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Kidney Morphogenesis During Prenatal Development in *Camelus dromedaries* Embryoes

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Abstract: This study was carried out to investigate the morphological development of kidney in the foetal stage of *Camelus dromedaries* by biometrical analysis. In the experiment, thirthy numbers of *Camelus dromedaries* embryoes were selected based on their crown-rump length and subsequently divided into 6 age groups consisting of 5 animals in each group. Group I (45 days), group II (60 days), group III (75 days), group IV (90 days), group V (105 days) and group VI (120 days). In foetus of about 45 days, kidneys demonstrated circle shape and no renal pelvis was evident in all kidneys under study. In the 60 days old foetuses, bean shape kidneys were present, renal pelvis was distinct and extensive with a well developed ureter that originated from the middle of the pelvis in both left and right kidneys. In 75-120 days old foetus, length, width and thickness of kidneys were more increased. Significant variation in measurements of some parameters have been resulted.

Key words: *Camelus dromedarius*, kidney, development, growth, parameters, embryoes

INTRODUCTION

The kidney is an important organ involved in the removal of unwanted nitrogenous substances, excess water and relative maintenance of osmotic concentration of the blood. Certain features of the renal anatomy of different mammals and variations with the aridity of their habitat have been reported (Sperber, 1944). The anatomy and histology of the adult kidney of domestic animals is described in numerous textbook of histology and anatomy (Fawcett and Raviola, 1994; Eurell *et al*., 2006; Dyce *et al*., 1995; Sisson, 1975) also numerous research studies investigated kidney development and morphology. The morphometric observations on the kidney of camel (Abdalla and Abdalla, 1979), one horned rhinoceros (Talukdar *et al*., 2003), biometrical study of the kidney of buffalo (Malik *et al*., 1978), morphometric study on kidney of African rat (Onyeanusi *et al*., 2007), histogenesis of human renal cell (El-Kott *et al*., 2006) and measurement of renal dimension (Moorthy and Venugopal, 2011). The available reports were entirely concerned with adult structures of the kidney and much less has been written about the prenatal development of the kidney in camel. In this reaserch, morphometry and detailed sequential changes involved in the development of the kidney in one humped camel (*Camellus dromedaries*), an important breed of camel in Iran will be described. The study will also add to the existing information on the morphometric analysis in camels.

MATERIALS AND METHODS

Kidneys used for this study were obtained from 30 foetuses, (5 specimen from each group). Camel uteruses were gathered from slaughter house in Yazd province. After dissecting the uteruses, the age of foetuses were measured by crl formula (using crown-to-rump length), Age of foetus = crl+23.9/336, according to McGeady *et al*. (2006). These foetii were fixed in 10% buffered formaline solution. The kidneys from these animals were collected by abdomino-sternal approach and were refixed in 10% buffered formaline solution for 48 h. Then, the biometrical parameters of the kidneys were recorded. The greatest

Fig. 1: Measerment of kidney parameters with digital vernier calipers in *Camelus dromedaries* embryoes (60 days old)

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length, width and thickness of the kidneys were measured by digital vernier calipers, separately for right and left kidneys (Fig. 1). The observations captured on a laptop computer and data obtained were subjected to statistical analysis (Snedecor and Cochran, 1967).

RESULTS AND DISCUSSION

Both kidneys were irregularly elongated and redish-brown in colour *in vivo*. In foetus of about 45 days, kidneys demonstrated circle shape with the advancement of age, kidney morphologicaly shifted to bean-shape which present in group II-VI. All kidneys were smooth and covered with a thin fibro-muscular capsule. The kidneys in group II-VI were attaching the posterior extremity of the adrenal gland at the respective sides. In these groupes, each kidney had a cranial and coudal surface, a medial and a lateral border, an upper and a lower pole. Adipose tissue surrounded the hilus and sides of the kidney. The lateral border were convex in shape and the medial border were concave and indented at the hilus. The major renal vessels had their entry and exit at the hilus. The kidneys in group I-III were found below the lumber transverse processes except animals of group IV-VI where the kidney detected more cranially. In group IV-VI right kidney were shifted rostrally more than left kidneys. Malik and Vais (1998) also reported that the right and left kidneys shifted rostral with advancement of age in ruminant. This cranial positioning of the kidneys might be due to relative variation in growth of different organs in the abdominal and pelvic cavities during various phases of embryonic development. No renal pelvis was evident in group I in all kidneys under study. However, from group II onwards, the renal pelvis was distinct and extensive with a well developed ureter that originated from the middle of the pelvis in both kidneys. This observation confirms the development of renal pelvis and ureter in early phase of the gestation period in *Camelus dromedaries* embryoes. In the foetii of group III onwards, the cortex was observed gradually becoming larger than the medulla. The pelvis became well demarcated from the medulla with a sharp demarcating line in group IV and V. In group VI, length, width and thickness of kidneys were more increased. Various biometrical parameters pertaining to right and left kidneys of different age groups have been measured. The measurements of all the parameters varied between the right and left kidneys (Fig. 2 and 3).

