Acardius acephalus in a goat kid – radiological and gross findings: a case report

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ABSTRACT: We received a malformed Messinese Black goat foetus for examination. The foetus was part of a triple gestation, from which two male kids presented no morphological abnormalities and underwent regular slaughtering. X-ray examination and necropsy were performed. On the basis of gross and radiological findings the malformation was classified as acardius acephalus. In human medicine, acardius is a rare and severe abnormality reported as a unique complication of monozygotic twin pregnancies, and is known as twin-reversed arterial perfusion (TRAP).

Keywords: acardius acephalus; X-ray; Messinese Black goat; congenital malformation; twin-reversed arterial perfusion (TRAP)

Acardius acephalus is a form of detached asymmetric conjoined twinning where one of the two twins, the parasite, is joined to an otherwise relatively normal foetus, the autosite, in one of the same sites of union as intact conjoined twins (Spencer 2001).

The parasite usually consists of an externally attached organoid mass with supernumerary limbs, some viscera, and very rarely with a functional heart or brain (Spencer 2001; Tovar 2009).

Acardius acephalus is connected by the chorionic or cord vessels to the autosite twin, which provides, therefore, circulation and feeding to the parasitic one, often devoid of a heart and head. At birth, only the autosite twin survives after umbilical cord division as the parasitic one has no independent circulation once separated (Baldwin 1992; Tovar 2009).

In human medicine acardius acephalus is one of the most severe and rare congenital congenital malformations and it occurs approximately once in 35,000 births (James 1977). In veterinary medicine, only a few cases of acardius in cows (Matteuzzi and Cianti 1988; Dunn et al. 1967; Czarnecki 1976; Mee 1990; Santos et al. 2008), five cases of acardius acephalus in sheep (Cole and Craft 1945, Dennis 1965; Uccheddu et al. 2009) and one acardius acephalic in a buffalo (Dhami et al. 2000) have been described.

Case description

During a regular slaughter, a malformed Messinese Black goat foetus was delivered to the Unit of Pathology of the Department of Veterinary Sciences of Messina for examination. The foetus came from a goat farm located in the area of Messina (Sicily) and was part of a triple gestation, from which two male kids presented no morphological abnormalities. Anamnestic data did not reveal any previous cases of malformations on the farm. Radiological examinations, using two direct orthogonal lateral and craniocaudal projections, X-ray settings of 65 kV, 8 mAs at a film focus distance of 1 m, were performed prior to the dissection to improve the morphological study and orient the necropsy.

Radiological projections revealed the presence of a disproportionate area of soft tissue embedding the two hind limbs, the pelvis and a malformed portion of the vertebral column. In the cranio-caudal projection, the presence of two radio-opaque round-shaped areas at the level of the inguinal region confirmed the previously observed scrotum (Figure 1a). Hind limbs were morphologically unremarkable; epiphyses were immature and characterised by several radio-transparent lines at the proximal and distal sides of all the bones due to growing cartilages. The vertebral column ap-

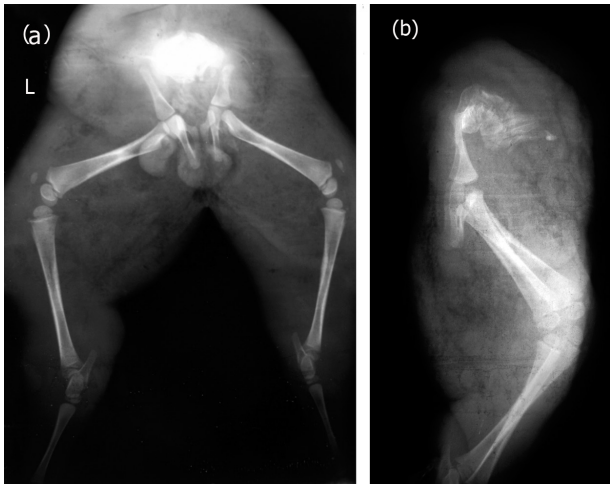

Figure 1. Ventro-dorsal radiographic projection: the presence of a disproportionate area of soft tissue embedding the two hind limbs, the pelvis and a malformed portion of the vertebral column (**a**). Lateral radiographic projection: the vertebral column appeared malformed, turned at an angle of 90° and cranially shifted (**b**)

peared malformed, turned at an angle of 90° and cranially shifted (Figure 1b). Vertebral bodies were crushed, not differentiable, but referable to those of the lumbar-sacral trait. Radiographs showed also abnormalities of vertebral bodies and transverse processes, the absence of spine processes, incomplete sealing of the vertebral arch and deformities of the medullar channel (Figure 1a, b). Externally, the foetus was oedematous with only a pair of limbs joined to a bony structure not better identified at palpation. External genitalia were represented by two uninhabited sketched scrotum. The head, abdomen and thorax were not identifiable (Figure 2a, b). Only a section of the umbilical cord was detected in the median-superior area or in the presumptive perianal region.

