Original Research Article

Variation of Renal Vasculature and Its Clinical Correlation

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Abstract

Introduction: Kidneys are supplied by renal arteries and veins of same name. However, variations in the form of presentation of renal arteries & their prehilar branches are common. **Aim:** In this study, we focused on vascular anatomy of kidneys, differences observed in their course, origin and any additional blood vessels, if any. **Materials and Methods:** This study is based on thirty-two formalin fixed human cadavers from Anatomy department of Maharishi Markandeshwar Medical College & Hospital, Kumarhatti, Solan (H.P) and Department of Anatomy, JNUIMSRC, Jaipur (Rajasthan). Kidneys were exposed after abdominal dissection, and variations in vasculature were noted. **Results:** Results which we come across in our study are listed:i.Additional or Accessory renal arteries ii. Pre hilar branching of arteries.iii.Polar arteries .iv. Additional or Accessory renal vein. **Conclusion:** Knowledge of renal vasculature i.e its normal as well as variational anatomy is important for performing angiographic studies, renal transplantation and urological or radiological procedures which in turn serves as a useful tool for the procedures like embolization, angioplasties.

Keywords: Renal Vasculature, Pre Hilar Branches, Polar Arteries.

Introduction

Kidneys often show variations in renal artery and vein. Detailed knowledge of the variations of anatomical pattern of vasculature of kidney is essential in the present generation of transplantations and other advanced renal surgeries. Renal artery is branch from abdominal aorta which is usually paired or bilateral[1] and vein normally drains into the inferior vena cava via hilum of the kidney. Additional/ accessory renal vessels may enter the kidney through a number of ways which may be through the surface of kidney, hilum or through upper or lower pole of kidney as polar arteries[2] and will in turn be helpful platform for urological or radiological procedures, renal conservative surgeries and treating hydronephrosis.

Materials and methods

Thirty-two well preserved (formalin fixed) human cadavers (sixty-four kidneys) of both sexes, from the Anatomy department of Maharishi Markandeshwar Medical College & Hospital, Kumarhatti, Solan (H.P) and Department of Anatomy, JNUIMSRC, Jaipur (Rajasthan) were used for study. Abdomen was opened during routine dissection, anterior abdominal wall reflected along with its muscles, then peritoneum and finally kidneys were removed. Renal arteries, veins were traced.

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Variations of renal vasculature were noted and photographed. Relation of Renal Vein, Renal Artery and Pelvis was also noted and photographed.

Fig 1: Relation of Artery – vein – pelvis (ureter) relation at hilum

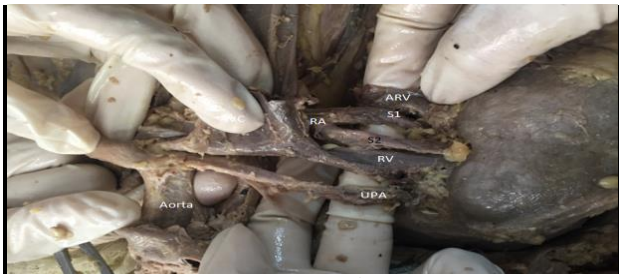

Fig 2: S1 & S2 Segmental branches of renal artery (RA), Upper Polar Artery (UPA), Accessary Renal Vein (ARV), IVC (Inferior vena cava), Aorta.

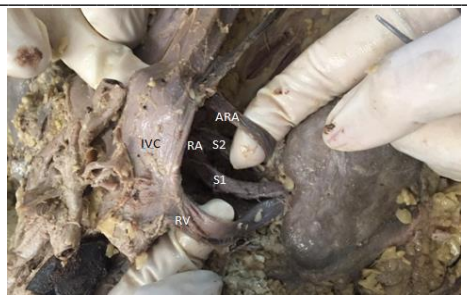

Fig 3: S1 & S2 Segmental branches of renal artery (RA), Accessary Renal Vein (ARA), IVC (Inferior vena cava), Renal Vein (RV), Aorta.

