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Arterial Vascularization of Kidneys in the Hasmer Sheep

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Absract: The study was conducted to investigate the variations of renal arteries in Hasmer sheep. Six animals were used in the study. Renal artery and its segments were prepared using standard corrosion cast techniques and examined. An electronic calibrator was used to measure the length and diameter of the renal arteries. Renal arteries were originating from the abdominal artery, right and left. The left renal artery was longer than the right. Renal arteries were also divided into dorsal and ventral branches. Dorsal and ventral branches respectively; interlobar, arcuate and interlobuler arteries were separated. An interlobar artery originating from the ventral branch of both kidneys fed both the dorsal and ventral surfaces of the kidney. None of the materials had anastomosis. As a result; Such studies may shed light on research such as renal transplantations, surgical operations of the kidneys and urinary diseases.

Keywords: Arterial vascularization, Hasmer sheep, Ren.

Hasmer Koyununda Böbreklerin Arteriyal Vaskularizasyonu

Öz: Çalışma, Hasmer koyunlarında renal arterlerin varyasyonlarını araştırmak amacıyla yapıldı. Araştırmada altı adet hayvan kullanıldı. Renal arter ve segmentleri standart korozyon kast teknikleri kullanılarak hazırlandı ve incelendi. Renal arterlerin uzunluk ve çap ölçümleri için elektronik kalibratör kullanıldı. Arteria renalis'lerin, aorta abdominalis'ten sağlı ve sollu olarak orijin aldıktan sonra dorsal ve ventral iki dala ayrıldığı tespit edildi. Sol renal arterin, sağ renal arterden daha uzun olduğu belirlendi. Renal arterler dorsal ve ventral iki dala ayrılmaktaydı. Dorsal ve ventral dallar sırasıyla; interlobar, arcuate ve interlobuler arterlere ayrıldığı gözlendi. Ayrıca, her iki böbreğin ventral kolundan orijin alan bir interlobar arterin, böbreğin hem dorsal hem de ventral yüzünü beslediği belirlendi. Materyallerin hiçbirinde anastomoz görülmedi. Sonuç olarak; Bu tür çalışmalar böbrek transplantasyonları, böbreklerin cerrahi operasyonları ve üriner hastalıklar gibi araştırmalara ışık tutabilir.

Anahtar Kelimeler: Arterial vascularizasyon, Hasmer koyunu, Ren.

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INTRODUCTION

Due to the need for genetic material with high breeding value in breeding Turkish sheep, the Hasmer genotype was obtained at the Bahri Dağdaş International Agricultural Research Institute by cross-breeding using meat varieties with good meat quality and good quality, with low fat and carcass quality (1). Hasmer genotype is a sheep breed formed by triple crossbreed of German Black Head, Hampshire and Merinos sheep breeds (2).

Anatomical information of the renal arteries is very important for experimental and surgical operations. Most species of mammals have been used as experimental animals in the study of variable diagnostic or surgical techniques in vascular and urologic field. To the most used species belong the rabbits (3-4), pig (5-7), dogs (8-13) and small ruminant (14-15).

We have aimed to determine that anatomical pattern type of intrarenal vascular structures of the Hasmer sheep. It is the first study on the distribution of renal arteries in the Hasmer sheep.

MATERIALS and METHODS

The study was carried out on six adult Hasmer sheep. We used Hasmer sheep, a genetically new race in our country. 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. Corrosion cast method (16-17) was applied to the kidney. For polymerization, materials were kept at room temperature for 24 hours. They were corrosion casted in 30% KOH at 60^0 C for 24-48 hours. After the dissolution of surrounding soft tissues, were their rests removed from the corrosion casts in running water. These materials had photographed. An electronic calibrator was used for measurements. The study was conducted in accordance with the ethical principles for animal experiments.

RESULTS

Renal arteries as branches arising from the ventral walls of abdominal aorta were supplied the kidneys. Left renal artery was longer than right renal artery. In all studied corrosion casts, the origin of right renal artery was located cranially to the origin of left renal artery. Distance between both renal arteries was 9.82-10.57mm. The diameter of abdominal artery was 6.92 mm (Figure 1-2).

