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رئيس القسم : أ . د . / محمد رشاد فتح البـــاب .

# الشـــرايين القوســـية وفروعها فى كلية الجمل وحيد الســـنام

محمد الشـــايب ، محمـــد فتح البـــاب ، أشـــرف صـــابـــر

فـــى هـــذا البحـــث تـــم الوصـــف التفصيلى لمنشـــأ ومســـار وتـــوزيع الشـــرايين القوســـية لكليـــة الجمـــل وحيـــد الســـنام . كمـــا أنـــه قـــد وضـــح أن المـــدد الشـــريـــانى وخاصـــة الشـــرايين القوســـية وتفرعاتهـــا فـــى كليـــة الجمـــل وحيـــد الســـنام تشـــابـــه أســـاســـا تلك الخاصـــة بالجمـــل ذو الســـنامين والحيـــوانات الأليفـــة الأخـــرى .

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# THE ARCUATE ARTERIES AND THEIR BRANCHES IN THE KIDNEY OF CAMELUS DROMEDARRIUS

(With 8 Figures)

By

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## SUMMARY

The origin, course and distribution of the arcuate arteries of the kidney of the kidney of the Camelus dromedarius were described in detail in the present investigation. It is evident that the arterial blood supply of the kidneys of the camel specially the arcuate arteries and their branches is basically similar to that of the two-humped camel and other domestic animals.

## INTRODUCTION

Since the kidneys are responsible for the regulation of the fluid balance of the body, it became necessary to carry out a full investigation of the arterial system of the kidneys specially the arcuate arteries and its branches of the camel with the object of finding out any special features attached to it for adaptation of this animal to the mode of living under adverse weather and enviromental condition of limited water supply. In this respect however the available literature lacks data on the kidneys of the camel except the very brief general description given by CHAUVEAU (1891), LESBRE (1903), LEESE (1927), GRAHAME (1944) and TAYEB (1948).

## MATERIALS AND METHODS

The present investigation was carried out on 25 kidney of adult one-humped camels of both sexes and ages collected from the slaughter houses of Cairo and Assiut provinces. The kidneys were injected through the renal artery with gummilk (latex) coulted with Vulcanosal red, then fixed in 10% formalin solution. A cast of the renal vessels was finally obtained by digestion in 25% pot. hydroxide sol. In addition plastoid casts were obtained from five other kidneys. Dissection and observation were performed by the aid of majnifying lens and steromicroscope "SMXX".

The nomenclature used is that adopted by the Nomina Anatomica Veterinaria (1973).

For sectioning indian ink-serum injection followed by haematoxylin and eosin stain (TAHER 1965) was also used.

## RESULTS AND DISCUSSION

The arcuate arteries of the kidney of the one humped camel were found to arise from the interlobar arteries. The latter arose from the dorsal or ventral branches of the renal arteries. Each interlobar artery is divided into 1-5 arcuate arteries which pass in the grooves produced by the crenations of the free edges of the renal recesses. The vessels curved in various directions, almost at right angles to their parent vessels.

The arcuate arteries coursed either singly or got divided into 2-3 arcuate branches (Fig. 1, A) which terminated directly either as intralobular teries or as afferent arterioles.

By the aid of the stereomicroscope each arcuate artery was found to detach 2-5 side branches from its convex surface and end by dividing into 2-4 terminal branches. Both the - side and terminal branches were described as inter-lobular arteries. A few of the afferent arterioles were observed to spring from either the dorsal or the lateral aspect of the arcuate arteries which also supplied the vasa vasora of the parent blood vessels. In addition, the arcuate gave off 3-6 minute long branches to the medulla. These medullary branches broke into 5-17 very fine long twigs, the arteriolae rectae verae, (Fig. 2) which are not reported by GRAHAME (1944) in the two humped camel but is supported by MORISON (1926) in many species of animals. HUBER (1907) in the dog, cat and rabbit, MORISON (1926) in a good number of animals and GRAHAME (1944) in the Indian elephant claimed that a few afferents arising from the convave side of the arcuate arteries. Such a condition was not encountered in the one humped

camel.

