**Fetiform teratoma in an Italian-Friesian calf: case report and literature review**

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**BACKGROUND**

**Fetiform teratoma** is a rare form of highly developed mature teratoma that includes one or more components resembling a malformed fetus. Most authors agree that **fetiform teratoma** are highly developed mature teratomas; the natural history of **fetus in fetu**, however, is controversial\textsuperscript{1}. **Fetus in fetu** has often been interpreted as a fetus growing with or within its twin. As such, this interpretation assumes a special complication of twinning, one of several grouped under the term parasitic twin. However, classification of similar congenital malformations is difficult because too few cases have been reported in humans and animals to provide the basis for generalization.

In the present paper, we describe the first case of highly differentiated extragonadal **fetiform teratoma** with cranial connection resembling a case of **craniopagus parasiticus** in an Italian-Friesian calf, successfully treated by surgery.

**CASE PRESENTATION**

A 35-day-old male Italian-Friesian calf weighing 55 kg was referred because of a mass localized in the fronto-nasal region. The delivery was without complications and the calf appeared in good condition with otherwise appropriate development of the musculoskeletal system.

The asymmetrical mass was covered with hair and had well-defined margins. The long axis measured 15 cm and the short axis 10 cm. Two lateral structures of similar size and conformation were recognized as underdeveloped hind limbs, while at its center there was a small tail (Fig. 1A).

Palpation revealed that the mass was not strictly adherent to the underlying tissues while bone structures were clearly palpable in the central area. Latero-lateral (Fig. 1B) and cranio-ventral X-ray projection revealed the presence of three bony structures: two with vaguely triangular shape and one with a more oval shape, identified as the pelvic portions of the parasitic twin.

Complete blood count (CBC) and the main haematocritical parameters proved to be in the normal ranges. Aliquots of serum were tested for **Neospora caninum** and **Chlamydia** spp. by indirect immunofluorescence antibody tests (IFAT) and for Bovine Viral Diarrhea Virus (BVDV) and Bovine herpe-
svirus-1 (BoHV-1) by enzyme-linked immunosorbent assay (ELISA). RT-PCR and Nested PCR were used to test the bulk milk for BVDV and BoHV-1, respectively. All tests on serum and milk gave negative results.

Cardiac auscultation, electrocardiography, thoracic and abdominal ultrasonography did not reveal any abnormality. The mass was surgically excised and sent to the pathologist for examination (Fig. 2).

The calf was discharged 11 days after surgery and eight months later was still in good condition as a normal subject.

On gross examination, the well-circumscribed mass excised from the cranial region showed on bisection two rudimentary limbs, each containing an incomplete long bone resembling a femur, and a sketch of bone located between the two appendices, morphologically referable to a rudimentary coxae-like bone (Fig. 3). Inside the excised mass, some small cysts filled with mucinous material were also seen, protruding within a virtual body cavity, whose cut section showed adipose and muscular tissues, and some cartilaginous nuclei that resemble other sketches of bone delimitating a coelomatic body cavity. Multiple cuts did not reveal any axial skeleton or cephalic differentiation. Multiple gross sections, confirmed by the histological examination of the different portions of the mass, showed differentiation into skin with dermal appendages, hair, adipose tissue, cartilage, bone, lymphoid tissue, neurovascular bundles, and rudimentary

Figure 1 - A) Clinical appearance of the mass. Note the underdeveloped hind limbs (arrowheads) and the small tail (arrow). B) Latero-lateral X-ray projection of the head. The central structure (arrow) was identified as the pelvic portions of the fetiform teratoma.

Figure 2 - Intraoperative picture of the surgery: A) before and B) after removal of the bony mass.
tail. No neural tissue including spinal cord, brain matter, or gonadal differentiation was seen. On the basis of these findings, the mass was diagnosed as a highly differentiated extragonadal fetiform teratoma.

**DISCUSSION**

Teratomas are embryonal neoplasms composed of tissue derived from all three germ layers. They can be extragonadal or gonadal and arise from primordial germ cells that may become stranded during their migration, coming to rest at extragonadal sites. **Fetiform teratomas** should not be confused with *fetus in fetu*, which is invariably associated with anencephaly and achardia2,3; difference in the origin of the two has been described in the literature3. Unlike classical teratomas, fetiform teratomas have complex tissue differentiation/organization and organoid differentiation. Usually the caudal development is better than the cephalic one, as in the present case, which entirely lacks cephalic differentiation. Limb formation is seen more often, while visceral organ tissue and skeletal muscle are inconspicuous or absent, as in this case.

In our case, on the basis of his tissue differentiation and the absence of a head or central and peripheral nervous system, the fetus-like structure may be classified as **fetiform teratoma**, a rare form of mature teratoma that include one or more components resembling a malformed fetus. This teratoma differs from "fetus in fetu" because it appears to contain complete organ systems, even major body parts such as the torso, tail, and limbs. *Fetus in fetu* differs from fetiform teratoma in having an apparent spine1.

In our case, surgery was performed successfully and no other abnormalities were detected on the autopsite. Although we cannot establish a breed predisposition, it is interesting to note that most (4 out of 5) cases of parasitic twins reported in bovine have occurred in the Friesian genetic strain5,6,7,8,9.

There is a dearth of epidemiologic, clinical and pathological information about these congenital malformations because the heterogeneous terminology can cause confusion and also because abnormalities tend to be underreported. Systematic reporting of cases of fetal malformation should be encouraged, in order to provide the basis for further investigation of the epidemiological, etiological, pathophysiological and therapeutic aspects of this kind of congenital disease.

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**References**


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**Figure 3** - Sketch of bone, found inside the excised mass, morphologically referable to a rudimentary coxae-like bone.