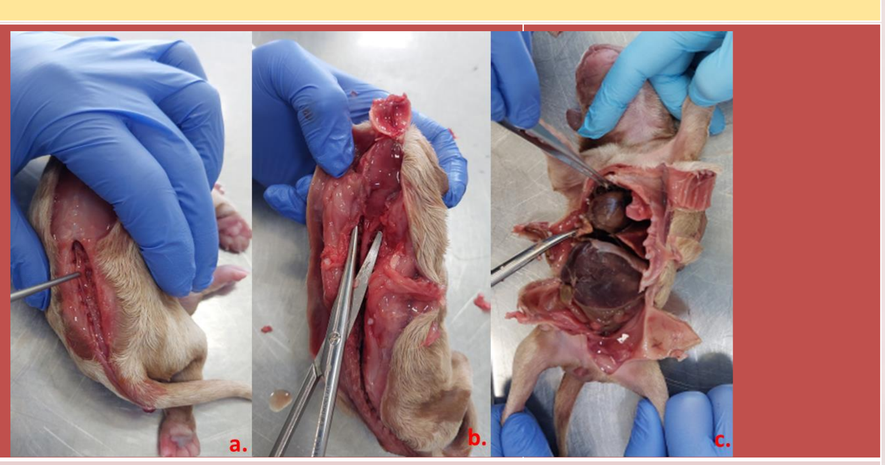


Fig.3. Dissection images (a. Open spinal cord in lumbar-sacral region, b. Softening with gelatinous appearance of the spinal cord in cervical region, similar aspect of the encephalus, c. Thoraco-abdominal cavites)

Cardiomegaly with a lack of pericardial fluid was observed upon opening the thoracic cavity. No visible organ modifications were observed in the abdominal cavity (Fig.3).

• Conclusions

Our findings enhance the available data on animal spina bifida and underscore the importance of utilizing paraclinical investigations, such as CT, to detect congenital anomalies in neonates and correctly diagnose NTDs.

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