Aa. Interlobulares:

Both the side and terminal branches of the arcuate arteries were considered as interlobular arteries may be classified according to their mode of distribution into: radiating and deep interlobular arteries. HOLIE (1964) in the sheep and goat, WELLER (1961) & in horse, and WILLE (1966) in cattle agreed with this classification but they also described the presence of perforating capsular arteries. In fact the perforating capsular arteries are the radiating interlobular arteries which reached and perforated the renal capsule. The radiating interlobular arteries (Fig. 3) arose at right angles from their parent vessels and run towards the surface of the kidney in a radiating manner either singly (Fig. 1, B) or after giving off, at acute angles, 1-4 side branches (Fig. 1, C &2) which similarly behaved as their parent vessels. In either cases two radiating interlobular arteries arose by a stem artery which may give off either two radiating interlobular arteries (Fig. 1, D) or a radiating and a deep interlobular artery (Fig. 2). The stem artery, however, might give off either three radiating interlobular arteries or two radiating and one deep interlobular artery. GRAHAME (1944) in the two - humped camel and MORISON (1962) in many species of animals-stated that the radiating interlobular arteries run either singly or gave off collateral branches.

Each radiating interlobular artery detached about 15-75 afferent arterioles,and intralobular vessels which divided into 2-11 afferent glomerular arterioles. The radiating interlobular arteries and their collateral branches when present terminated either by splitting into 4-10 afferent arterioles (Fig. 1, A, B, C) or by dividing into 2-9 intralobular arterioles which in turn detached the afferent glomerular arterioles (Fig., 1, D & 10). Pew number of the radiating interlobular vessels reached and perforated the renal capsule; these supplied the perirenal fat. In these cases either afferent or intralobular arterioles might be given off before perforating the capsule and the formers were given off near the point of origin of the perforating capsular arteries or just before pentrating the renal capsule (Fig. 4).

GRAHAME (1944) in the two-humped camel and MORISON (1926) in many species of animals reported similar findings concerning the termination of the radiating interlobular arteries. Moreover, MORISON (1926) mentioned that the perforating capsular arteries were more observed in the lobulated kidneys.

The deep interlobular arteries followed a course almost parallel to those of the arcuate arteries. After a short course they gently curved towards the surface of the kidney to terminate at a deeper level than that of the radiating interlobular arteries. These vessels gave off either 1-2 side branches or non at all. The side branches included both afferent and intralobular arterioles and terminated by splitting into 4-10 afferent arterioles or after they divided into 2-3 intralobular arteries (Fig. 2).

Both the radiating and deep interlobular arteries gave off, in addition to previous branches, the arteriolae rectae verae which supplied the medulla (Fig. 2).

Arteriolae Intralobulares:

Reference has already been given to the origin of the intralobular arterioles from the interlobular arteries. Short and long terminated in 3-4 afferent arterioles. The long intralobular ones detached in addition, afferent arterioles either from each side (Fig. 5, A, B), or only from one side (Fig. 5, D), ARNAUTOVIC (1959) in the dog confirmed the presence of the intralobular arteries but he did not reprot on the pattern of their distribution.

Arteriolae Afferentiae:

The afferent arterioles might be short or long, either a straight or slightly twisted. They might arise either singly from the interlobular arteries or by several branches 3-11 from the intralobular arteries.

Arteriolae Efferntiae:

The efferent arterioles soon divided several times after emerging from the glomeruli (Fig.6). These gave off 5-17 very long twigs, the arteriolae ractae spuriae which passed towards the renal medulla. It should be pointed out that some of the efferent arterioles detached small twigs froming periglomerular capillary networks surrounding their corresponding glomeruli. Other efferent arterioles in addition gave off the arteriolae rectae spuriae while others divided into dorsal and ventral branches.The dorsal branches were directed towards the cortex forming a capillary network and the ventral branches proceeded towards the medulla where they divided to constritute the arteriolae spuriae (Fig. 2).

