

Dicephaly and other associated anomalies in a newborn lamb: Anatomic study

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June, 2016



Introduction

Conjoined twins can be defined as a progressive series of malformations, ranging from a partial duplication of a part of the body to the almost total formation of 2 individuals. Dicephalus twins are one kind of these conjoined twins, and they are characterized by the presence of two well-formed heads.

Two theories have been proposed to explain these malformations: The fission and the fusion theory. The most accepted is the first one, which explains that there is an incomplete fission at some stage of the primitive streak.

There are some discrepancies about the incidence of these alterations. However, it's been seen that dicephaly occurs in 2 out of 27 embryonic duplications in sheep, and the Merino breed is the most common breed in which such defects occurs.

These malformations may be caused by environmental factors, genetic factors, or both.

Objectives

The aim of the present study was to expose a dicephalus dibrachus dipus case in a newborn lamb and its associated anomalies.

Material and methods

A rasa aragonesa twin lamb was the subject of the study, and was delivered dead. There was no additional maternal history and pedigree information about the flock.

A dissection was carried out, and photographs were taken reporting all abnormalities.

Subsequently, Computed Tomography (CT) scans were performed, and the images were reconstructed to three-dimensional animations to visualize the position of bones.

Results and discussion



Fig. 1: The dicephalic lamb had a single body with duplicated heads. It can be seen cleft palate of the secondary palate in both heads. There was also a spina bifida with myeloschisis in the lumbodorsal region, and arthrogriposis in the pelvic members. It has been reported that myeloschisis in the lumbar region can cause this neurogenic atrophy of the pelvic members.

