Macerated Monozygotic Twins in Quadruplet Pregnancy of the Cape hyrax (*Procavia capensis*)

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**ABSTRACT.** Two macerated monozygotic twins associated with two live fraternal twins in a pregnant hyrax are reported. The identical twins had a single, monozonary, infarcted placenta and corresponded to one corpus luteum in the homolateral ovary, whereas the fraternal twins with two placentas had two corpora lutea in the opposite ovary.

The Cape hyrax (*Procavia capensis*) has been recommended as an animal of potential value for medical research in the study of gastric ulcer (Griner, 1968). They resemble rodents only superficially but are placed more closely to the Proboscidea in taxonomic position, in a separate Order, the Hyracoidea, because of characteristics of their feet and the large bulge of the anterior maxillary skull, placentation, etc. Most litters of the hyrax at the San Diego Zoo have been born during May and June and the gestational period of the hyrax is estimated to be 7 1/2 months (Griner, 1968).

Thurbsy-Pelham (1924) pointed out that the hyrax placenta has a zonary form and a certain resemblance to that of the elephant. Wislocki and Westhuyzen (1940) described the placenta and fetal membranes of Procavia in greater detail and also suggest that the elephant and the manatee exhibit very close structural placental affinities. Placentation is characterized as chorioallantoic, labyrinthine and of the hemochorial type (Wislocki and Westhuyzen, 1940).

The usual litter size of hyrax varies from one to six, the average being three (Griner, 1968). The distribution of the embryos in the uterus and their relationship to the corpora lutea in the ovaries of pregnant Procavia has been described as usually homolateral (Wislocki and Westhuyzen, 1940), that is to say, the number of corpora lutea in one ovary usually corresponds to the number of embryos of the uterine horn on the same side. Exceptions, however, were recorded and "internal migration" is a suggested explanation. No information concerning the occurrence of identical twins in the hyrax has been recorded.

This report describes the uterus of a pregnant hyrax in which one horn contained fraternal twins with two independent placentas, whereas the opposite horn held presumably monozygotic twin fetus papyracei with a single placenta. There were two corpora lutea in the first ovary and only one in the second.

**Material and Methods**

A female adult Cape hyrax, weighing 2,900g, died of gastric ulcers and intestinal...
nematodes (*Grassenema procaviae*, Petter, 1959) towards the end of pregnancy (Autopsy #9273, approximately five hours post mortem, February 23, 1975). The uterus contained two large female fetuses and two atrophied minute ones and three placentas. Uterus and ovaries were dissected and fixed in 10% formalin after opening. Sections were prepared and stained with hematoxylin and eosin.

**Results**

**Macroscopic findings**

Two large fetuses were in one uterine horn, the other contained two minute fetus papyracei (Fig. 1). The uterus was paper thin and the tubes extremely attenuated. Two small corpora lutea were found in one ovary and one corpus luteum in the other ovary each measuring 2 mm in diameter.

The zonary placentas with the large twins measured approximately 9.5 cm in circumference, 2.5 to 3 cm in width and more than 0.5 cm in greatest thickness and

Fig. 1. Two living fetuses of the hyrax above and two fetus papyracei below.

Fig. 2. The two placentas of the large twins above and the infarcted single placenta from which the two fetus papyracei have been removed below. Arrows indicate the three zonary villous structures.

Fig. 3. External genitalia of the live fetuses. The larger (left) has a much more pronounced clitoral process.

Fig. 4. One corpus luteum showing composition of uniform luteal cells and thin ovarian cortex with occasional ova. (H & E × 80).
was brown (Fig. 2). The amnion was very closely applied to the fetuses. Amniotic plaques were present in large numbers. The umbilical cords of the live fetuses were 3 cm long, and contained two arteries and one vein.

