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ScienceDirect
Theriogenology 69 (2008) 918–924
Theriogenology
www.theriojournal.com

Morphological features of the placenta at term in the Martina Franca donkey

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Received 6 December 2007; received in revised form 10 January 2008; accepted 12 January 2008

Abstract

This study was designed to establish the morphological features of the placenta of the Martina Franca jenny. Ten placentas were harvested at the time of foal delivery and examined both for gross and histological characteristics. The following factors were determined: the total weight and volume of the placenta and its components, the surface area of the allantochorion, umbilical cord length and site of insertion, and the diameter of the umbilical cord vessels and vascular pattern type. The weight of the placenta was similar to previously reported for ponies, and represented 12% of foal birth weight. Umbilical cord length was similar to that in the horse but longer than in the pony, while cord weight was intermediate between the two. In a histological examination, numerous strong villi were observed at sites corresponding to the non-pregnant and pregnant horn and uterine body. No villi were detected in the area overlying the cervical star. Despite obvious similarities between the donkey and horse placenta, specific morphological features do exist, and are possibly related to the differences in length of gestation.

Keywords: Donkey; Placenta; Morphological features

1. Introduction

In Mediterranean countries, the donkey was for centuries an important form of transport and tool used in agriculture. However, as soon as the donkey was replaced by machines, this animal was essentially ignored until the interest of researchers was recently renewed for several reasons. First, most donkey breed populations have declined to levels considered by the FAO as endangered. Therefore a risk that several breeds will disappear within a relatively short period of time exists. Moreover, the interest in several possible uses for these animals should be underlined, including the production of hypo-allergenic milk, in pet therapy, or ''onotherapy'', and in the production of mules for agricultural work in national parks, in which there is a ban on the use of machines. These incentives have prompted efforts to increase the existing donkey population. The most important target for these research activities is certainly to improve the reproductive performance of the animal based on detailed knowledge

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0093-691X/$ – see front matter © 2008 Elsevier Inc. All rights reserved.
doi:10.1016/j.theriogenology.2008.01.004

of both male and female reproductive activity. Given the considerable length of pregnancy in equids and that they only carry singletons, a healthy pregnancy leading to the birth of a live, viable foal is a necessary pre-requisite for a successful reproductive process. In mammals, the placenta plays a key role in the correct development of the fetus and ensures its viability until parturition [1–3]. This role is dependent on both its anatomic integrity and functional efficiency. Moreover, since fetus and placenta are strictly interdependent and the birth of a healthy foal at term is determined by normal placental development, a thorough placental examination can give clues that may not be evident on initial examination of the newborn foal [4,5]. Several descriptions of the anatomy of the horse placenta and its most common abnormalities exist [4,6–12]. However, information on the normal anatomical features of the placenta in the donkey is still scarce [13–16].

The placenta of donkeys and horses are structurally similar. The villi are organized in microcotyledons diffuse on the entire allantochorion surface. The placentation is non-invasive and classified as epitheliochorial [13–16]. Regarding the feto-maternal interdigitation, the donkey presents distinct ramifications of villi and organized septa in microplacentomes. A study on donkey placenta blood vascular system revealed structural differences to the horse placenta with higher vascular density and thinner interhaemal membrane [16]. From a functional point of view, Urwin and Allen [17] found also in the donkey as in the mare the production of chorionic gondatrophin (starting around day 40) that stimulates the formation of secondary corpora lutea.

However the authors are not aware of morphologic studies concerning the specific characteristics of the jenny placenta. The aim of the present study was to increase our existing knowledge of reproduction in the donkey by describing the placenta in Martina Franca jennies reaching full-term and undergoing normal, spontaneous parturition.

2. Materials and methods

2.1. Animals and clinical data

The study was conducted on 10 Martina Franca jennies (A–J), 5–18 years old, kept at the Chiareto estate, which belongs to the Faculty of Veterinary Medicine, University of Teramo, Italy. The jennies had been successfully mated and monitored throughout gestation, to check for the normal development and viability of the fetus. At term, the jennies were allowed to foal spontaneously with no obstetric intervention.

Foalings were included in the study provided the following criteria defining normal parturition, mostly based on previous studies conducted in the mare [9,12,18–20], were satisfied: delivery in recumbency; allantochorion rupture and fetal delivery unassisted; dorsal anterior presentation of fetus; second stage of foaling (from allantochorion rupture to fetus expulsion) no longer than 20 min; natural rupture of the umbilical cord; and placental expulsion time no longer than 120 min.

Pregnancy length, age and body weight of each jenny, as well as foal sex and birth-weight, were recorded. Each foal was weighed within 30 min of birth, before nursing.

2.2. Placenta examination

The placenta was examined for gross anatomy and fragments were obtained for later analysis according to the procedure used in the mare by Whitwell and Jeffcott [9]. The allantochorion was weighed and arranged in the typical 'F' configuration [4,21] with the fetal surface outermost followed by measurement of its surface area (allantochorion surface area, ACS). To determine the vascular pattern type of the placenta, each artery was followed from the umbilical cord to the terminal vessel branches [22,23]. The allantochorion was then cut open around its entire perimeter. The gross allantochorion area was measured using a transparent perspex sheet marked with lines to form a 10 cm^2-test grid and a small hole at each intersect. The perspex sheet was suspended a few centimeters above the allantochorion and the gross area in cm^2 was calculated by multiplying the number of grid intersections overlying allantochorionic tissue by 10^2 [24]. Next, the allantochorion was cut into four pieces which were each placed in a 2 L graduated cylinder half filled with water. The volume of water displaced was measured to calculate the total volume of the allantochorion. The same procedure was used to measure the volumes of the amnion and umbilical cord.

Weights of the amnion (AW), allantochorion (ACW), umbilical cord (UCW) and total weight (TW), and volumes of the amnion (AV), allantochorion (ACV), umbilical cord (UCV) and total volume (TV) were recorded. Umbilical cord length (UCL), twisting degree, and the presence of any vascular compromise were determined. The umbilical cord insertion sites along with blood vessel diameters measured in their middle portion were also recorded.

For histological examination, specimens were collected from different areas corresponding to the