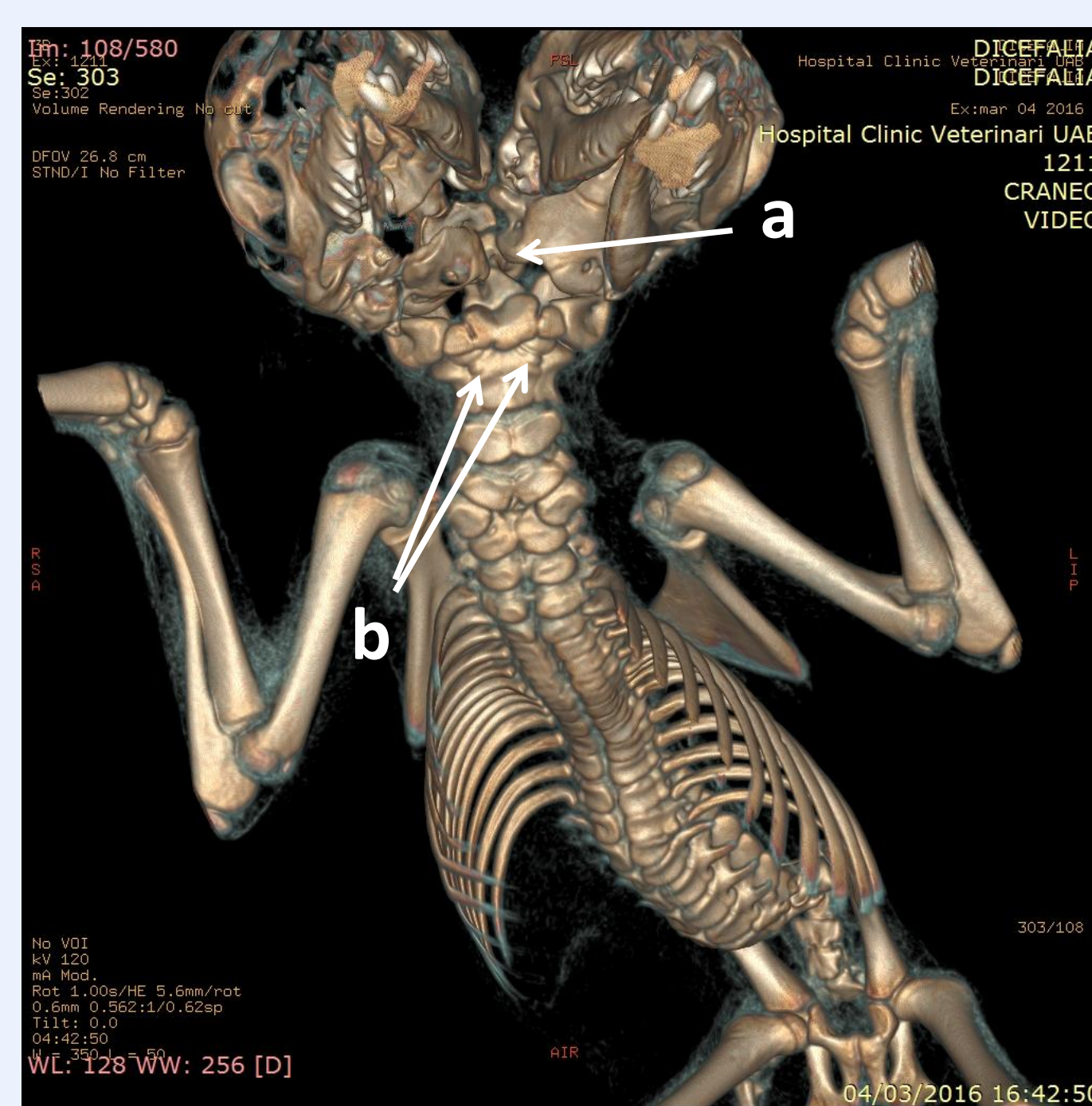


Fig. 3: Dorsal vision of the three-dimensional reconstruction. The two heads articulated both lateral occipital condyles with an abnormally big atlas, and the medial occipital condyles of both heads articulated with a strange piece (a). The axis was also partially duplicated, and had two dens (b). Butterfly vertebra could be seen in the entire length of the spine. This alteration occurs when there is a persistence of the notochord, causing a sagittal cleft in the vertebrae.