The length of the left kidney was found having higher values than its right counterpart in all groups. Also, the values pertaining to width of the left kidney were more than the right one in all groups. The thickness of the right kidney were recorded less than those of the left kidney in all age groups.

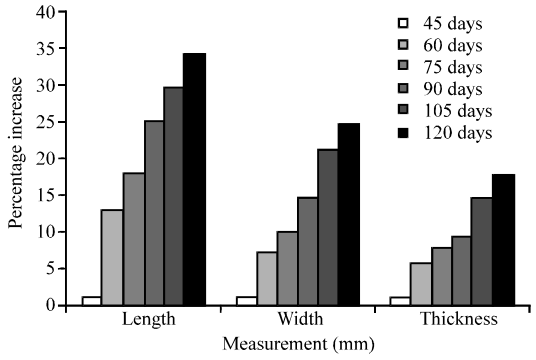

Fig. 2: Percentage of increase in growth in terms of various biometrical parameters of right kidneys of *Camelus dromedaries* embryoes

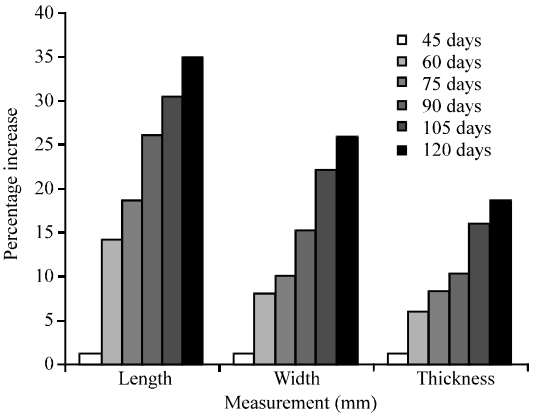

Fig. 3: Percentage of increase in growth in terms of various biometrical parameters of left kidneys of *Camelus dromedaries* embryoes

Statistical analysis revealed that the variation in growth between the left and right kidneys in terms of length in group I and II, group I and VI were highly significant ($p<0.01$). However, no significant difference was noticed for the same in other age groups. The width of both the kidneys varied significantly ($p<0.05$) between group I and II and this variation was highly significant in group I and VI ($p<0.01$). Significant variation ($p<0.05$) between the right and left kidney was recorded in terms of thickness in group I and VI.

In the present study, maximum growth in length was observed in group VI in right (33.7%) and left (35%) kidneys, respectively, the growth being more in the left one. However, the increase in percentage of growth in width of the right kidney were observed in group VI (24.2%) and group VI (26.7%) in left kidney. Similarly, highest and least percentage of growth in thickness were documented in group VI and I, respectively in both kidneys. The least growth in length was seen in group I in

right kidney (2.1%) and group I in left kidney (2.4%), respectively. The finding suggested that highest percentage of growth in length, thickness and width in both kidneys were documented between group I and II and group I and VI was highly significant ($p<0.01$). But percentage increase in growth in length, width and thickness of both kidneys between group II and III, group III and IV, group IV and V was not significant ($p = 0/1$). This result indicated that a greater embryogenesis of both kidneys pertaining to the early stages of development in *Camelus dromedaries* embryoes. Similar findings were also reported in foetal goats (Malik and Vais, 1998). Similar patterns of embryonic growth was recorded in cerebral ventricles (Malik *et al*., 1992) and scrotum (Malik *et al*., 1995) in foetal goats.

