

# Prenatal Development of the Metanephros of the Dromedary Camel Foetus

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## Abstract

30 foetuses of dromedary camel were used in this study and the age ranged from 5 cm CVRL (79 days of age) to 132 cm CVRL (426 days of age). The left and right metanephros, during the first trimester, were elongated and had the same size, had no clear medullary tissue, reddish-brown in colour, but got paler with gestation. Then the shape changed to bean-shaped. The medulla was a gelatinous transparent material neither formed distinct renal crest nor renal pelvis. The left and right metanephroses were lobulated during the second trimester. During the third trimester, the left and right metanephros lost their lobulation. The left and right metanephroses became different in shape and in other biometrical parameters.

**Keywords:** Fornices; Metanephros; Medulla; Trimester.

## 1. Introduction

Many references including anatomy and histology of the kidneys of adult domestic animals were documented by many authors [22, 8, 11]. The topography of the ovaries and paramesonephric ducts in relation to the mesonephros and metanephros of camel was reported by [28] while the development of the genital ridge and the testis in relation to the mesonephros and metanephros during its prenatal development of camel foetuses was reported by [10]. References [20, 4] investigated the development of the kidney in the camel foetuses. The histogenesis and morphology of the mesonephros and metanephros of the foetus of the Dromedary Camel have only been briefly studied by [17, 9, 14, 4].

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The present study was carried out to give detailed information and about the topography, gross anatomy of the metanephros of the dromedary camel.

## 2. Materials and method

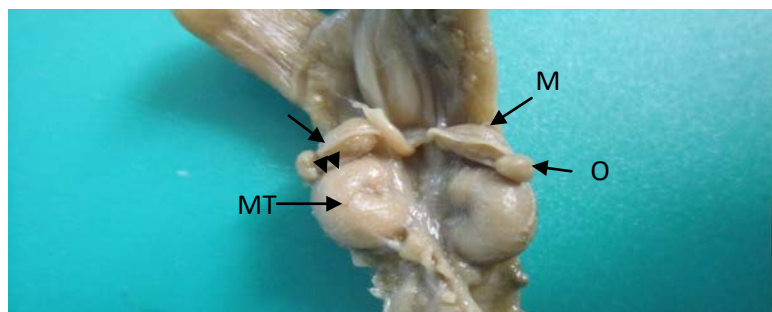
30 foetuses of different ages ranged from 5cm CVRL (79 days of age) to 132 cm CVRL (426 days of age) were used. The foetuses were divided into three trimesters (trimester= 4months) with 10 foetuses in each one. After the animals were slaughtered at *Tamboul* slaughter point and *Elsalam* slaughter house, the curved crown rump length (CVRL) was measured and the equation:

$$Y = 0.366X - 23.99$$

Which was described by [13] was used to determine the age of the foetus ( $x$ ) in days from the known ( $Y$ ) CVRL in centimeters using tape meter, then the foetuses were fixed in 10% buffer formalin. The topography of the metanephros in relation to the visceral organs, the testis and ovaries was studied. The length, thickness and width of each kidney were measured using thread ruler and Vernier caliper, respectively.

## 3. Result

The left and right metanephros during first trimester were found to be regularly elongated, had the same size, had no clear medullary tissue and reddish-brown in colour, but it got paler with advancing gestation. Then, both the metanephros were changed to bean-shaped, with round poles, having a smooth surface and covered by a thin capsule which became whiter with the advancement of gestational period and they had the same size and situated at the same level. In 5 cm CVRL (79 days of age) camel foetus, the left and right metanephros were still bean shaped, situated in the sublumbar region ventral to the level of the transverse processes of (2-5) the lumbar vertebrae, dorsal to the dorsal surface of the mesonephros and medial to the gonads. The left and right metanephros were located below the transverse processes of the lumbar vertebrae on each side, but the right one was situated more cranial than the left one in camel foetuse after the third month of gestation ( 11 cm CVRL about 96 days of age) (Figure.1).



**Figure 1:** Photograph of ventral view of female dromedary camel foetus of 11 cm CVRL (96 days of age) showing the ovary (o) cranial to the descended mesonephros (M) and the right metanephros (MT) was more cranial than the left one. Note the mesonephric duct (arrow) and the paramesonephric duct which became the oviduct (arrow head).

During first trimester and up to the middle of the second trimester, the cortex and the medulla were nearly of equal size. The medulla was a gelatinous transparent material integrated with the renal crest and the renal pelvis was not established yet (Figure.2). The hilus of each metanephros was directed medially and it was well established. The ureter was embedded in thick gelatinous connective tissue at the center of the hillus in the right metanephros whereas it was situated dorsal to the hillus in the left metanephros.

