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Original Article

Variations in Course and Branching Pattern of Posterior Segmental Artery and Its Relation with Collecting System.

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ABSTRACT

Aims: To study the course and branching pattern of posterior segmental artery and its relation with collecting system. **Method:** We studied 50 human Kidneys by corrosion cast method. Kidneys were obtained from postmortem bodies. Colour coded cast material with 20% strength, solution of butyl butyrate in acetone was injected into renal artery and ureter. Injected Kidneys were immersed in concentrated KOH solution for complete maceration of soft tissue of Kidneys. **Results:** We observed three different variations in course and branching pattern of posterior segmental artery and in the present study these variations have been divided into three groups namely PSAG1, PSAG2 and PSAG3 which have been observed in 25(50%), 12(24%) and 13(26%) Kidneys respectively. We also noted three types of relation between posterior segmental artery and collecting system namely PSAT1, PSAT2 and PSAT3 which we observed in 22(44%), 16(32%) and 12(24%) Kidneys respectively in present study. **Conclusion:** Findings of present study are important to know before performing interventional radiological procedures, intrarenal operations and renal trauma management to avoid urological complications.

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1. Introduction

Kidney is one of the very important and chief excretory organ of body. Classically each Kidney is supplied by a single renal artery. In its course renal artery divides into anterior and posterior division, both of these division further divide into segmental arteries. They later on divide in lobar arteries, usually one to each renal pyramid. They subdivide into two or three interlobar arteries. In their course interlobar arteries dichotomize into arcuate arteries which diverge at right angles. The arcuate arteries give off interlobular arteries which extend radially outward through the cortex. Each interlobular artery gives origin to a number of afferent glomerular arterioles from its side which forms glomerular plexuses which are received by the Bowman's capsule to form renal corpuscle. Renal corpuscle is responsible for filtration of substances from the plasma. Selective resorption of glomerular filtrate is carried out in renal tubules which end by joining into the collecting duct. Many collecting ducts unite together to form the duct of Bellini which

opens into the minor calyces through the renal papillae. The minor calyces unite to form major calyces. The major calyces drain into renal pelvis. In this way Kidney receives blood through renal artery and filtration leads it to form Urine, which drain via collecting system. In its course posterior segmental artery run in close relation with collecting system. Knowledge of these segmental branching patterns of renal artery and their relation of posterior segmental artery with collecting system is essential for uro-surgeon to perform operative procedures.

Materials and Methods

50 human Kidneys were obtained from postmortem bodies within 24 hours of death. We dissected out renal artery, from renal pelvis and ureter at the hilum of the Kidney. The vessels were irrigated and washed with 0.9% saline solution injected via renal artery. Colour coded (red for artery and black for collecting system) cast material with 20% strength, solution of butyl butyrate in acetone was injected into renal artery and ureter. The solution was injected till the increase in resistance was observed. The injected study materials were kept in 10% formal saline for 24 hours at room temperature for polymerization. Later on injected Kidneys were immersed in concentrated KOH solution for 24 hours at 50°C. After maceration of soft tissue was completed, the casts were ready for study after they were washed with running tap water.

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Result

We studied 50 human Kidneys by corrosion cast method and observed three different variations in the course and branching pattern of posterior segmental artery and these variations have been divided into three groups namely PSAG1, PSAG2 and PSAG3. PSAG1 ran downward with lateral convexity and gave branches as it descended. It was found in 25(50%) Kidneys (Figure1). PSAG2 divided first into two branches superior and inferior. Each of them further subdivided into two branches. This pattern was observed in 12(24%) Kidneys (Figure2). PSAG3 divided into radial fashion at one point into terminal branches. It was seen in 13(26%) Kidneys (Figure3). We also observed three types of relation between posterior segmental artery and collecting system namely PSAT1, PSAT2 and PSAT3. PSAT1 passed on posterior surface of pelvis and further from the junction of pelvis with upper major calyx. It was seen in 22(44%) kidneys (Figure 3). PSAT2 passed on to posterior surface of upper major calyx. It was seen in 16(32%) Kidneys (Figure 2). PSAT3 passed on posterior surface of pelvis and lower major calyx. It was seen in 12(24%) Kidneys (Figure 1).

Table 1: Showing comparative study on course and branching pattern of posterior segmental artery.

Author	Groups of posterior segmental artery		
	PSAG1	PSAG2	PSAG3
Present study	50%	24%	26%
V.P.Raghavendra ^[6]	28.33%	51.66%	16.66%
Longia G.S. et al ^[4]	46%	36%	17%
H. Fine et al ^[5]	50%	30%	10%
Verma et al ^[2-3]	62%	29%	9%

Figure 1 : Showing PSAG1 and PSAT3. P- PSAG1 and PSAT3, RA-Renal Artery, U-Upper Major Calyx, L-Lower Major Calyx, V-Pelvis, UR-Ureter.