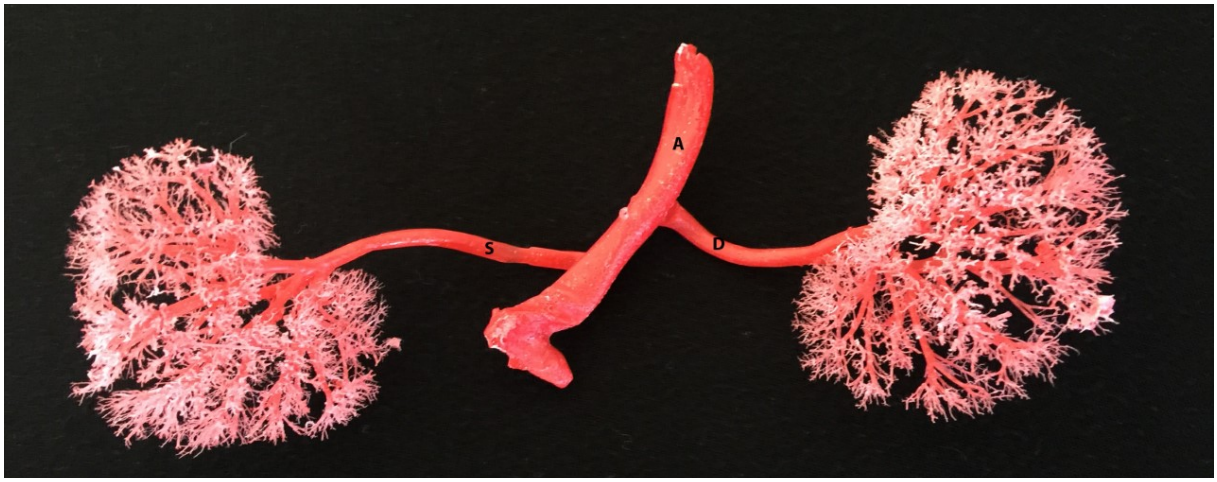

Figure 1. Dorsal view of the renal arteries; A-abdominal aorta, D-right renal artery, S-left renal artery.
Şekil 1. Renal arterlerin dorsal'den görünümü; A-aorta abdominalis, D-sağ renal arter, S-sol renal arter.

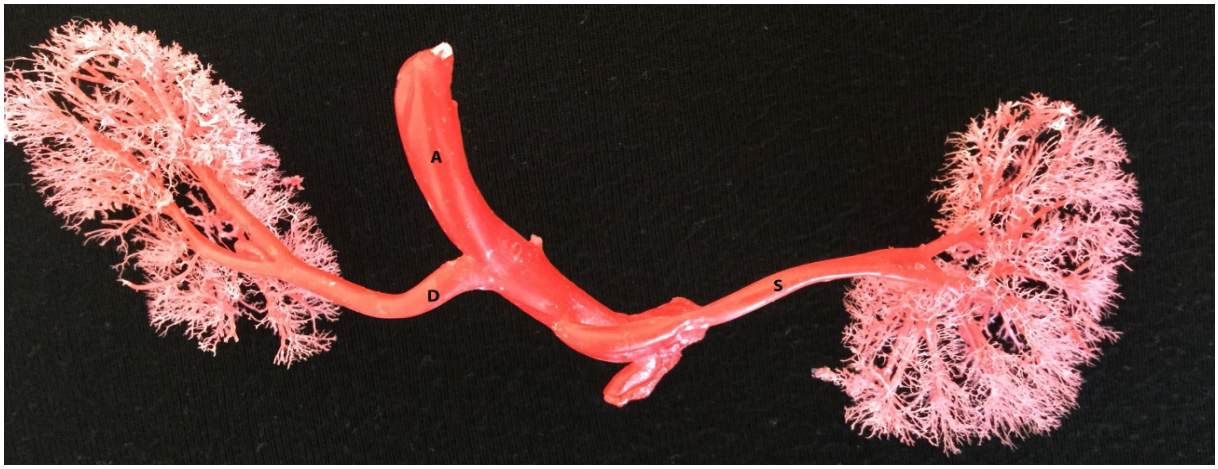

Figure 2. Ventral view of the renal arteries; A-abdominal aorta, D-right renal artery, S-left renal artery.
Şekil 2. Renal arterlerin ventral'den görünümü; A-aorta abdominalis, D-sağ renal arter, S-sol renal arter.

The right renal artery gave rise to the dorsal and ventral branches 33.2–34.3 mm from the hilus of kidney, and the left renal artery 46.2–48.4 mm. The average diameter of right renal artery was 3.46-3.69 mm and the average diameter of left renal artery 3.12-3.26 mm (Figure 3-4). These arteries were divided into two dorsal and ventral branches before entering the hilus of kidney.

Figure 3. Dorsal view of the right renal artery; D-right renal artery, I-right dorsal branch, II-right ventral branch, 1-interlobar artery, 2-arcuate artery, 3-interlobular artery.
Şekil 3. Sağ renal arterin dorsal'den görünümü; I-sağ dorsal dal, II-sağ ventral dal, 1-arteria interlobaris, 2-arteria arcuate, 3-arteria interlobularis.

Figure 4. Ventral view of the right renal artery; D-right renal artery, J-An artery that feeds both the dorsal and ventral surfaces of the kidney, I-right dorsal branch, II-right ventral branch, 1-interlobar artery, 2-arcuate artery, 3- interlobular artery.
Şekil 4. Sağ renal arterin ventral'den görünümü; J-böbreğin hem dorsal hem de venral yüzeyini besleyen bir arter, I-sağ dorsal dal, II-sağ ventral dal, 1-arteria interlobaris, 2-arteria arcuate, 3-arteria interlobularis.