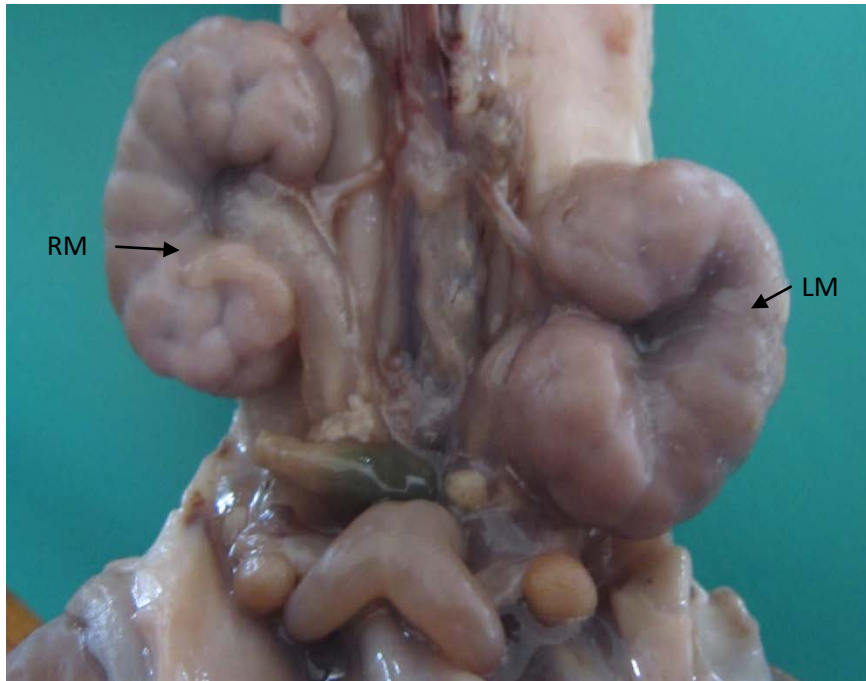
The ureter extended up to the renal crest, but still the renal pelvis was not observed. Numerous specialized fornicies were developed as canals between the renal pyramids and drained to the pelvis. There was one orifice in the pelvis body leading to the ureter wall and opened at the middle of the renal crest. The renal artery bifurcated before interning the hillus and the renal vein lied ventral to the arteries.



**Figure 2:** Photograph showing longitudinal section of right metanephros of 32.5 cm CVRL camel foetus (154 days of age). The cortex and the renal pyramids project as arrow heads into the gelatinous substance of the medulla. The ureter was developed (arrow).

The renal crest was separated from the medullary tissue during the beginning of the second trimester. In 29 cm CVRL (146 days of age foetus), the left and right metanephros were superficially lobulated immediately under the capsule and the lobulation was more clear in the left metanephros at the dorsal surface than in the right metanephros.

The two poles of the left metanephros became in contact to each other, due to change in its shape in 32.5 cm CVRL (145 days of age foetus) (Figure.3).



**Figure 3:** Photograph of female camel foetus of 39 cm CVRL (172 days of age), demonstrating the ureter (u) embedded in thick gelatinous connective tissue, at the center of the hilus in the right metanephros (Rm) while it was situated dorsal to the hilus in the left metanephros (Lm). Note the difference in shape between the right and left metanephros and the right one was situated more cranial than the left one.

During the third trimester, the left and right metanephros lost their lobulation. The medulla extended in a large area in contrast with the cortex.

In 118 cm CVRL (388 days of age) foetus, the shape of the left metanephros became somewhat like a rectangle and situated ventral to the (3-6) transverse lumbar processes and the two poles were very close to each other. The right metanephros occupied the area ventral to (1-5) transverse lumbar processes and it was bean shaped (Figure.4).

