

GROSS MORPHOLOGICAL STUDIES ON PLACENTA IN PIG (*Sus domesticus*)

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ABSTRACT

The porcine placenta may be grouped as less advanced but tremendous changes were noticed during its development. The present gross morphologic study was done on 58 specimens of gestational age ranging from 20 to 110 days. Marked hyperaemia of uterine endometrium was observed as early as around 20 days. The demarcation between locular and interlocular zones amplified very much during the later stages. The vascularisation of allantochorionic sac was distinguishable at around 20 days that extended to its extremities in time. Five different zones: central placental zone and two each of paraplacental and necrotic tips positioned on either side were distinguished on the fully formed chorionic sac. Specialised structures called areolae were noticed from around 30 days of gestation. The umbilical cord was of primitive nature up to 42 days of gestation. The formation of necrotic tips may prevent freemartinism.

Key words: Porcine placenta, allanto chorionic sac, areolae, endometrium

Placenta may be defined as “an approximation or combination of an embryo’s tissues with those of its natural or surrogate parent for physiological interchange”. The placenta acts as a multi-functional organ of

physiological exchange between mother and conceptus. The initially small area of foeto-maternal apposition is usually enormously increased by folding and refolding as it proliferates in parallel with the growth of the developing embryo or foetus (Fowden and Moore, 2012). The placenta of pig is of diffuse, chorio-allantoic, non-deciduate, epitheliochorial type. The foetal part, allanto chorionic membrane and the maternal part, endometrium are highly specialised during morphogenesis of placenta and the growth rate is rapid. Even if structurally porcine placenta may be considered as of less specialised type to consider it as a separate entity, the changes occurring during its development is tremendous. Though some studies had been made by Ashdown and Marble (1967) and Flood (1973), the progressive changes in mixed bred Large White York Shire pigs are less. So the present study was undertaken to depict the gross changes during pregnancy.

MATERIALS AND METHODS

The specimens were collected from mixed bred Large White York Shire pigs of around 20 days to 105 days of gestation from authorised slaughter places in Bengalooru. The gestational age of the specimens was determined according to the crown-rump length

of the embryos and/or fetuses (Marrable, 1971). The specimens from early (up to 40 days) (n=20), mid (41 days to 80 days) (n=26) and late (above 80 days) (n=12) gestational stages were used for the present study.

RESULTS AND DISCUSSION

The placenta of pig comprised of maternal and foetal parts. The maternal component of porcine placenta was contributed by the endometrium while the foetal element *via* allantochorion. Umbilical cord formed the connecting stalk between foetus and the placenta

Early gestation:

On gross examination, the non pregnant uterine endometrium was uniformly vascular throughout the entire length. Small circular primary folds and smooth secondary folds were also noticed on its surface. However at around 20 days of gestation, the locular endometrium (placental attachment regions) exhibited intense hyperaemia (Fig. 1). The interlocular regions did not intensify in vascularisation as of the locular zones so that these zones appeared as pale, oedematous and translucent. The number and dimensions of primary and secondary folds of the locular endometrium augmented by around 35 days so that they were more prominent than of interlocular regions. The demarcation between the two zones became intensified during later stages of gestation. These changes are in accordance

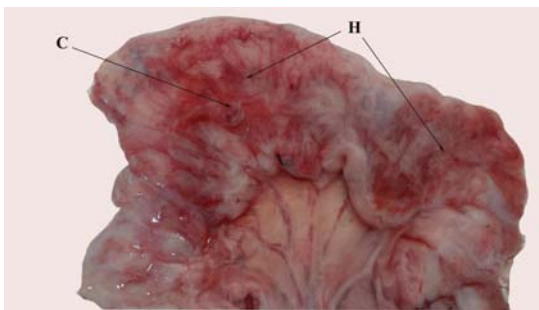


Fig. 1 Uterus of pig from around 20 days of gestation
C- Conceptus, H- Hyperaemia of endometrium

with the reports of Flood (1973) in pig.

The vascularisation of the foetal part- allantochorionic sac was noticed in the equatorial zone by 20 days which extended to extremities by around 30 days (Fig. 2). This central region of chorionic sac created the placental zone. Though the hyperaemia was uniform at initial stages; by around 35-40 days the extremities revealed dull brown spots or discrete brown caps that indicated ischemic changes. These regions were designated as necrotic tips. Two allantoic arteries and veins which formed the axial vessels of the allantochorionic sac were obvious from 30 days of gestation along its mesometrial or concave border (Fig. 3). These vessels diverged in opposite direction from the distal element of umbilical cord which gave off branches on its course within the placental zone. In the paraplacental zone, only a few straight brown terminal branches were observed while the terminal necrotic regions were devoid of any vascular supply.