The variation in growth among the various groups pertaining to embryonic life of the right and left kidney in terms of length, width and thickness was highly significant ($p<0.01$). Although, variation among groups I-VI, indicative of better sequence of growth phase in the left kidney as compared to the right one. This trend of growth was accordance with the findings of Patten and Carlson (1977) who reported that variable growth and structural diversities at different stages of development of an organ is a normal phenomena for accommodating and molding of the organ. According to Farbman and Mbiene (1991), there is an intimate relationship between the feeding habits and the development of the the most organs. Studies by Tisher (1971) have shown that rhesus monkey produced concentrated urine in the absence of a well developed inner medulla and loop of henle. Moutairou *et al*. (1996) have also suggested that protein binding mechanism involving calbidin might be responsible for the ability of the rat to live with restricted drinking water. According to Abdalla and Abdalla (1979), anatomical requisites for the production of concentrated urine are to be found in the kidney of the camel but further studies will be needed to elucidate this fact that special anatomical adaptation in the urinary system for water economy originated from prenatal period and continued in the postnatal life.

CONCLUSION

There are significant complex changes during the development of the kidney during the period from day 45-120 of prenatal period which is continued in the postnatal life.

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REFERENCES

Abdalla, M.A. and O. Abdalla, 1979. Morphometric observations on the kidney of the camel, *Camelus dromedaries*. J. Anat., 129: 45-50.

Dyce, K.M., W.O. Sack and C.Y.G. Wencing, 1995. Text Book of Veterinary Anatomy. Sannders Company, USA., Pages: 136.

El-Kott, A.F., M.F. Ismaeil, M.M. El-Moneim and M.A. El-Baz, 2006. Histogenesis of human renal cell carcinoma by using electron microscopy and immunohistochemical techniques. Int. J. Urol. Nephrol., 37: 439-445.

Eurell, J.A., B.L. Frappier and H. Dellmann, 2006. Textbook of Veterinary Histology. 6th Edn., Lea and Febiger, Philadelphia, pp: 174-175.

Farbman, A.I. and J.P. Mbiene, 1991. Early development and innervation of taste bud-bearing papillae on the rat tongue. J. Comp. Neurol., 304: 172-186.

Fawcett, D.W. and E. Raviola, 1994. Bloom and Fawcett: A Textbook of Histology. 12th Edn., Champan and Hall, New York.

Malik, M.R. and R. Vais, 1998. Morphogenesis of kidney in goat (*Capra hircus*). Indian J. Vet. Anatomy, 11: 161-167.

Malik, M.R., G.P. Tiwari and A.P. Singh, 1978. The biometry of the kidney of buffalo (*Bubalus bubalis*). J. Anatomical Soc. India, 27: 11-14.

Malik, M.R., J.S. Taluja and M.L. Parmar, 1992. Histogenesis and mode of growth of choroids plexus in goat fetuses. Indian J. Anim. Sci., 62: 1151-1159.

Malik, M.R., J.S. Taluja and M.L. Parmar, 1995. Histogenesis and mode of growth of scrotum in foetal goat. Indian J. Anim. Sci., 65: 409-413.

McGeady, T.A., P.J. Quinn, S.F. Patrick and M.T. Ryan, 2006. Veterinary Embryology. Blackwell Publishing, UK, ISBN: 9781405111478, pp: 331-336.

Moorthy, H.K. and P. Venugopal, 2011. Measerment of renal dimensions *in vivo*: A critical appraisal. Indian J. Urol., 27: 169-175.

Moutairou, K., N. Hayez, V. Pohl, G. Pattyn and R. Pochet, 1996. Calbindin localization in African giant rat kidney (*Cricetomys gambianus*). Biochim. Biophys. Acta, 1313: 187-193.

Onyeanusi, B.I., A.A. Adeniyi, J.O. Ayo and J.O. Nzalak, 2007. Morphometric study on the kidney of the African Giant rat. J. Anim. Vet. Adv., 6: 1273-1276.

Patten, B.M. and B.M. Carlson, 1977. Foundations of Embryology. 3th Edn., Tata Mcgraw Hill, New Delhi.

Sisson, S., 1975. Ruminant Urogenital System. In: Sisson and Grossmans: The Anatomy of the Domestic Animals, Getty, R. (Ed.). 6th Edn., W.B. Saunders Company, Philadelphia, pp: 937-939.

Snedecor, G.W. and W.G. Cochran, 1967. Statistical Methods. 6th Edn., Oxford and IBH, New Delhi, India, pp: 557-578.

Sperber, I., 1944. Studies on the mammalian kidney. Zoologiska Bidrag Fran Uppsala, 22: 249-432.

Talukdar, M., M. Sarma and K.B. Dev Choudhury, 2003. Macromorphology of kidney of one-horned rhino calf. Indian J. Anim. Sci., 73: 184-184.

Tisher, C.C., 1971. Relationship between renal structure and concentrating ability in the rhesus monkey. Am. J. Physiol., 220: 1100-1106.