The efferent arterioles situated close to the surface of the kidney divided into small twigs which anastomosed with each other forming a network, the subcapsular capillary bed (Fig. 2). GRAHAME (1944) did not describ the various modes of distribution of the efferent arterioles in the two humped camel but WELLER (1964) in the horse and WILLE (1966) in cattle were in agreement with our findings. MORISON (1926) described similar distribution except that he did not refer to the formation of the periglomerular capillaries.

Previous results have indicated that the efferent arterioles either surrounded the proximal and distal convoluted tubules as periglmerular capilaries, or formed subcapsular capillary bed. Networks of capillaries also surrounded the ascending and descending loops of Henle as well as the collecting tubules as evidenced after injection with indian ink-serum (Fig. 7, 8).

The cortex was supplied with blood from the capillary plexuses derived from the efferent glomerular arterioles in the cortical and juxtameduallry zones. This was supported by the findings of MORISON (1926) in rat, pig, monkey, and other domestic animals. On the other hand the renal medulla was supplied by the arteriolae rectae spuriae as well as by the arteriolae rectae verae. GRAHAME (1944) in the two-humped camel and MORISON (1926) in many species of animals gave no evidence to the presence of the latter vessels, but similar findings were given by KUGELGEN and BRAUNGER (1962) in the dog, PLAKKE and PFEIFFER (1964) in several species of wild and domestic mammals, and HOLLE (1966) in sheep and goat.

