

# Ossified yolk sac remnant in horse: a case report



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## SUMMARY

Foetal adnexa are derived from the blastocyst, they rapidly grow during the first stage of the pregnancy and are finally expelled after foaling. Congenital anomalies, as well as acquired (infectious and non-infectious) diseases of the foetal adnexa can result in reproductive disorders. As a consequence, the comprehensive and systematic examination of the foetal adnexa is widely regarded as a very useful procedure for diagnostic purposes. In this respect, it is important to correctly identify and to interpret the main features of the equine foetal membranes.

We describe herein a case of yolk sac remnant, recently observed in a 10-year-old Quarter Horse mare. After parturition, foetal adnexa were routinely collected and carefully examined. At this point, a large, round-shaped mass of about 9 cm in diameter was observed, connected to the umbilical cord through a fibrous and pedunculated stalk. Such mass was very hard, it showed a bony appearance and contained reddish-to-brown serous fluid. Foetal membranes were otherwise normal. On the basis of what above, the diagnosis of ossified remnant of the yolk sac was made.

The yolk sac is a temporary annex and ensures the early exchange between the uterine environment and the embryo, thanks to its dense vessel network. In horses, the transition from the yolk sac to the allantoic sac occurs between the 21<sup>st</sup> and 40<sup>th</sup> days of gestation, and the yolk sac obliteration is complete at the 3<sup>rd</sup>-4<sup>th</sup> month of pregnancy. However, the yolk sac can persist as a mass which vaguely resembles a skull and is often misdiagnosed as a twin foetus that failed to develop.

In horses, the persistence of a yolk sac remnant is considered an uncommon, idiopathic condition of unknown origin. It most commonly represents an incidental finding, which usually has any clinical relevance for the foal and do not affect the future breeding career of the mare.

## KEY WORDS

Horse, delivery, foetal adnexa, yolk sac remnant.

## INTRODUCTION

Foetal adnexa are often referred to as foetal membranes or afterbirth, they are derived from the blastocyst and rapidly grow during the first stage of the pregnancy, in order to provide nourishment and protection to the embryo/foetus. Foetal adnexa, namely chorion, amnion, yolk sac, allantois and umbilical cord, are expelled after foaling. The in-depth description of the foetal adnexa morphogenesis goes well beyond the purpose of the present case report. However, it could be useful to retrieve some basic knowledge, with special reference to equids.

The chorion is the outermost membrane and contains the embryo/foetus and all the other foetal adnexa. The external surface of the chorion is red-to-brown in colour, velvety due to the presence of countless micro-cotyledons, and intimately adheres to the uterine mucosa, thus participating to form the placenta. The chorion shape traces that of the uterus, making possible to recognize the body, the foetal and the non-foetal horns ("F-shape").

The amnion is the innermost foetal membrane; it is quite large and elliptic in shape, provided with an evident hilum through which the umbilical cord runs. The amnion houses the foetus, which is immersed in a variable amount of amniotic fluid (3-5 litres at the end of the gestation in the horse). In equids, the allantois is large and consists of two sheets: the outer sheet strictly adheres to the chorion ("allantochorion"), while the inner one covers the amnion. These sheets mark a large cavity, filled with the allantoic fluid (8-12 litres at the end of gestation in the horse).

The yolk sac is a temporary annex and ensures the early exchange between the uterine environment and the embryo, thanks to its dense vessel network. In equids, the yolk sac regress and then persists inside the umbilical cord in the form of a thin red-brown streak.

The umbilical cord extends from the navel to the placenta and hosts the umbilical vessels, which provide for gas and substrate exchange during the foetal life. In horses, the umbilical cord is about 60 cm in length and consists of two different portions: amniotic and allantoic<sup>1,6</sup>.

Congenital anomalies and acquired (infectious and non-infectious) diseases of the foetal adnexa can result in reproductive disorders, such as infertility, embryonic death, abortion and stillbirth. Therefore, the comprehensive and systematic examination of the foetal adnexa is very useful for diagnostic purposes<sup>2,7</sup>.

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## CASE DESCRIPTION

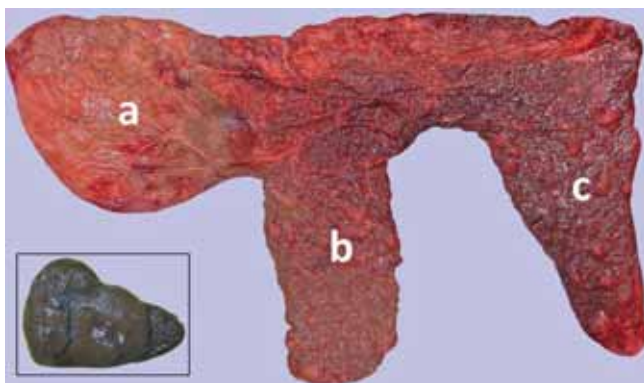
### Material and methods

A 10-year-old, Quarter Horse mare was naturally mated with a Quarter Horse stallion. As routinely carried out at the equine breeding facility of the University of Teramo (Italy), pregnancy was diagnosed at 14 days post-mating and confirmed at 25 days post-mating by ultrasound examination. The mare was then monthly monitored until the parturition. Pregnancy regularly proceeded during a physiologic timespan of 350 days. The delivery was slightly "languid" and required the assistance of two operators, who exerted a gentle traction about 20 min after that the foetal limbs and nose appeared through the vulva.