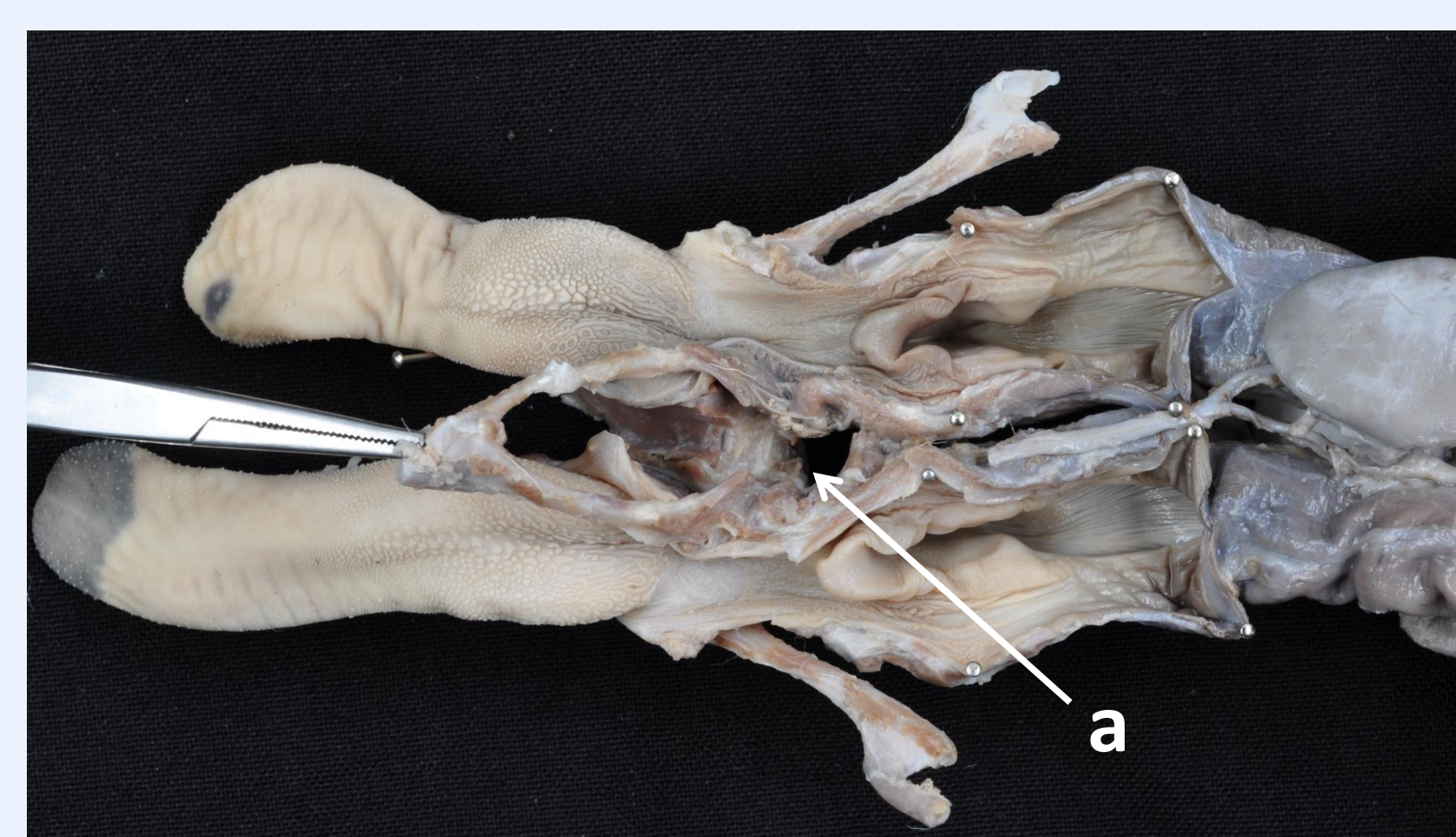


Fig. 5: The newborn lamb had two hyoid apparatus, the stylohyoid and basihyoid of each side fused medially (a). The larynx was also duplicated, but the cricoid cartilages weren't fused dorsally in both sides.