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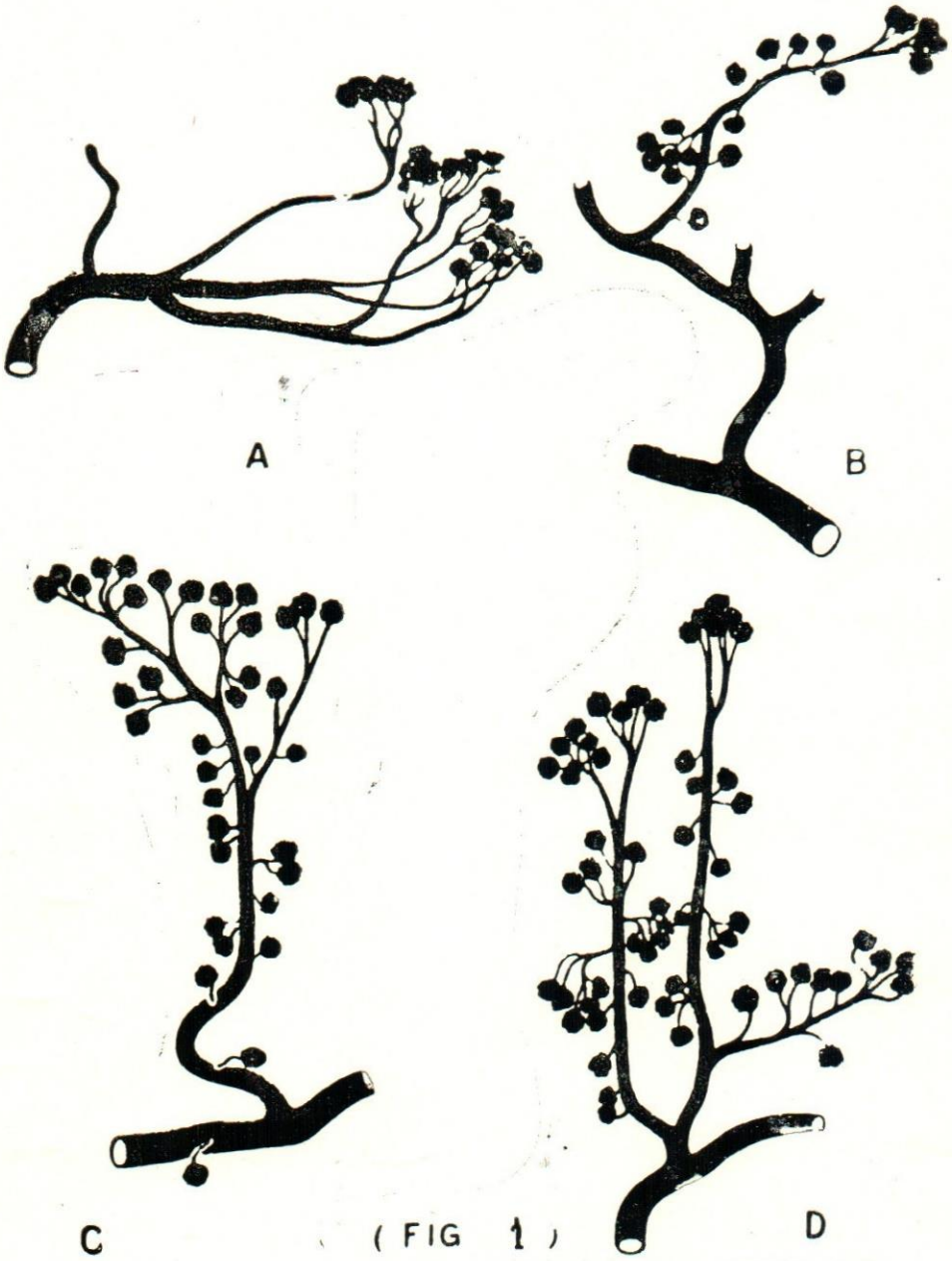
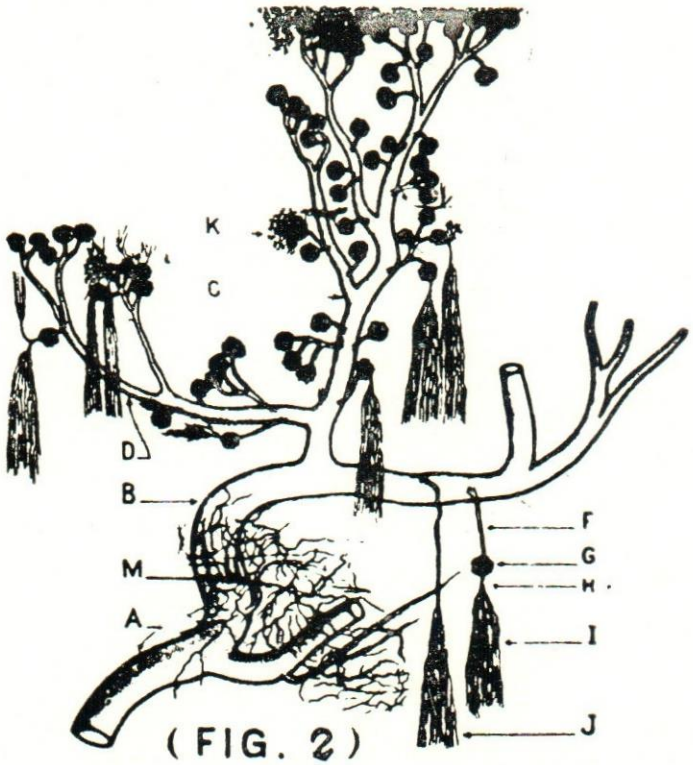



( FIG 1 )