Specialised structures called areolae were appreciated macroscopically on the placental zone of the allantochorion from 30 days of gestation onwards in the present study. The emergence of areolae made possible to divide this zone into areolar and inter areolar regions. Two types of areolae were noticed:

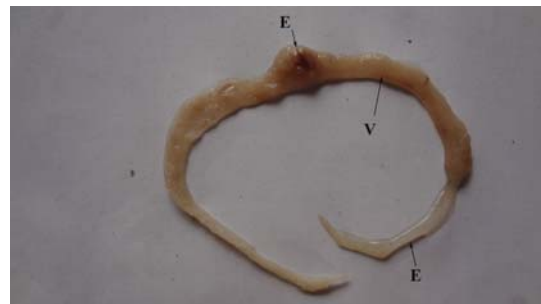


Fig.2. Embryo of around 30 days within allantochorionic sac

E- Embryo in the equatorial zone, V- Allantoic vessels, E- Extremities of chorionic sac

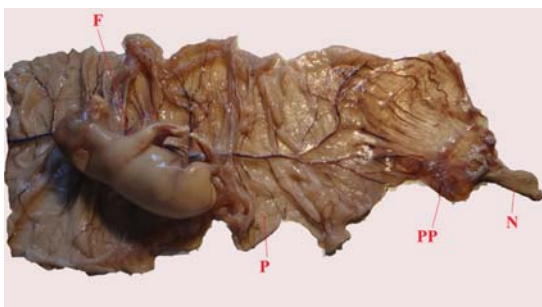


Fig. 3 Foetus of around 60 days within allanto-chorionic sac (cut open) F- Foetus, P- Placental zone, PP- Paraplacental zone, N- Necrotic tips

regular and irregular. The regular variety appeared as small circular opaque or pale spots of about 2 mm in size with a darker centre while the irregular as large, translucent polymorphic areas. The regular areolae were more in number and uniformly distributed than the irregular type. The irregular areolae were more frequent on the mesometrial side of the uterus and close to the large allantoic vessels. Irregular areolae have been reported in pig (Jamuna, 1993).

The umbilical cord of pig (Fig. 3) was short and had an average length of 1.5 cm, 3 cm, 5.5 cm, 8.5 cm, 9.5 cm and 12 cm respectively at 35 days, 42 days, 62 days, 70 days, 85 days and 105 days of gestation. The umbilical cord was of primitive nature up to 42 days. The average circumference of primitive cord at 42 days was 2.8 cm whereas that of the definitive cord of later periods was 1.5 cm. The cord revealed two spirally coiled allantoic arteries. Though two allantoic veins were distinct in the distal part only one noticed in the proximal part as these vessels fused within the distal part of cord itself as recorded by Mc Geady *et al.* (2006) in pig.

Mid gestation

The demarcation of locular and interocular endometrium was much augmented from around 50 days (Fig. 4) and the interocular regions was about 4-5 cm long. The endometrial folds of locular zones also amplified in time. The interocular regions

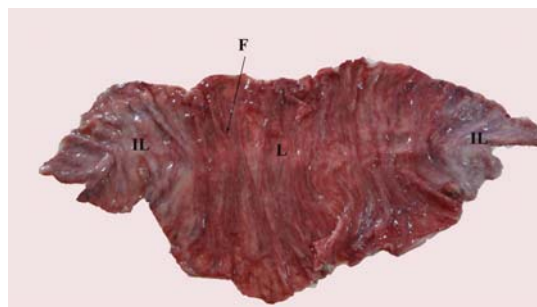


Fig. 4 Uterus of around 75 days of gestation L- Locular endometrium, IL- Interocular endometrium, F- Endometrial folds



Fig. 5 Allanto-chorion (separated) of around 55 days of gestation

F- Foetus in the placental zone, P- Paraplacental zones, N- Necrotic tips

contained a few medium sized folds.

The necrotic tips of allanto-chorionic sac from mid gestation onwards appeared dry, wrinkled and layered with dark brown sticky material. An intermediate region separating placental zone from necrotic tips termed paraplacenta was observed from around 45 days (Figs. 3 and 5). These paraplacenta were clearly demarcated by constrictions with necrotic tips at around 50 days. These zones were smooth and glistening that enclosed almost straight longitudinal brown vessels. Similar findings were also recorded by Ashdown and Marble (1967) and Dantzer (1984). The formation of necrotic tips plus paraplacenta may avoid placental anastomoses of adjacent foetuses and thus may play a role in prevention of freemartinism as suggested by Flood (1973) in pig. The number as well as the size of areolae

of the placental zone improved rapidly during this period.

The allantochorion when separated from the properly perfused fixed gravid uterus had a crescent-shape at around 45-55 days of gestation that enclosed embryo in its centre (Fig. 5). Five different zones were clearly distinct on this sac: a large central placental zone, limited on either side by paraplacental regions and necrotic tips at the extremities. The large highly vascular central placental zone enclosed numerous irregular concentrically arranged macroscopic and microscopic folds which gave it a matt-like velvety appearance. These folds though apparent to some extent at 30 days became clear and distinct by 50 days of gestation. The folds were prominent on the concave border of the chorionic sac which faded away on its convex surface. The plentiful irregular concentric macroscopic and microscopic folds of the placental zone of allantochorionic sac interlocked with the complementary furrows of the endometrium during the morphogenesis of placenta. The increasing complexity of these folds in time may correspond to the intimate and intricate association of maternal and foetal parts as gestation advanced. In improperly perfused fixed specimens, the allantochorionic sac was seen detached from the endometrium. Such separated sac had an apparent increase in length to that of the corresponding endometrium. The apparent enlargement of improperly fixed allantochorionic sac can be attributed to the sac's temporary microscopic folds which vanished following its separation from the endometrium whereas on the maternal side both macroscopic and microscopic folds remained permanent as suggested by Dantzer (1984).

Late gestation

The allantochorionic sac at around 85 days revealed an apparent transition of the necrotic tips from the terminal to sub terminal

position along with terminal displacement of paraplacental zones. The number and demarcation of both types of areolae enhanced along with progress of gestation.

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