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Arterial Vascularization of Kidneys in the Hasak Sheep

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The aim of this study was to investigate the variation of the renal arteries in Hasak sheep. Six animals was used for this purpose. Renal artery and its segments were prepared using standard corrosion cast techniques and examined. An electronic caliper was used to measure the length and diameter of the renal arteries. Each kidney was vascularized by a corresponding single renal artery that arose from each side of the abdominal aorta. The renal arteries divided, forming a dorsal and a ventral branch. The dorsal and ventral branches gave off the a.interlobaris, a. arcuate and a. interlobularis, respectively. No anastomoses were seen all materials. In the left kidney, one interlobar artery, the originated from the ventral branch was nourished dorsal surface.

Key Words: *Anatomy, Hasak sheep, kidney, renal artery*

Hasak Koyununda Böbreklerin Arteriyal Vaskularizasyonu

Bu çalışmanın amacı, Hasak koyunlarında renal arterlerin varyasyonlarını incelemekti. Bu amaç için altı adet hayvan kullanıldı. Renal arter ve segmentleri standart korozyon kast teknikleri kullanılarak hazırlandı ve incelendi. Renal arterlerin uzunluk ve çap ölçümleri için elektronik kumpas kullanıldı. Her bir böbrek, aorta abdominalis'in her iki yanından çıkan tek bir arterle vaskularize edilmekteydi. Renal arterler dorsal ve ventral dallara ayrılmaktaydı. Dorsal ve ventral dallar sırasıyla; a.interlobaris'i a. arcuata ve a. interlobularis'i vermekteydi. Hiçbir materyalde anastomoz görülmedi. Sol böbrekte, ventral koldan orijin alan bir interlobar arter böbreğin dorsal yüzeyini beslemekteydi.

Anahtar Kelimeler*: Anatomi, Hasak koyunu, ren, renal arter*

Intoduction

In order to increase the production of lamb meat in our country, the Hasak genotype was obtained at the Bahri Dağdaş International Agricultural Research Institute by cross-breeding using meat varieties with good meat quality, with low fat and carcass quality (1). In 1989-2000 studies on hybridization and selection projects, Akkaraman sheep crosses with the German Black Head and Hampshire Down obtained F1, German Black Headed G1 and Hampshire Down G1. A balanced type of insemination program was applied to the hybrids from these two father lines to form a single type. Accordingly, this new type contains 31.25% Hampshire Down, 31.25% German Blackheaded and 37.50% Akkaraman genotype (1-3).

Kidneys are supplied by the right and left a.renalis originating from the abdominal aorta in the mammals (4-7). The renal arteries give rise to the dorsal and ventral branches before entering at the hilus of the kidney (8-9). The dorsal and ventral branches respectively divide in turn into the aa. interlobares, aa. arcuates and aa. interlobulares (9).

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Renal arterial system's anatomy was studied in some mammals; pigs (10), carnivore (11-17), ruminant (18-20), laboratory animals (21-24) and wild animals (25-27).

There are no reports on the details about this vessel's segmentation in this new sheep breed. We have aimed to investigate the anatomical variations of renal arteries in this hybrid sheep type.

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Materials and Methods

The kidneys of six adult Hasak sheep, regardless of their sex, were used in this study. The originally described corrosion cast method (22, 28) was applied to the materials. The kidneys were obtained along with the renal arteries, followed by the injection of the takilon prepared in 20% powder monomethyl-methacrylate and 80% liquid polymethyl-methacrylate. They were kept at room temperature for 24 hours for polymerization. They were corrosion casted in 30% KOH at 60ºC for 24-48 hours, washed with tap water. The different segments were identified and photographed. An electronic caliper was used for measurements. The different findings from patterns of renal irrigation were reported number of renal arteries, side on which presented, length, diameter, emergent surface from the aorta. The nomenclature employed in this study was in accordance to Nomina Anatomica Veterinaria (29).