The two large fetuses, apparently living at time of maternal death, weighed 107g, 93g and measured 12.5 and 12 cm in crown–rump lengths. Although they had very different appearing external genitalia (Fig. 3), on dissection, both were normal females. Their uteri (0.21, 0.18 g) were swollen and the vaginas were distended with fluid. The intestines were distended, and "Meckel diverticula" were present. Each stomach measured 2.5 or 3.0 x 0.1 cm, the small intestines were 21.5 cm and 27.5 cm in lengths, and the colon 8 cm. The lungs weighed 0.2 g each and the hearts 0.2 g. The livers weighed 3.8 and 4.1 g and each spleen weighed 0.5 g; both kidneys weighed 0.69 g, and 0.86 g, both adrenals weighed 0.02 g. The adrenals/body weight ratio was from 0.00021 to 0.00018, and the adrenals/kidneys weight ratio from 0.0145 to 0.0121.

The two fetus papyracei were minute, weighed 4 g each, were yellow-brown and curled up. They possessed only one zonary placenta which was infarcted to a great extent. It was 4 cm in length and 1.5 cm in width. The umbilical cords were 1 and 1.6 cm long. The sex could not be determined because of the extensive degenerative changes, borne out by histologic study.

*Microscopic findings*

A. The maternal ovaries.

Two corpora lutea associated with the large fetuses protruded from the surface of one ovary. Each was surrounded by a shell of cortex containing few primordial follicles and a dense theca externa (Fig. 4). The luteal cells were of one cell type, assumed to derive solely from theca interna (O'DONAGHUE, 1963). In the opposite ovary, the single protruding corpus luteum measured 2 mm in diameter and was identical to the corpora of the normal fetuses.

B. The fetal tissues.

Many primordial germ cells in clusters were present in the outer zone of the

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Fig. 5. The fetal ovary of the hyrax with masses of peripheral oocytes and trabecular central area of unknown nature. (H & E × 200).

Fig. 6. Extensive infarction of the single placenta with identical twins. (H & E × 200)
fetal ovaries (Fig. 5). Their centers had a trabecular cellular pattern whose precise nature is not clear but whose details have been described for a related species (Dendrohyrax) by O'Donoghue (1963). The fetal adrenals were small. A thin layer of cortex and fetal zone were congested but histologic study did not suggest a remarkable endocrine activity. Other tissues were unremarkable.

C. The placentas.

On histological examination, the placenta of the hyrax can be divided into three zones as illustrated by Wlslocki and Westhuysen (1940). Zone I constitutes the bulk of the placenta, being coextensive with territory of the chorionic mesoderm. Zone II, composed of cytotrophoblast, is steadily encroached upon by the expansion of Zone I until it has become extremely narrow. Zone III consists of the basal layer of cytotrophoblast. The histologic findings in our placentas conform to this description.

The placentas associated with the fraternal twins were markedly congested and had some thrombi in the trabeculae. Most of monozonary placenta with the stunted twins presented extensive infarctive necrosis of the placental labyrinth and the entrapped trophoblastic zone, with infiltration of leucocytes into the trabeculae (Fig. 6).

**Discussion**

In our specimen, the two live fetuses are considered dizygotic. Their placentas implanted in one uterine horn and the corresponding two corpora lutea were situated in that ovary. The two macerated fetuses are thought to be monozygotic. They were in the opposite horn to which one corpus luteum in the other ovary and a single placenta corresponded. "Identical twinning" in hyrax has not been reported. Death of one twin may occur long before birth of the other, its fluids become resorbed and the embryo becomes compressed and dehydrated, a fetus papyraceus or fetus compressus. The placental portion of such a degenerated fetus is usually completely infarcted. Possibly placental vascular anomalies occurred in the monozonary placenta of the dead twins. Such accidents are known to occur in human monochorionic twins and may lead to fetal death. Pregnancy was maintained in this polytocous species by the other littermates, otherwise abortion is likely to have occurred before. Similar intrauterine deaths in hyrax have been recorded by Thursby-Pelham (1924). Had quadruplets been born to this hyrax, they would surely have been regarded as of poly-(4)-ovular derivation. This specimen indicates that polytocous species may well have intermixed mono- and poly- zygotic offspring.

**References**