Table 1: Present study findings

Number of kidneys (64)		
Variation	**No. of Kidneys**	**Percentage of variations**
Artery – vein – pelvis relation at hilum	12	18.75%
Prehilar renal artery branching	4	6.25%
Polar arrtery	4	6.25%
Accessary renal artery	2	3.12%
Accessary renal vein	2	3.12%

Results

From all the 64 kidney specimens, variations at hilum were observed in 18.75% kidneys (12 out of 64 specimens) Normally the structures at hilum is placed as vein first then artery followed by pelvis (from anterior to posterior). The order was artery then vein followed by pelvis (from anterior to posterior) in 18.75% kidneys of our study. Polar arteries were observed in 2 kidneys i.e 3.12% pre-hilar branching of renal arteries was observed in 4 kidneys i.e 6.25% and accessory renal arteries were ssen in 4 kidneys i.e 6.25% respectively. Accessory renal arteries also arise from aorta and accompany the main renal artery to the hilum of the kidney. Polar arteries are the Accessory renal arteries entering the kidney from superior or inferior pole. Main renal artery enters the hilum by dividing into a number of segmental arteries known as pre-hilar branches. Accessory renal vein is the presence of extra renal vein draining into inferior vena cava and was observed in 2 (3.12%) kidneys.

Discussion

Renal artery variations accounts for about 30%[1] which are named as additional/accessory or aberrant renal arteries. Knowledge of these variations helps in investigation and treatment of renal trauma, vascular reconstruction surgeries, renal hypertension, renal artery embolization, and angioplasty.[2]Extra arteries which traverse alongside the renal arteries through the hilum are called accessory renal arteries and those which enters through upper or lower pole (polar arteries) are Aberrant Renal arteries and have embryological basis for these variations.Dorsal aorta, lateral mesonephric arteries supply Renal, Suprarenal and Gonadal organs. Felix stated that renal arteries arise from the middle group (6-9th) segment of lateral mesonephric arteries. Persistance of more than one artery in the middle group results in additional/accessory renal arteries.[3]Fork, duplicate, triplicate and ladder patterns were the different types of patterns of pre - hilar branches observed. Segmental distribution of the kidney is represented by these branches[4] and hence the chances of bleeding or haemorrhage is more during ischaemia, and transplantation. Bilateral accessory artery was reported by Saldarriage et al in 7.7% cases. He also reported accessory arteries in 12% and it was inferior polar arteries in 1.8% of cases.[2] We also observed presence of accessory renal arteries bilaterally in our study and that too both inferior and superior polar arteries are observed.In a study done by Bordei P et al., out of fifty four cases, twenty four cases entered kidney through the hilum, sixteen via inferior and five via superior polar arteries.[5] Additional and aberrant artery arise from the abdominal aorta and origin is same in our study also.

These double renal arteries are important for the clinicians, as they play an important role in causation of clinical conditions like hydronephrosis and renal transplantations. Variations in renal veins are encountered in micro vascular accidentally during routine operative procedures. Variations of arteries are encountered quite often when compared with renal veins, which accounts for 18% of the cases.[6] Various congenital variations of renal veins were revealed by Anupama et al, in which accessory renal vein was draining into inferior vena cava. Out of thirty, right sided supernumerary renal vein was observed in ten cases and a bilateral supernumerary renal vein in only one case.[7]Renal vein variations are usually due to anomalies of inferior vena cava developmentally[8] and these variations are common on right (28%) than left side (1%) as narrated in literature.[9] In present study, Accessory renal vein was observed on left side.

Variations in middle suprarenal arteries are commonly encountered in the past literature. Inferior supra renal artery superior testicular artery arose commonly.[10] But in our study inferior suprarenal arteries arises from accessory renal arteries bilaterally on both sides and it is a rare variation.

Conclusion

These variations of the renal arteries have a great importance for the urologists especially while0 performing invasive procedures and vascular surgeries on kidney like nephron-preserving surgery, kidney transplantation and the managing renal vascular hypertension. Knowledge of these variations also plays an important role as guidelines before surgery, reduces the risk of trauma to the vessels by vascular ligation and anastomosis. So, prior to every nephrectomy, angiography, multi detector computer tomography (MDCT) and arteriography should be performed to avoid any vascular complication.

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