Skinning revealed subcutaneous and soft tissue oedema, muscular hypotrophy and the absence of fat tissue (Figure 2d). The hind limbs were normally developed over their entire length; the vertebral column appeared crushed and malformed (Figure 2e). An omphalocele and an immature preputial sheat (Figure 2c), internally connected to a rudimentary urethro-penial structure in continuity with the urinary bladder, were detected (Figure 2f). The intestine was comprised only of an ileum, an atretic, dilated and blind caecum and a colon (Figure 2g). No other abdominal or thoracic organs were detectable.

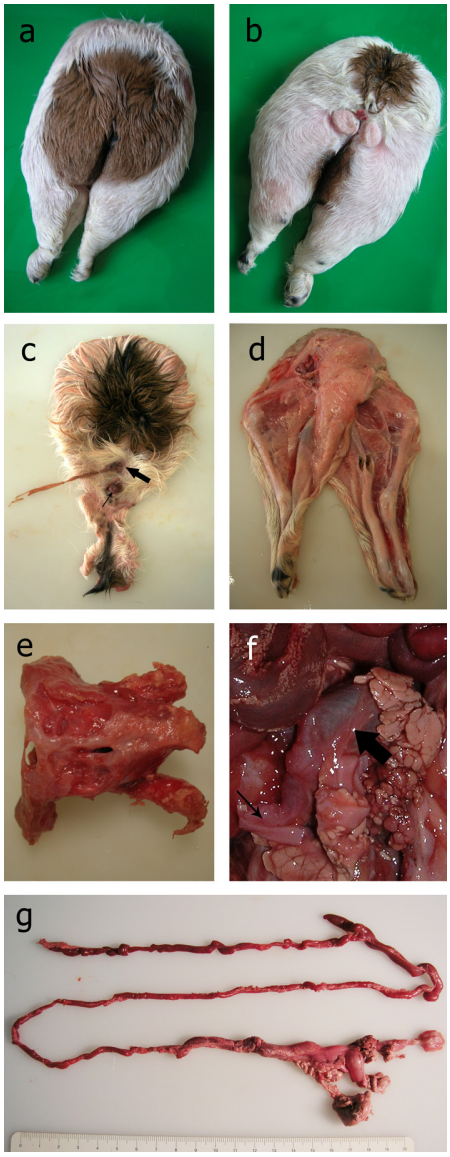

Figure 2. Caudal view of the acardius (**a**); cranial view of the acardius, with the evidence of external genitalia (**b**); omphalocele (large arrow) and an immature preputial sheat (small arrow) (**c**); evidence of subcutaneous and soft tissue oedema with muscular hypotrophy and absence of fat tissue (**d**); malformed portion of vertebral column (**e**); rudimentary urethro-penial structure (small arrow) in continuity with the urinary bladder (large arrow) (**f**); intestine (**g**)

DISCUSSION AND CONCLUSIONS

On the basis of gross and radiological findings the malformation was classified as Acardius acephalus.

In human medicine, acardius is a rare and severe abnormality reported as a unique complication of monozygotic twin pregnancies, and is known as twin-reversed arterial perfusion (TRAP) (Cohen

et al. 2010). Acardius twins are subdivided into four morphologic categories: Acardius acephalus, in which the head as well as the upper extremities are lacking; Acardius anceps, the most highly developed form in which the body and extremities are developed and the head is partly developed; Acardius acormus, in which there is a head without a body; Acardius amorphous, which is the least form and is not recognisable (Napolitani and Schreiber 1960). The pathogenesis of this abnormality is thought to be due to reversed arterial perfusion. Oxygen- and nutrient-depleted umbilical artery blood leaves the normal twin and is driven into the abnormal twin by way of anastomoses with its umbilical artery. Two pathogenetic hypotheses are currently accepted. The first hypothesis suggests that there is a primary defect in the development of the heart and that the acardius twin only survives as a result of the compensatory anastomoses that develop. The second states that the acardius twin begins life as a normal foetus, and that a reversal in the circulatory blood flow results in atrophy of the heart and other organs (Blenc et al. 1999). The present case, to the authors' knowledge, is the first description of acardius acephalus in a goat, and represents an addition to the scant literature on this topic.

Acknowledgement

Authors are grateful for assistance to Dr. Agata Tucci (Veterinary practitioner). For the editing and translating the English version of this manuscript, authors want to thank Professor Eugenio Cianflone (University of Messina).

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Received: 2013–03–12
Accepted after revision: 2013–11–22

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