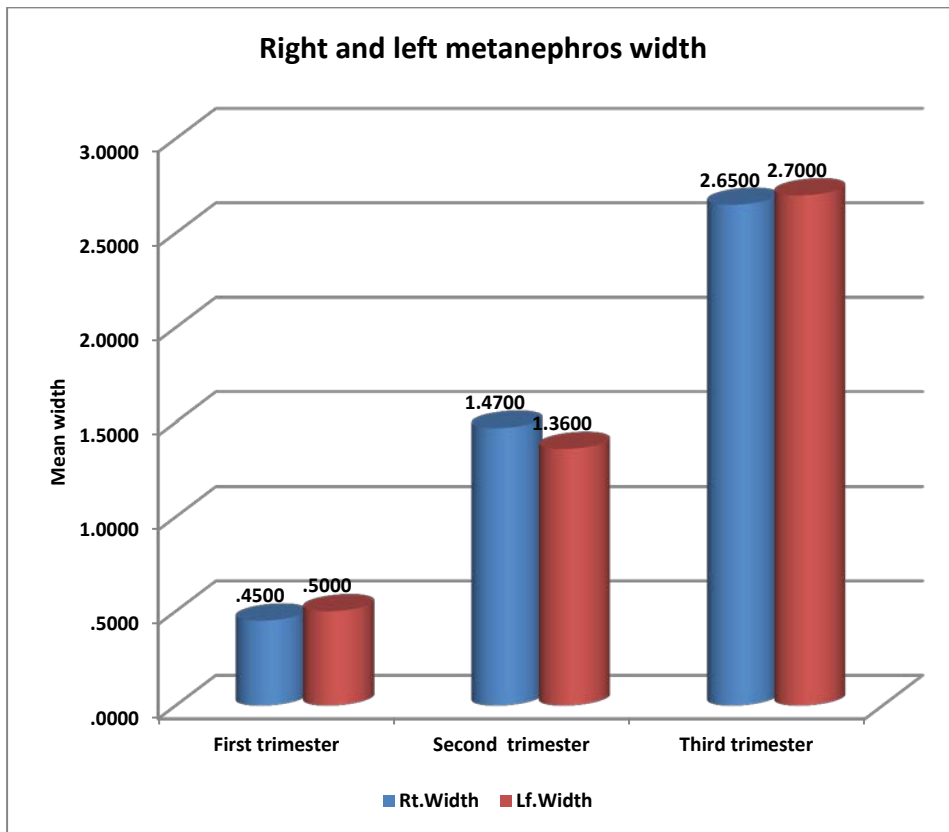
Both metanephros were covered with thick white fibrous capsule, which had a smooth surface except in rare areas where shallow demarcations of lobulations were observed. Adipose tissue was present at the hilus and gelatinous connective tissue surrounded the ureter.

In 132 cm CVRL (426 days of age) camel foetus, the shape of both metanephros resembled that in adult dromedary camel, as [24] described it, that it was bean shaped and smooth externally, the cranial pole of the right metanephros is round but its caudal pole is slightly flattened dorsoventrally, whereas the left metanephros was regular in shape. The left metanephros was more rounded than the right one but still there were shallow demarcations of lobulation after removing the capsule and the adipose tissue in both metanephros.

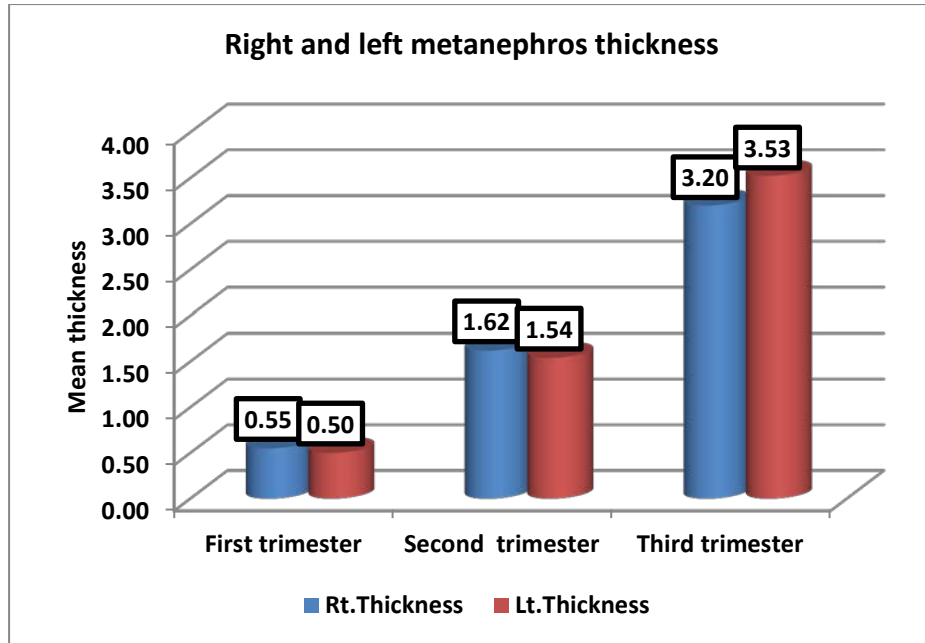
The left and right metanephros were different in shape and in some other biometrical parameters as shown in the following Figures.