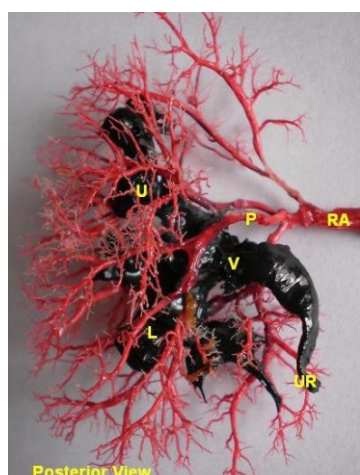


Figure 2 : Showing PSAG2 and PSAT2. P- PSAG2 and PSAT2, RA-Renal Artery, U-Upper Major Calyx, L-Lower Major Calyx, V-Pelvis, UR-Ureter

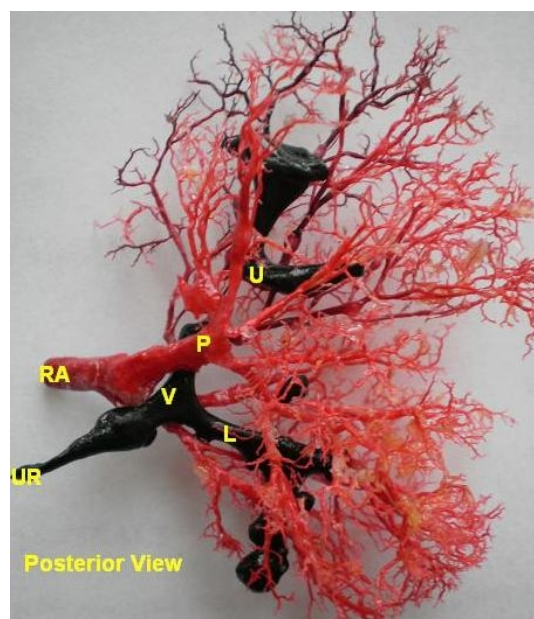
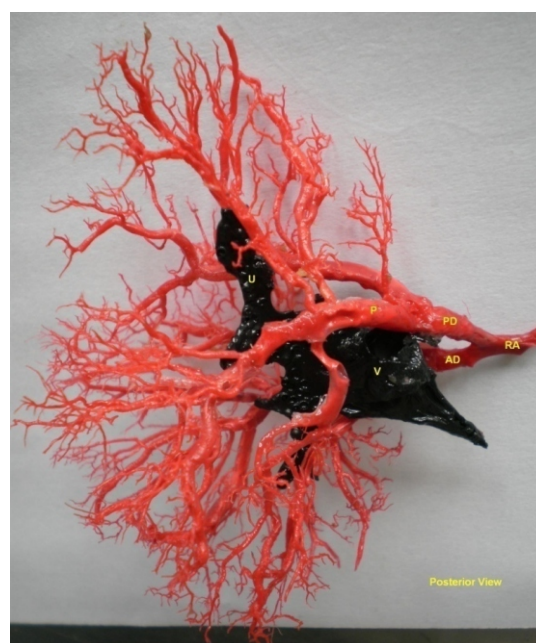


Figure 3 : Showing PSAG3 and PSAT1. P- PSAG3 and PSAT1, RA-Renal Artery, AD- Anterior Division, PD- Posterior Division, U-Upper Major Calyx, V-Pelvis.



Discussion

Course and branching pattern of posterior segmental artery and its relation with collecting system have been observed by other Authors. Posterior division continued as posterior segmental artery[1] It is similar to our findings we found continuation of posterior division as posterior segmental artery in all 100% Kidneys. In present study we observed three different variations in course and branching pattern of posterior segmental artery. Similar variations have been also seen in past studies by other Authors[2-6](Table1). In older studies few cases(1%) posterior segmental artery was absent[4] but in our study posterior segmental artery was not absent in any case rather it was present in all cases. Posterior segmental artery has been found to have four types arterial pattern[6]. In which type-1, type-2 and type-3 are similar to variations found in our study. The relationship between the cast of segmental artery and that of collecting system, anterior branches divided to form 3 segmental arteries run in radiating from the anterior portion of pelvis, while posterior segmental artery crossed posterior portion of pelvis[7]. We also studied relation between posterior segmental artery and collecting system and found three types (PSAT1, PSAT2 and PSAT3) of variation. PSAT1, PSAT2 and PSAT3 were seen in 44%, 32% and 24% Kidneys respectively. PSAT1 reported in 99.4% Kidneys[4]. PSAT2 was seen in 67% Kidneys[5] and 18% Kidneys[10]. PSAT1 and PSAT2 together shown in 57.3% Kidneys[8].

Conclusion

In present study we observed variations in course and branching pattern of posterior segmental artery and its relation with collecting system. These variations are of utmost importance during puncture in endourological procedures and intrarenal operations to avoid risk of bleeding. Also a good knowledge of such variations can be helpful preservation of healthy renal fragment to provide equal benefits in conservative operations instead of going for total and partial nephrectomy, also the urological complications after such operations can be easily reduced.

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