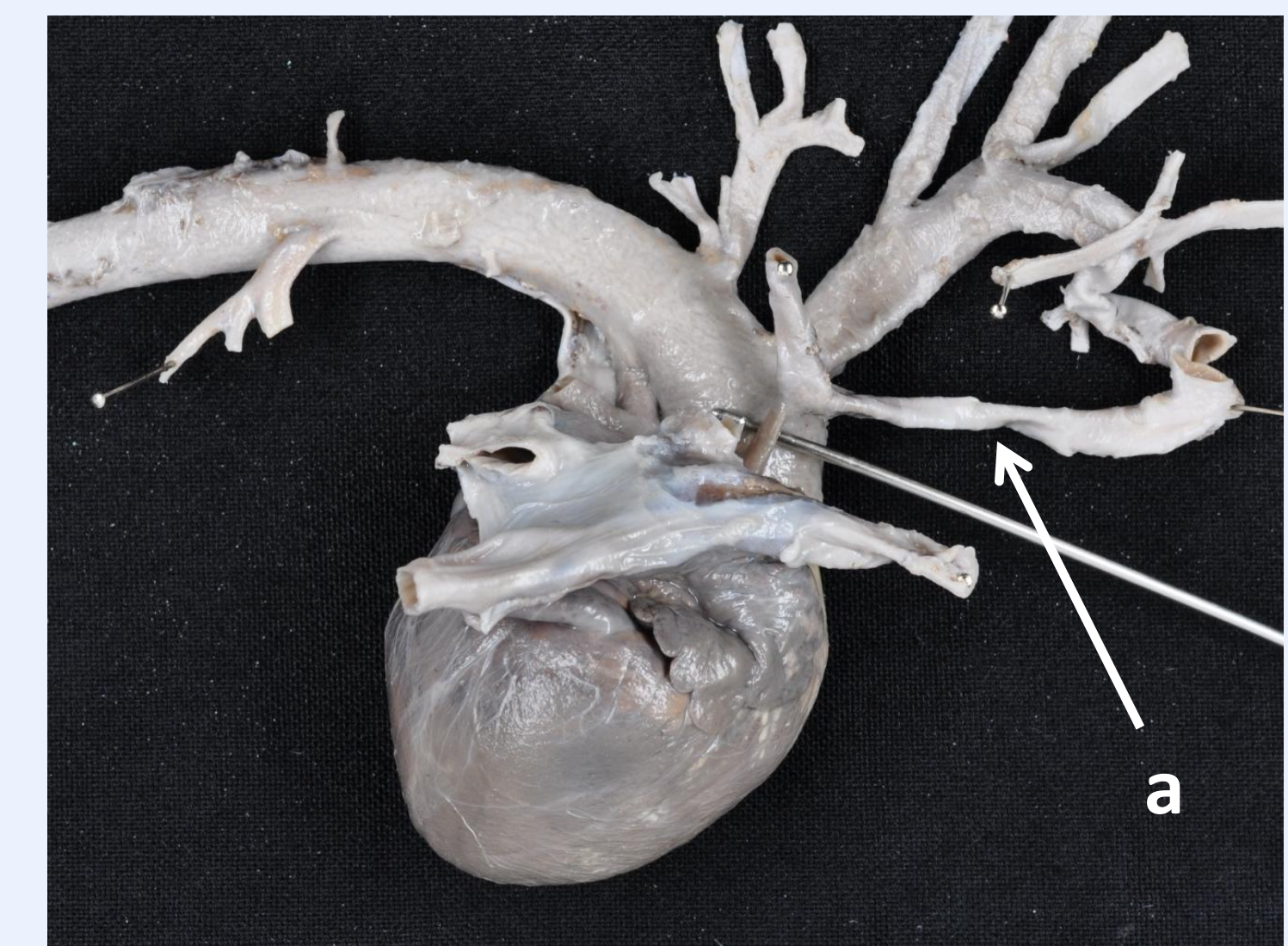


Fig. 2: Right side vision of the only heart. There was transposition of the great vessels, and hypertrophy of the right ventricle. The ramification pattern was also altered; There were three common carotids arteries, the left subclavian artery originated from the aortic arch, and the right subclavian artery had a branch that vascularized the right lung of the right side and the basis of the aorta (a). The most complex cardiovascular disorders tend to occur more in dicephalus twins than in other conjoined twins.

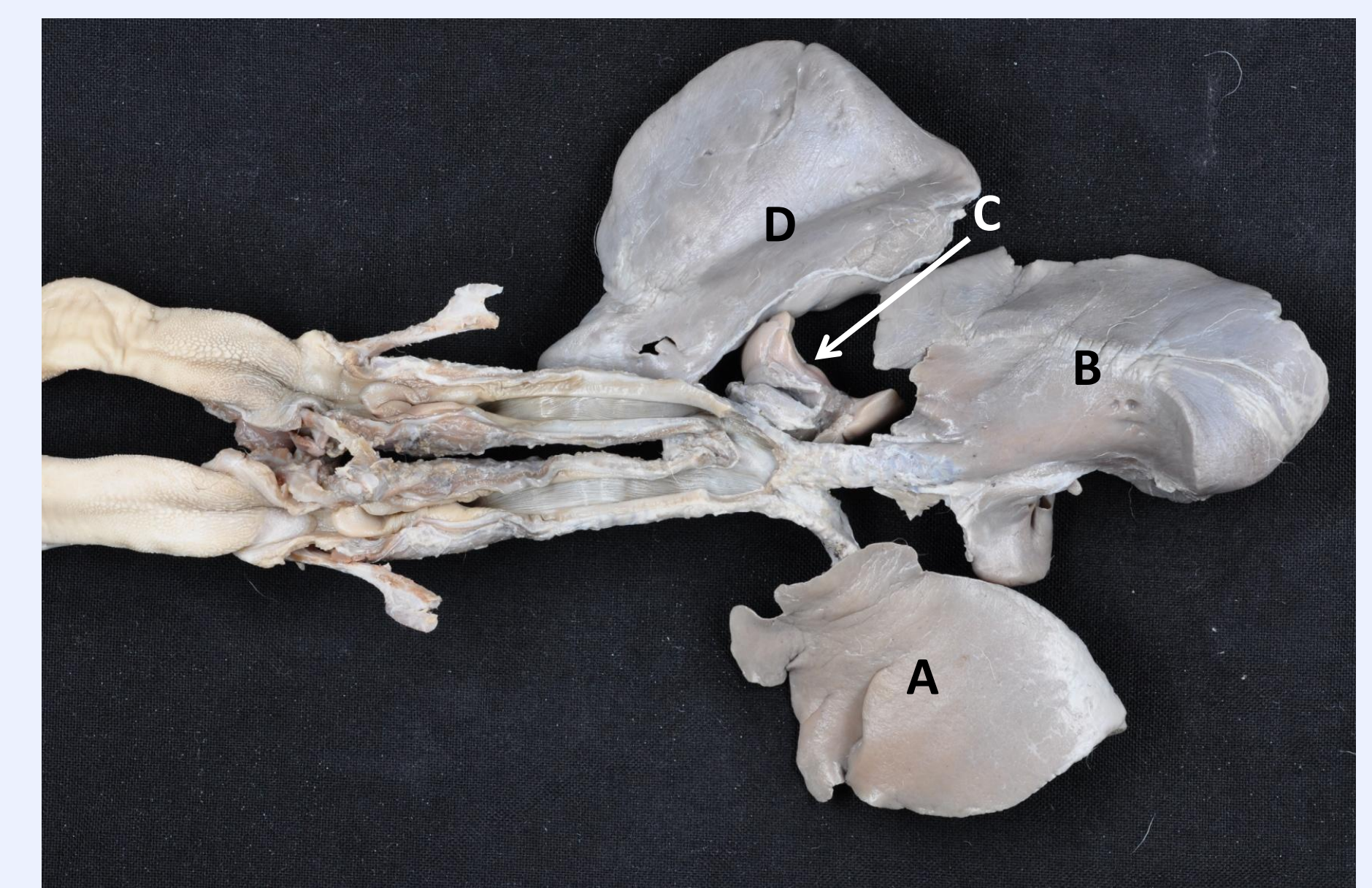


Fig. 4: Dorsal vision of the tracheas and lungs. There was a communication dorsally between both tracheas and esophagus, due to the absence of formation of the tracheoesophageal septum. Both tracheas were fused caudally, and communicated with four lungs, only one of them with the proper size and lobation (A). There were two lungs per side; **A:** Left lung of the left side, **B:** Right lung of the left side, **C:** Left lung of the right side and **D:** Right lung of the right side.