Results

Renal arteries originated from both sides of the abdominal aorta and ran towards the hilus of the kidneys. After its origin, the left and right renal artery coursed caudolaterally and bifurcated as dorsal and ventral branches before arriving at the hilus. The length of the a. renalis dextra arriving at the hilus was greater than the a. renalis sinister. A. renalis dextra gave rise to the dorsal and ventral branches 3.5–4.5 cm from the hilus, and a. renalis sinister 2.5–3.8 cm (the average diameter 4.14 to 6.02 mm and 4.21 to 4.98 mm, respectively) (Figure 1). These arteries divided into two dorsal and one ventral branches before arriving at the hilus. The right dorsal branches were about 3.42 to 4.01 mm in diameter and 0.9 to 1.1 cm in length. These vessels gave off five–six right aa. interlobares. The right ventral branch was about 3.05 to 4.21 mm in diameter and 1.1 to 1.2 cm in length and ramified as seven–eight right aa. interlobares (Figure 2). The left dorsal branches were about 3.97 to 4.34 mm in diameter and 1.2 to 1.6 cm in length. These arteries gave off 5–6 left aa. interlobares (Figure 3). The left ventral branch was about 3.43 to 3.70 mm in diameter and 1.12 to 1.57 cm length and ramified as seven–eight left aa. interlobares (Figure 4). At the medulla-cortex junction, the right aa. interlobares and the left ones gave off aa. arcuates that arch over the bases of the medullary pyramids. It was observed that all the aa. interlobares observed gave off several aa. arcuates. From the aa. arcuates, in turn, were originated the aa. interlobulares spreading the entire surface of the kidney. No anastomoses were seen between any of the subdivisions of the renal arteries (Figure1-4). A ventral branch gave rise to an a. interlobaris nourishing the dorsal surface of one left kidney (Figure 4).

Figure 1. Dorsal view of the right renal artery. A = right renal artery, D = right dorsal branch, V = right ventral branch, I= interlobar artery, C = arcuate artery, L = interlobular artery

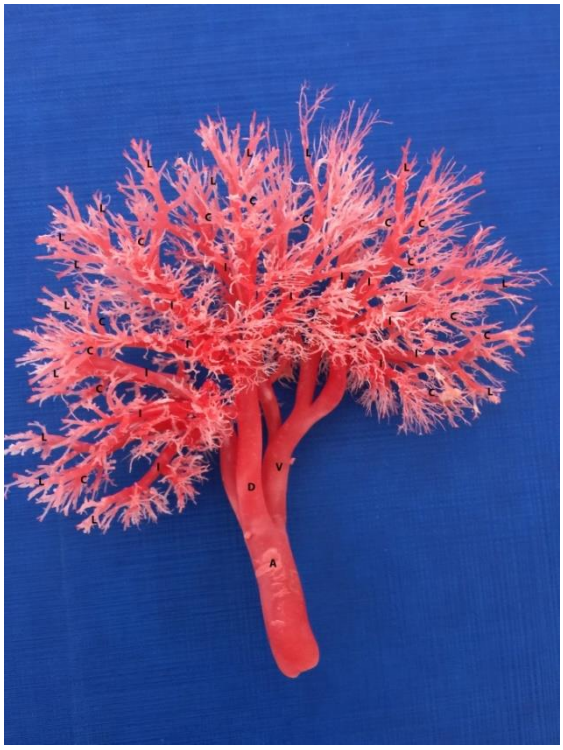

Figure 2. Dorsal view of the left renal artery. A = left renal artery, D = left dorsal branch, V = left ventral branch, I= interlobar artery, C = arcuate artery, L = interlobular artery

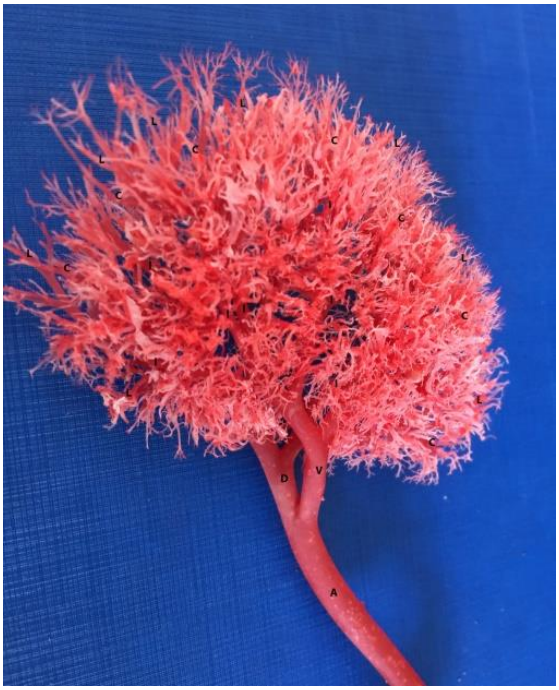

Figure 3. Ventral view of the right renal artery. A = right renal artery, V = right ventral branch, D = right dorsal branch, I= interlobar artery, C = arcuate artery, L = interlobular artery