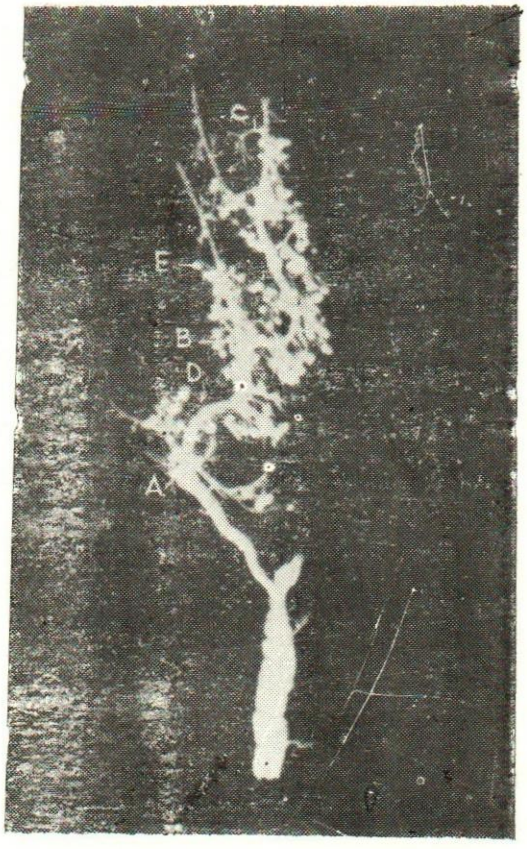
Diagram of an arcuate artery (A) and different types of interlobular arteries ( B, C, D )




(FIG. 2)

Diagram of an arcuate artery and its interlobular arteries showing:

A. interlobar artery XII .
B. arcuate artery .
C. radiating interlobular artery
D. deep interlobular artery .
E. intralobular artery .
F. afferent arteriole .
G. glomerulus .
H. efferent arteriole .
I. arterioles rectae spuriae .
J. arterioles rectae verae .
K. peritubular capillaries
L. subcapsular capillary bed
M. vasa vasora .




( Fig. 3 )

Plastcid cast of an A arcuata.

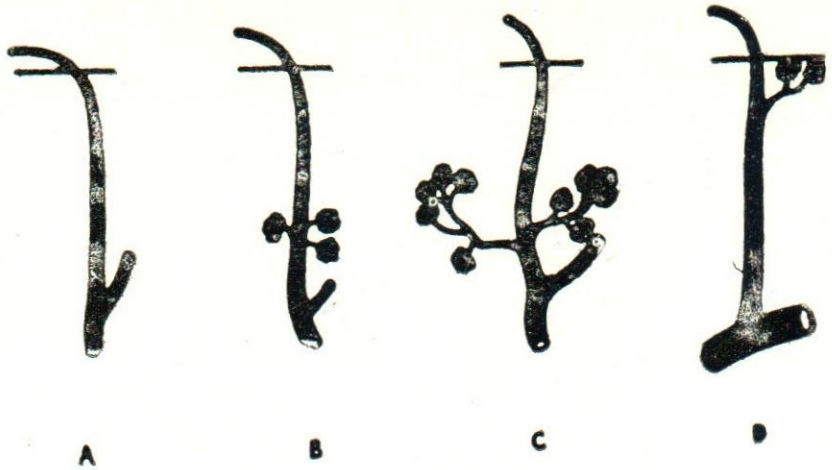
A. A arcuata.

B. A. interlobares radiata.

C A. interlobulares.