The right dorsal branches were about 2.14 to 2.45 mm in diameter and 9.28 to 9.56 mm in length. These vessels were giving five or six right interlobar arteries (Figure 3). The left dorsal branches were

about 2.49 to 2.72 mm in diameter and 9.17 to 9.68 mm in length. These arteries were giving four or five left interlobar arteries (Figure 4). The right ventral branch was about 2.59 to 2.78 mm in diameter and 2.19 to 2.35 mm in length and ramified as seven–eight right interlobar arteries (Figure 5). The left ventral branch was about 2.4 to 2.58 mm in diameter and 6.73 to 6.99 mm length and ramified as five–six left interlobar arteries (Figure 6).

At medulla-cortex junction, right and left interlobar arteries gave off arcuate arteries that arch over the base of the medullary pyramids. The interlobular arteries originating from the arcuate arteries were spread over the entire surface of the kidney. An interlobar artery originating from the ventral branch of both kidneys fed both the dorsal and ventral surfaces of the kidney (Figure 3, 6). None of the materials had anastomosis.

Figure 5. Dorsal view of the left renal artery; S-left renal artery, I-left dorsal branch, II-left ventral branch, 1-interlobar artery, 2-arcuate artery, 3-interlobular artery.
Şekil 5. Sol renal arterin dorsal'den görünümü; S-sol renal arter, I-sol dorsal dal, II-sol ventral dal, 1-arteria interlobaris, 2-arteria arcuate, 3-arteria interlobularis.

Figure 6: Ventral view of the left renal artery; S-left renal artery, J-An artery that feeds both the dorsal and ventral surfaces of the kidney, I-left dorsal branch, II-left ventral branch, 1-interlobar artery, 2-arcuate artery, 3-interlobular artery.
Şekil 6: Sol renal arterin ventral'den görünümü; S-sol renal arter, J-böbreğin hem dorsal hem de venral yüzeyini besleyen bir arter, I-sol dorsal dal, II-sol ventral dal, 1-arteria interlobaris, 2-arteria arcuate, 3-arteria interlobularis.

DISCUSSION and CONCLUSSION

In this study showed that the renal arteries observed that their origins to be from the ventral surface of the abdominal aorta, in relation with the literature (18). While, some literature (14,19-21) described that the renal arteries observed that originated from each side of the abdominal aorta.

Although multiple renal arteries for each kidney have been reported in dogs (22) and humans (23), in all kidneys examined study we observed only a single renal artery, as has also been reported for goats and sheep (15), small laboratory animals (24-26).

In all studied specimens, left renal artery was longer than left renal artery which is consistent with the findings literature (18,26-28). While, some researcher reported that right renal artery was longer than the left renal artery (12,14,29).

In this study, the primary divisions of renal arteries were a dorsal and a ventral branch, as also reported in most mammals (12,14,21,30-31).

Though, two or more branches have been noted in the dog (31-32), it had been reported that the primary division of the pig renal artery forms a cranial and a caudal branch in 93.4% of cases (6,33). After that, the dorsal and ventral branches of renal arteries emerged from multiple arterial arteries. However, the dorsal and ventral branches for rabbits (25), rats (21), goats (15), sheep (14) and Kangal dog (12) have no cranial and caudal branches of the renal arteries, Hasmer sheep resembles its kidneys.

In the kidney of Hasmer, at the medulla-cortex junction the interlobular arteries gave rise to arcuate arteries. Each arcuate artery was giving interlobular arteries, as reported for small laboratory animals (21,24-25), canines (8,12,27,30-31,33), and sheep (14-15). Some researcher (15-34) reported that an anastomosis between the dorsal and ventral branches in one kidney. No such findings were found in the study.

Aksoy et. al (14) stated that, the right dorsal branch divided into three-five interlobar subbranches, while the right ventral one gave off four-six interlobar ones, and the left dorsal branch, on the other hand, branched out three-six and the left ventral branch three-four interlobar arteries. We have noted that right dorsal branch divided into five-six interlobar subbranches, while the right ventral one gave off four-five interlobar ones, and the left dorsal branch, on the other hand, branched out four-five and the left ventral branch five-six interlobar arteries.

Aslan and Nazli (15) reported that, the dorsal branch gave two interlobar arteries for the ventral surface and the ventral branch delivered one interlobar artery for the dorsal surface in one goat and one Morkaraman sheep. Aksoy et al. (14) mentioned that, one right kidney, a third branch arising from the junction of the dorsal and ventral branches and supplying the dorsal surface of the kidney. Furthermore, he was observed that in one left kidney, an interlobar artery arose from the dorsal branch nourishing the ventral surface of the caudal extremity, and the interlobar artery of the ventral branch normally supplying the ventral surface of the caudal extremity was absent. In this study, we have identified an interlobar artery originating from the ventral branch of both kidneys fed both the dorsal and ventral surfaces of the kidney.

Although many researchers (12,14,27,30) weren't mentioned that interlobar arterial anastomosis, Aslan and Nazli (15) found that, an anastomosis between a dorsal and ventral branches of a sheep and two interlobar arteries originating directly from the renal artery in two sheep. Anastomosis was not detected in any of the lower parts of the renal arteries.

In conclusion, such studies can be used as reference in that kidney arteries are an important anatomic feature that surgeons need to know in order to prevent damage to these arteries during renal transplantation, to evaluate donor kidneys for kidney transplantation and uroradiological fields.

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