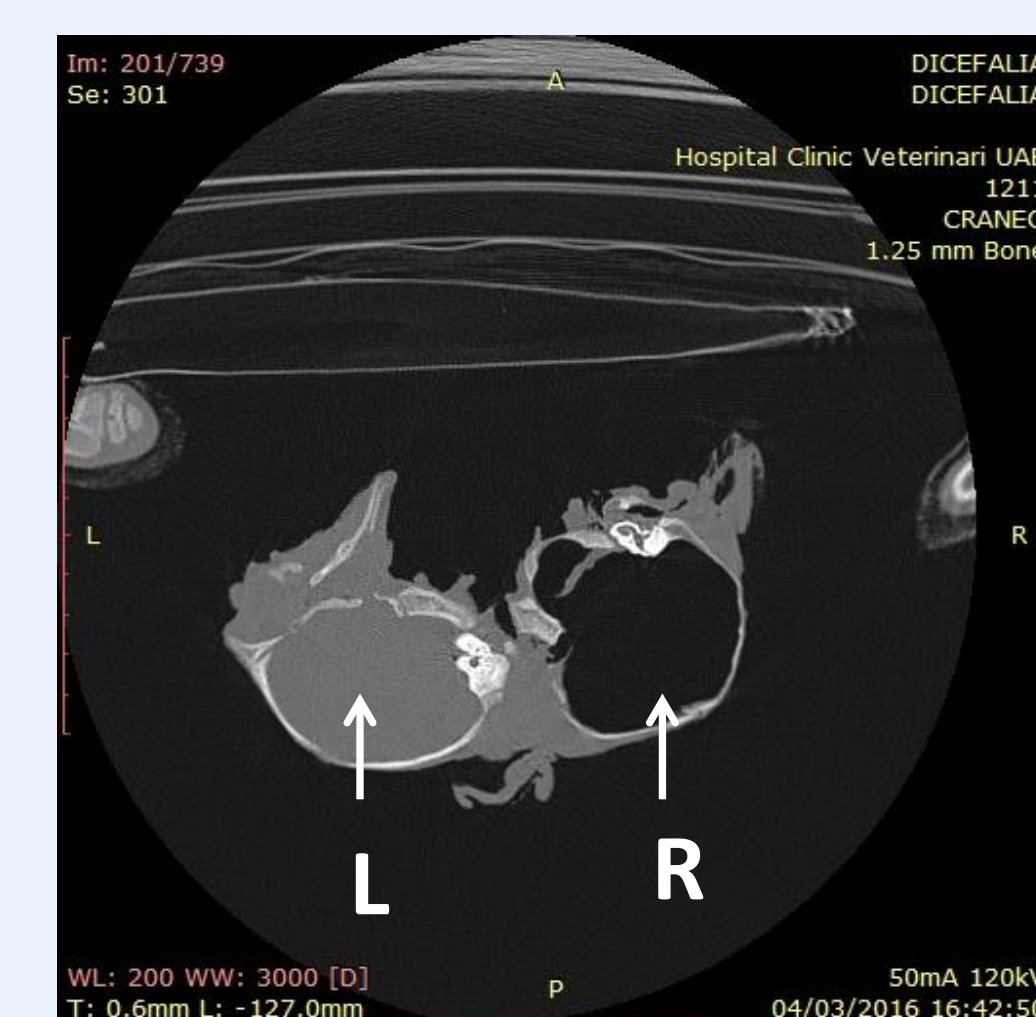


Fig. 6: This image shows a CT slice where both heads can be seen. There is an increased radiolucency in the right head (R), which may be due to hydrocephaly and atrophy of the brain. In other dicephalus cases alterations in the nervous system have been described, like edema or tissue disorganization. However, in our case the nervous system couldn't be well appreciated because of its deterioration.

Conclusions

Dicephalus conjoined twins are characterized by the presence of two heads, but this usually implies other associated anomalies. In this case the cardiovascular and respiratory system were the most affected. No explanation was found for alterations like the caudal fusion of both tracheas or the abnormal branching pattern of the great vessels of the heart.