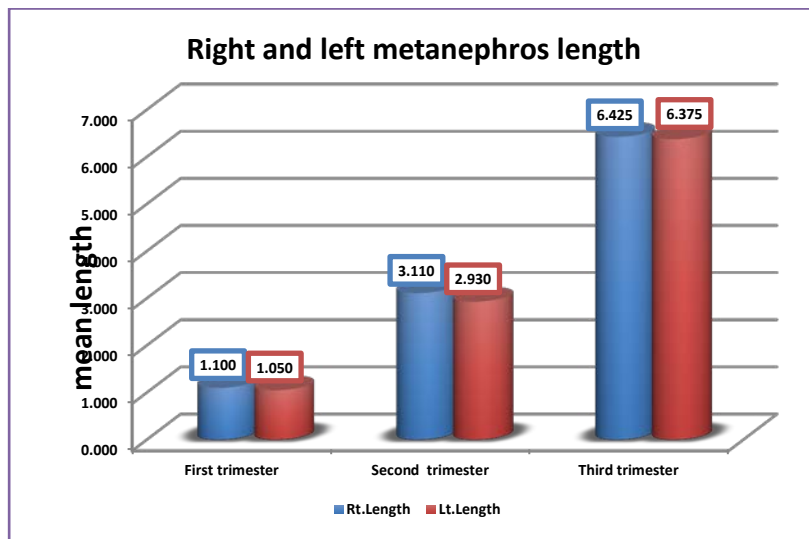
**Figure 4:** photograph at dorsal surface of the left metanephros from foetus of 118 cm CVRL (388 days of age) (A) and 86 cm CVRL (301 days of age) (B). Note that the deep impressions of lobulation in B and the fine demarcations of lobulation in A metanephros and the ureter (u) projected dorsal to the hilus.



**Figure 1:** Showing the increase of means of width during the three trimesters in comparison between the right and left metanephros.



**Figure 2:** Demonstrating the increase of means of thickness during the three trimesters in comparison between the right and left metanephros.



**Figure 3:** Illustrating the increase of means of length during the three trimesters in comparison between the right and left metanephros

#### 4. Discussion

Several authors [27, 12, 23, 3] reported that, the gestation period of the dromedary is between 365 and 395 days, whereas the gestation period of the Bactrian camel is about 402 days [7]. In the present study, the foetuses with long term of pregnancy (388, 391 and 426 days of age), were in the same degree of development when compared to foetuses of young ages (360 days of age) regarding the development of their inner organs. This may indicate that the camel has the ability to prolong the gestation period due to breed of the camel, calf gender,

or may be due to the environmental factors and the season of the year.

The left and right metanephros during the end of the first trimester in the present study, were elongated, had the same size, had no clear medullary tissue reddish-brown in colour and get paler with advancing gestation. This is in agreement with the statement of [21,16] who reported that the metanephros was elongated at the beginning of the first trimester, but became bean-shaped during the first trimester. The right metanephros was more cranial than the left one in the present study after the third month of gestation and this may be due to the enlargement of the liver. In the present study, the cortex was a clear layer and equal in size to the medulla which was a gelatinous transparent material integrated with the renal crest. References [5,16] observed a similar finding. The hilus of each metanephros was directed medially and it was well established. The ureter was present at the center of the hillus in the right metanephros while it was projected dorsal to the hillus in the left metanephros. The renal pelvis, during the second trimester formed numerous specialized fornices which were situated as canals between the renal pyramids and drained to the pelvis. This situation leads to the suggestion by [19] and [2] that there was a special morphology of the renal pelvis and medulla of the camel. The renal artery bifurcated before entering the hillus and the renal vein lies ventral to the arteries in the present study and this confirms the finding of [24]. The left and right metanephros were located below the transverse processes of the lumbar vertebrae on each side. In bovine foetus at 6-8 weeks of gestation the metanephros had distinct borders and simple 3-4 incomplete lobations [6]. In human foetus at 12-14 weeks of gestation, the kidney is lobulated histologically and at 14-16-18 weeks of gestation, the kidney is lobulated macroscopically but the lobules were fused in the histological sections [15, 25, 26]. In the present study, the left and right metanephros were lobulated superficially during the second trimester and this transitory lobulation may be to support the establishment of the renal tubules within the loose matrix of the medulla. In the present study, the lobulation disappeared during the third trimester of gestation, and it resemble that of adult camels [1, 24, 18]. During the third trimester, in the present study, adipose tissue was observed at the hillus, but [16] noticed it during the first trimester. In the present study, the right metanephros was longer than the left one in all foetuses during all stages of development and this finding disagree with the report of [16] who found that the left metanephros was more elongated during the first trimester. The values pertaining to the width of the right metanephros were higher only during the second trimester in the present study. The thickness of the right metanephros was less than that of the left metanephros during the third trimester, but it was higher during the first trimester and also this finding contradicts the finding of [16] in the dromedary camel metanephros.

## **5. Conclusion**

The development of the metanephros of the dromedary camel foetus was resemble that of the human foetus metanephros development in some parts, The left and right metanephroses became different in shape, length, thickness and width during the three trimesters. .

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