



PRE HILAR SEGMENTAL PATTERN OF RENAL ARTERY IN HUMAN KIDNEYS

Anatomy

Dr.A.Himabindu Professor, Department of Anatomy,gitam Institute of Medical Sciences and Research, Rushikonda, Visakhapatnam. - Corresponding Author

Dr.S.Muralikrishna Associate Professor, Department of Anatomy, Gitam Institute of Medical Sciences and Research, Rushikonda, Visakhapatnam.

ABSTRACT

Kidney is supplied by renal artery. This artery is divided into anterior and posterior divisions near hilum which later gives segmental branches. These segmental branches supply five segments of kidney. This is helpful in renal procedures as these are end arteries. In some cases there is prehilum division and aberrant segmental arteries which will create difficulty while performing procedures on kidney. The present study was done on 40 kidneys to know the different prehilum division of renal artery. This study observed origin of polar artery from renal artery and variant branches of anterior division and posterior division of renal artery. As there is no anastomosis between these branches partial nephrectomy and renal transplantation procedures can be done successfully. In order to avoid undue complications during surgery, renal angiography is must before planning any procedures on kidneys to know the segmental division of renal artery.

KEYWORDS:

kidney, renal artery, polar artery, segmental artery

Introduction:

Kidneys are important organs of excretion. It receives its arterial supply by renal artery, a branch of abdominal aorta and venous blood is drained into inferior vena cava through renal vein. Based on their vascular division the kidney is divided into segments. This segmentation helps in partial resection procedures as they are supplied by segmental arteries which are end arteries. This helps the clinicians to retain the function of the organ by removing only the damaged part. Normally the renal artery divides into anterior & posterior divisions at the hilum of the kidney. The anterior division gives apical, anterosuperior, anteromiddle and anteroinferior segmental arteries and posterior division passes behind renal pelvis and supplies posterior segment of the kidney. Segmental character of renal artery was first formed by Bertin in 1744 and confirmed by Hyrtl J and Brodel M. Graves described the classification of renal segments. He mentioned five segments. Apical or superior pole, upper for anterosuperior segment, middle for anteroinferior segment, lower for inferior pole and posterior for entire posterior region between apical and inferior segments. This feature is helpful in partial nephrectomy, nephrolithiasis for preserving the healthy tissue. Successful procedures depends on its arterial supply and renal transplant need detailed knowledge of the vascular pattern. The present study was done on renal vasculature of kidney to know the different patterns of the segmental arteries of the kidney.

Materials & Methods:

The present study was done on 40 kidneys that were removed from the cadavers during dissection of undergraduate students. The renal fascia was removed and the structures that are present near the hilum of the kidney were exposed. The division of renal artery was studied and if there was any prehilum division it was studied in detail.

Observations:

Variant division of renal artery was observed in the following pattern.

1. In a left kidney, renal artery gave upper polar artery, later the artery gave a large inferior polar artery. Rest of the artery divided into anterior and posterior divisions. Anterior division gave anterosuperior branch and a common trunk for antero middle and antero inferior branches. The anteroinferior branch passed with inferior polar artery. Renal vein was behind the artery. (fig.1)



Fig.1 Showing polar artery

(PA-Polar artery, RA-Renal artery, RV-Renal vein, AD-Anterior division, PD-Posterior division,

IPA-Inferior polar artery, ISRA-Inferior suprarenal artery)

2. In a right kidney, renal artery divided into anterior and posterior divisions. Anterior division gave anterosuperior and anteromiddle branches. Posterior division gave polar artery and posterior segmental artery. Anteroinferior artery was a separate branch entering the lower pole of the kidney. (fig.2)



Fig.2 showing inferior polar artery & superior polar from posterior division

3. In another right kidney the division of renal artery showed this pattern. There was higher division of renal artery into anterior and posterior divisions. The posterior division passed behind the renal vein and continued as posterior segmental artery. The anterior division divided into upper & lower trunk. Upper trunk gave a large anterosuperior branch, and a small middle segmental artery. The lower trunk divided into middle segmental & anteroinferior segmental artery. Inferior suprarenal artery & polar artery had a common origin from renal artery. (fig.3)



Fig.3 ladder pattern of anterior division of renal artery

4. Renal artery in this right kidney divided into anterior and posterior

divisions. Anterior trunk gave anterosuperior, anteromiddle and antero inferior branches. Polar artery was given by renal artery. At the hilum the relation of structures were normal. (Fig.4)



Fig.4 Triforked anterior division

5. In a left kidney renal artery divided into anterior and posterior divisions. The anterior division gave a common trunk that divided into anterosuperior and antero middle segmental branches and antero inferior branch was a separate branch of anterior division. Polar artery was a branch of posterior division. (fig.5)



Fig.5 Common trunk for anterosuperior & anteromiddle br.

6. In a right kidney, hilum had two renal arteries. Upper one divided into polar artery, anterosuperior branch and posterior division. The lower accessory artery gave anteromiddle and antero inferior branches. The polar artery was cut (fig.7)



f Fig.6 Accessory renal artery at the hilum

Discussion:

The segmental character of the renal artery was confirmed by Hyrtl and Brodel M encouraged the development of urological surgery based on this feature. Normally the renal artery ends in two branches—anterior & posterior in relation to the excretory ducts (Schmerber). Various authors described different segmental branching pattern of renal artery. Weld KJ et al study on 73 kidneys explained the presegmental arteries. Presegmental artery is a branch of renal artery that divides into segmental artery which enters the renal parenchyma. Gregoire R described two branches in the form of a common trunk of anterior side & inferior pole and posterior common trunk for posterior branch and upper pole. Prehilar multiple branching pattern was described as triforked, duplicate & ladder pattern by Rao & Budhiraja. Rao explained that prehilar branches correspond to segmental arteries and damage of these vessels leads to segmental ischemia & post operative hyper tension due to parenchymal loss. Due to lack of arterial anastomosis in the neighboring segments a bloodless field can be achieved by ligating segmental artery. So segmental vascular diseases are best treated by partial nephrectomy, if details of segmental pattern

are known (Pontasse). Renal angiography is an essential investigation for all cases of partial nephrectomy as the knowledge of the avascular plane is most important. (Riche 1955). The segmental pattern of renal artery is important in performing partial nephrectomy, segmental resection in vascular lesion preserving the healthy tissue of the most important excretory organ. Girish & Shishirkumar described different patterns of origin of segmental arteries that can help in operative procedures on kidney. Accessory renal artery of different origins is important in renal transplantations because kidneys with vascular variations have higher failure rate or than the kidney with single renal artery (Sansou et al).

Conclusion:

Knowledge of Prehilar divisions of renal artery is very important in performing surgical procedures on kidney as it is supplied by segmental artery which are end arteries. As there is little anastomosis between the renal segments partial resections can be done preserving the healthy renal tissue. Success of the surgery depends on the amount of the blood loss so renal angiography is an essential investigation to know the segmental division of renal artery while performing operative procedures on kidney.

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