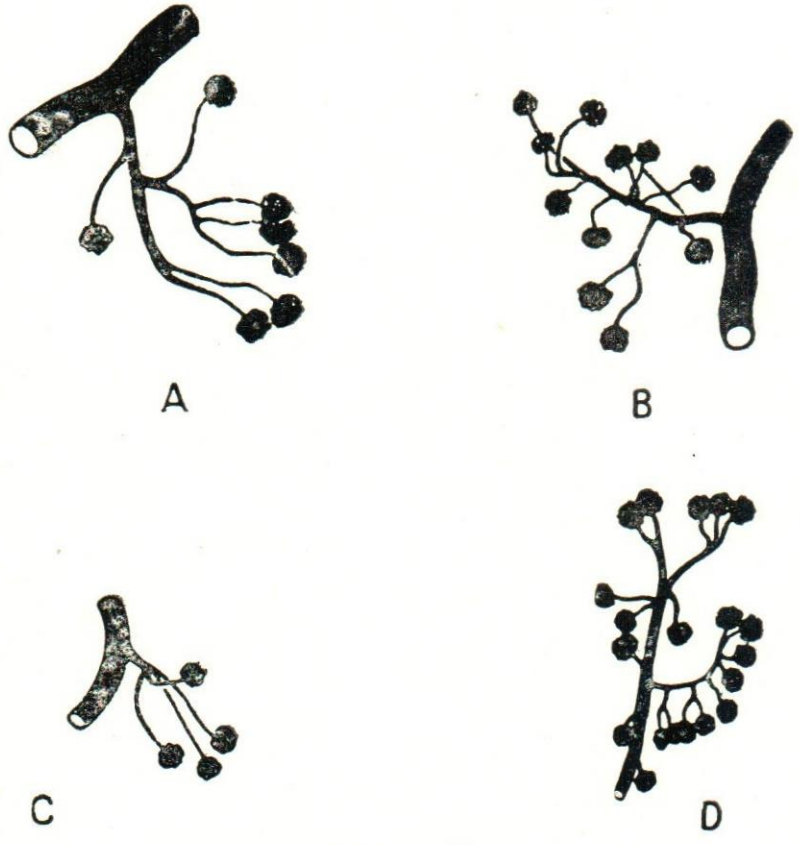
D Arteriolae afferentiae.

E. glomerulus.




( FIG. 4 )

Diagram showing the different types of penetrating capsular arteries .

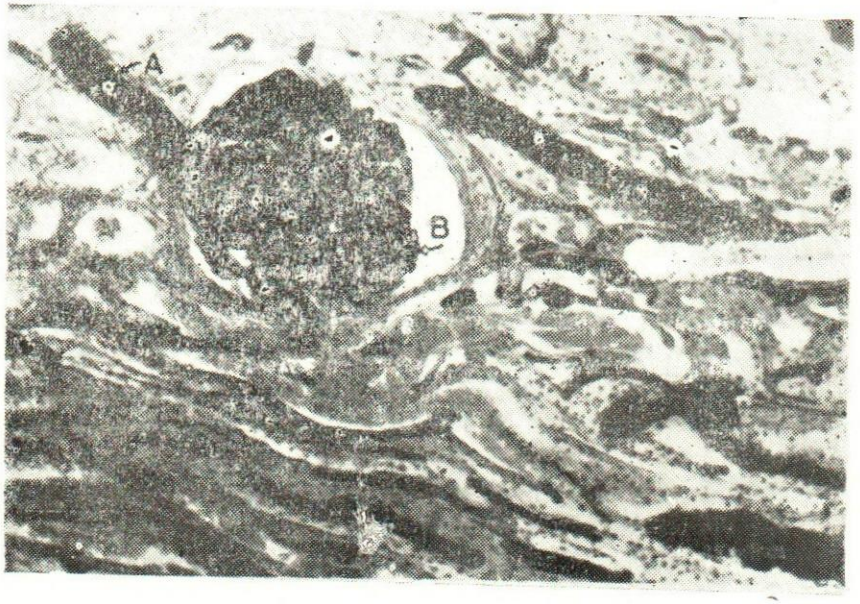



( FIG. 5 )

Diagram showing the different patterns of the intralobular arteries.


( Fig 6 )

A glomerulus (G) giving an efferent arteriole (E) which get branched.
(Indian ink-serum injection, 12.5 x 25 X).




(Fig 7)

Afferent arteriole (A). glomerulus (B) and peritubular capillaries (Black) in the cortex. (Indian ink-serum injection, 10 x 10 X).

( Fig.8 )

Arteriolae rectae (Black) between the collecting tubules.
(Indian ink-serum injection. 10 x 20 X).