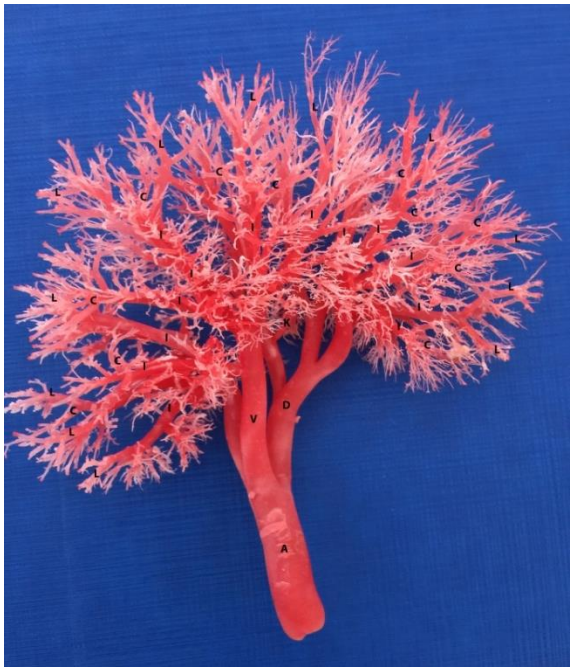

Figure 4. Ventral view of the left renal artery. A = left renal artery, V = left ventral branch, D = left dorsal branch, K = one interlobar artery, the originated from ventral branch nourished dorsal surface of the ren, I= interlobar artery, C = arcuate artery, L = interlobular artery

Discussion

In this study we showed that the aa. renales originated from each side of the abdominal aorta. This finding was in agreement with that described by Aksoy et al. (18) in Tuj sheep and Nickel et al. (5) for ruminants. Although, Ghoshal (30) determined that their origins to be from the ventral surface of the aorta in the ruminants.

In the study under investigation observed that the a. renalis dextra was longer than the a. renalis sinistra, confirming observations of Sajjarengpong and Adirektaworn (31) in dog, Ozdemir et al. (17) in Kangal dog, Aksoy et al., (18) in Tuj sheep and Nickel et al. (5) in horse, Paryani (32) in one humped camel mentioned that the a. renalis dextra was longer than the left one. While, Maženský et al. (33) in New Zealand White rabbits, Aksoy and Ozudogru (13) in Van cat, Ozudogru and Ozdemir (27) in wolf, Nickel et al (5) in cattle mentioned that the a. renalis sinistra was longer than the right one.

We have reported that the primary divisions of renal arteries were a dorsal and a ventral branch, as also reported in most mammals (13, 17, 18, 27).

We have observed that dorsal and ventral branches of renal arteries gave off multiple aa. interlobares. Thereafter, aa. interlobares gave off multiple aa. arcuates. Finally, these arteries were terminated as aa. interlobulares. However, it has been also described for calves (20), goats (19), sheep (18), Kangal dog (17) and rabbits (22).

Aslan and Nazli (19) showed in the goat and Morkaraman sheep that origins of the dorsal and ventral branches were approximately 2.44 cm and 2.35 cm far from the hilus, respectively, Aksoy et al. (18) reported that distance to be 1–1.7 cm. We have measured that dorsal and ventral branches of renal artery 3.5–4.5 cm from the hilus, and the thereof left renal artery 2.5–3.8 cm.

In conclusion, pattern of the renal arteries of Hasak sheep resembled that reported in the literature even though there present some essential variations. There were, at first, no anastomoses between the renal arteries and their branches. A ventral branch gave rise to an a. interlobaris nourishing the dorsal surface of one left kidney.

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