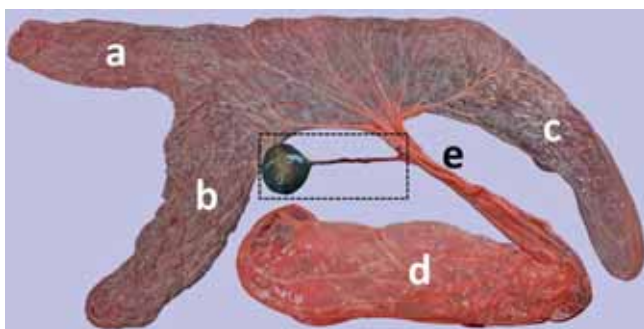
After the birth, the foal reached the sternal recumbency within 5 min, and it stood up and assumed the colostrum within 1 h of parturition. Foetal adnexa were expelled about 1 h after the delivery. Thereafter, the mare was injected with 10 I.U. oxytocin (twice at a 12 h interval) to treat the retention of a small amount of fluid inside the foetal horn of the uterus. As a routine, foetal membranes were collected and carefully examined. Tissue samples were fixed in 10% neutral buffered formalin and routinely processed for histopathological investigations.

### Results

All foetal adnexa were apparently "healthy" in size, shape and colour (Figures 1 and 2). However, a round-shaped mass, of



**Figure 1** - Foetal adnexa. Outer surface of the chorion. The body (a), the non-foetal horn (b) and the foetal horn (c) can be easily appreciated. The chorion appears normal in size, shape and colour. A large hippomane (insert), sized about 8x5 cm, was detected inside the amniotic sac.



**Figure 2** - Foetal adnexa. In this picture, the allantochorion (a = body; b = non-foetal horn; c = foetal horn), the amnion (d) and the umbilical cord (e) can be seen. In addition, a round-shaped mass is observed, connected to the allantoic segment of the umbilical cord by means of a thin, fibrotic streak (rectangular box).

about 9 cm in diameter, was observed. This mass was connected to the allantoic segment of the umbilical cord through a fibrous and pedunculated stalk (Figure 2). At sectioning, the mass consisted of a hard, bony "shell" and contained reddish-to-brown serous fluid (Figure 3 and 4). Microscopical investigations confirmed that the mass consisted of lamellar bone, intermingled with necrotic tissues and haemorrhagic foci. Overall, the gross findings reported herein are fully consistent with those of an ossified remnant of the yolk sac.

### Discussion

The examination of the equine afterbirth should be routinely and carefully performed, in order to identify the aetiology of an abortion, as well as to early detect neonatal diseases and/or to forecast the mare's ability to continue its breeding career. Accordingly, it is crucial to correctly identify and understand some structures of the equine afterbirth, which are often confused with lesions:



**Figure 3** - At a closer view, the mass consists of a thin fibrotic sac, containing bloody fluid and surrounding a hard, ossified core.



**Figure 4** - On cut section, the mass consists of bony trabeculae which border multiple, interconnected cavities. A bloody fluid also filled those cavities.

- amniotic plaques - 1 mm sized nodules composed of stratified squamous keratinizing epithelium, which are present on the foetal side of the amnion;
- hippomanes - foetal waste products which can be seen floating in the allantoic fluid or attached to the inner surface of the allantochorion;
- allantoic pouches - remnant of the endometrial cups, usually detected where the umbilical vessels join the allantochorion;
- allantochorion folds, cervical star, utero-tubal junctions - areas physiologically devoid of chorionic villi<sup>2,7</sup>.

Among these is the yolk sac remnant, which vaguely resembles a skull and is often misdiagnosed as a twin foetus that failed to develop. In horses, the transition from the yolk sac to the allantoic sac occurs between the 21<sup>st</sup> and 40<sup>th</sup> days of gestation<sup>3</sup>, and the yolk sac obliteration is complete at the 3<sup>rd</sup>-4<sup>th</sup> month of pregnancy<sup>1</sup>. The persistence of a yolk sac remnant is considered an uncommon, idiopathic condition of unknown origin. In a large study carried out in Italy by Morini et al. (2009), the yolk sac remnant was detected in 8 out of 336 equine afterbirths, its prevalence being of 2.3%. As described herein, yolk sac remnants are usually detected within or attached to the allantoic segment of the umbilical cord, their median diameter being about 5 cm. Hypothetically, the pedunculated stalk of the yolk sac remnant could loop around the umbilical cord, thus occluding the blood

vessels. However, such masses most commonly represent incidental findings, which apparently have no clinical relevance for the foal and do not affect the future breeding career of the mare<sup>2,4,5,7</sup>.

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