Original Article

Number of Human Segmental Arteries in Local Population

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ABSTRACT

Objective: To investigate the variations in the total number of segmental arteries in human kidneys obtained from cadavers of the local adult population.

Study Design: Observational Study.

Place and Duration of Study: This study was conducted at Anatomy Department of University of Health Sciences, Lahore, for a period of one year from October 2006 to October 2007.

Materials and Methods: Forty four adult human kidneys were obtained after autopsy; they were randomly divided in two groups A and B of right and left kidneys respectively. Simple blunt dissection and corrosion cast techniques were used to study the number of segmental arteries. Statistical analysis was carried out by using SPSS version 16.0 and STATA version 8.0.

Results: Segmental arteries were present in 100% of specimens of groups A and B; variations were seen in the number of segmental arteries of both groups.

Conclusion: The segmental branches of renal artery in local population showed variations different from those reported in the earlier work carried out in other countries.

Key Words: Kidneys, Segmental arteries.

INTRODUCTION

Recent advances and refinements in renal surgery as well as radiological interventional procedures have revived interest in renal arterial anatomy.[1,2] The vascular pattern of the kidney had been the topic of repeated anatomical investigations and the variations of renal arteries are considered critical issues of which the surgeons should have thorough knowledge.[3,4]

Renal arteries arise from abdominal aorta and supply the kidneys through a number of subdivisions. Near the renal hilum, each renal artery divides into anterior and posterior divisions (presegmental arteries), which further divide into segmental arteries supplying the renal arterial segments.[5-7] On the basis of arterial distribution, five segments of the kidney have been described and were named as apical, upper, middle, inferior (lower) and the posterior segments.[5,8]. Segmental artery clamping is anatomically feasible, it minimizes the number of nephrons exposed to potential ischemic injury and its accessibility may be a factor for choosing laparoscopic surgical approach; precise hilar dissection, including dissection of the segmental arteries has been safely performed on routine basis. If access to a segmental artery is challenging, presegmental arterial ligation can still spare most of the kidney from an ischemic challenge.[9] Familiarity with the possible variations in the renal arterial pattern is especially important for the surgeons dealing with kidney transplantation, various endourologic procedures and innumerable interventional techniques.[10-12]

MATERIALS AND METHODS

Forty four unclaimed adult human cadaveric kidneys were obtained from forty four cadavers from the Forensic Medicine Department of King Edward Medical University, Lahore. The kidneys were randomly divided into two groups, A and B, having right and left kidneys respectively; twenty two specimens were present in each group (n=22). The kidneys were irrigated with normal saline for flushing out of blood and formalin from the organ.[13,14] The segmental branches of renal arteries were studied by using simple blunt dissection and corrosion cast technique. After performing blunt dissection, the renal artery and its branches were painted with red oil paint. Batson's No. 17 corrosion kit (Polysciences) was used to make the renal arterial corrosion cast.[15] For maceration purpose, the kidney was placed in 20% solution of potassium hydroxide in a glass jar at room temperature; the amount of potassium hydroxide solution used was two to three times the volume of the renal mass.[14,16-19] After about ten days, the macerated tissues were removed; the specimen was washed with tap water and air-dried. The exclusion criteria consisted of: presence of renal abnormalities on gross inspection, evidence of renal trauma or renal surgery, and presence of abdominal growths. [17,20-24]

The statistical analysis was carried out using computer software Statistical Package for Social Sciences (SPSS) version 16.0 and STATA version 8.0. The significance of the data between the groups was calculated by Pearson Chi-square test and Fisher exact test; the

association was regarded statistically significant if the 'p' value was <0.05.

RESULTS

Variations in the total number of segmental arteries were observed. Segmental arteries were present in all the specimens of groups A and B. Total number of segmental arteries was 346, 176 in group A and 170 in group B. Although observations were observed in the number of segmental arteries in both the groups, no statistically significant association was found between the two groups (p value>0.05) (Figure I).

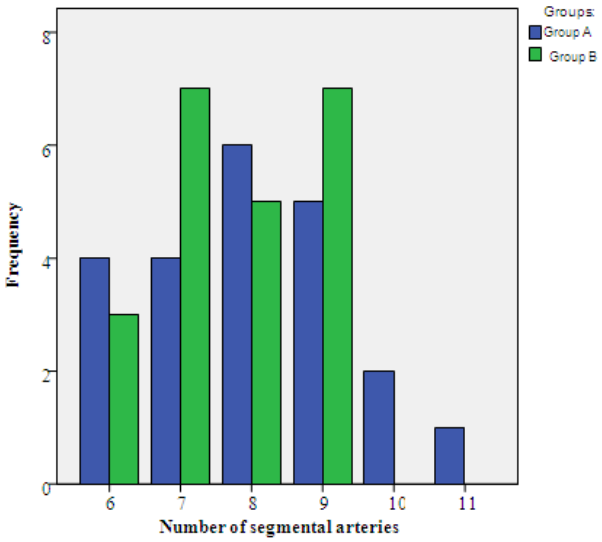

Figure No.I: Diagram showing variations in the number of segmental arteries in groups A and B.

DISCUSSION

The renal arteries are considered as an important anatomical landmark by all the anatomists, surgeons and radiologists dealing with the aortic and renal surgeries.[10] The present study gave the data for the variations in the total number of segmental arteries in right and left human cadaveric kidneys. In the current study, the segmental branches of renal artery showed high variability in their total number, which varied from six to eleven. These findings were consistent with the observations made by Kosiński and Oszukowski, in which two hundred corrosion casts of renal arteries demonstrated high variability in their origin, ramifications and the area of renal parenchyma supplied;[25] they showed difference in total number of segmental arteries.

Association between groups A and B in the total number of segmental arteries was statistically insignificant. The realization of the segmental nature of the branches of renal artery has led to the attempts of putting the partial resection of kidney on a rational basis.[26] Extensive hilar dissection with selective renal presegmental or segmental vascular occlusion may serve as another tool in the renal surgeon's armamentarium.[9] According to Moore, the manner in which the renal artery divides into its primary branches (segmental arteries) is variable and deviates markedly from the typical anterior and posterior branches described earlier.[27]

The variations of the branches of renal artery are important for various operative procedures like renal transplants, incision of renal pelvis, creation of a transcutaneous passage for nephroscope insertion, vascular reconstructions as well as constructive renal surgery.[25] The present study showed differences in the number of segmental arteries present in different specimens with a statistically non-significant association between the two groups. However, the present findings were consistent with the typical arterial pattern set by Graves and other researchers who found that segmental arteries originating from the presegmental branches of renal artery showed comparable pattern of supplying the apical, upper, middle, inferior and posterior renal segments and are variable in number. This difference could be explained on the basis of geographical and ethnical variations.

CONCLUSION

The segmental branches of renal artery in local population showed variations different from those reported in the earlier work carried out in other countries.

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