

A CADAVERIC STUDY OF RENAL HILAR STRUCTURES AND THEIR VARIATIONS IN ANDHRA PRADESH POPULATION OF SOUTH INDIA

Sunnapu Uma Maheswararao¹, Vanju V. V. Lakshmi², B. Shahajeer³, D. Asha Latha⁴

¹Assistant Professor, Department of Anatomy, Andhra Medical College, Visakhapatnam.

²Assistant Professor, Department of Anatomy, Andhra Medical College, Visakhapatnam.

³Tutor, Department of Anatomy, Government Medical College, Ananthapuramu.

⁴Professor & HOD, Department of Anatomy, Andhra Medical College, Visakhapatnam.

ABSTRACT

AIM

To study the variations in the arrangement of renal hilar structures in human cadavers which are observed in anteroposterior direction.

MATERIALS & METHODS

Forty two (42) embalmed cadaveric kidneys are observed for studying the variations, the renal hilar structures arrangement and for branching of renal vessels. The number of branches of renal artery, number of supernumerary renal arteries & arrangement of structures at the hilar and prehilum region is studied.

RESULTS

In the present study, 29 kidneys were having normal renal arteries, whereas 13 kidneys were having the supernumerary renal arteries. In these 29 kidneys group, 15 kidneys (51.7%) were having common pattern of renal hilar structures, arrangement is RV-RA-RP in an anteroposterior direction. In 7 kidneys (24.1%), AD & PD of RA are present in between the RV & RP. In 4 kidneys (13.4%), RV is present in between AD, PD of renal artery.

CONCLUSION

Information about the arrangement of renal hilar structures is very important for general surgeons, urologists & transplant surgeons because this knowledge minimises the intraoperative & postoperative complications.

KEYWORDS

Renal Hilum, Renal Artery, Renal Vein, Renal Pelvis, Variations.

ABBREVIATIONS

AD-Anterior division, PD-Posterior division, RA- Renal artery, RV-Renal vein, RP-Renal pelvis.

HOW TO CITE THIS ARTICLE: Maheswararao SU, Vanju Lakshmi VV, Shahajeer B, et al. A cadaveric study of renal hilar structures and their variations in Andhra Pradesh population of South India. J. Evid. Based Med. Healthc. 2016; 3(69), 3760-3763. DOI: 10.18410/jebmh/2016/804

INTRODUCTION: Hilum of the kidney is a depression/slit like opening through which vital structures enter or leave the organ.⁽¹⁾ Hilum of the kidney lies about 5 cm away from the midline, its upper pole lies 2.5 cm and lower pole lies 7.5 cm away from the midline.^(2,3) Hilum of the kidney leads into a central sinus, lined by renal capsule and it is filled by renal pelvis, renal vessels & renal fat. At the hilum of kidney, usual arrangement of structures is renal vein, renal artery, renal pelvis anteroposteriorly.⁽⁴⁾ There are so many old reports describing the variations in disposition of renal hilar structures. Usually one branch of renal artery and a corresponding tributary of renal vein may pass behind the renal pelvis.⁽¹⁾

In a two thirds of the population, each kidney has a single renal artery but according to Standing et al, single renal artery is present in 70% of population.⁽⁴⁾ Accessory renal arteries are present in 30% of the individuals, they enter into the hilum/upper pole/lower pole of kidney.⁽⁴⁾ Knowledge of structures at the renal hilum is necessary prior to any surgical intervention of the kidney. Several kidney disorders lead to prolonged hospitalisation and death. In renal surgeries like radical nephrectomy, laparoscopic partial nephrectomy, knowledge of renal hilar structures arrangement is important because these procedures require ligation/clamping of renal vessels and it is necessary during the procedure.⁽⁵⁾ Clamping of individual structure is more comfortable than en-bloc clamping of all structures at the hilum of kidney.⁽⁶⁾ Nowadays, laparoscopic partial nephrectomy is a very popular procedure as this procedure has less complications.⁽⁷⁾ During endopyelotomy procedure of a kidney, knowledge of arrangement of renal hilar structures is very beneficial, it minimises so many complications during surgical procedure.

Financial or Other, Competing Interest: None.

Submission 30-07-2016, Peer Review 09-08-2016,

Acceptance 20-08-2016, Published 29-08-2016.

Corresponding Author:

Dr. Sunnapu Uma Maheswara Rao,

Do. No: 16-6-24, (Ground Floor),

Official Colony, 2nd Lane, Beside C.S.R. Hospital, Maharaniapeta,

Visakhapatnam-530002, Andhra Pradesh.

E-mail: drumamahesh100@gmail.com

DOI: 10.18410/jebmh/2016/804

Studies performed on topographic arrangement of renal hilar structures are very less, so we are studying the arrangement of renal hilar structures in Andhra Pradesh population of South India.

MATERIALS & METHODS: The present study was undertaken to observe the arrangement of structures in hilar region of kidney. 42 (21 right, 21 left) embalmed cadaveric kidneys from the Department of Anatomy, Government Medical College, Ananthapuramu & Andhra Medical College, Visakhapatnam were observed in this study. Hilum and the prehilum region of each kidney dissected carefully to study the arrangement of structures and the division pattern of the renal vessels.

The arrangement of renal hilar structures is observed 0.5 cm from the anterior lip of hilum. Division of renal vessels is also observed at the hilum. In most of the cases, renal artery is divided into anterior & posterior divisions. Few no. of cases show anterior trunk of renal artery in an anterior most position at the hilum. In our study, we are observing the arrangement of hilar structures in kidneys with supernumerary renal arteries and kidneys without supernumerary renal arteries.

OBSERVATIONS: The following types of structural arrangements at the renal hilum were observed. They are 4 types-A, B, C, D.

Type A	Type B	Type C	Type D
- Renal Vein. - Renal Artery. - Renal Pelvis. No. of Kidneys =15/29(51.7%). Right =8/15, Left =7/15.	- Renal vein. - AD of Renal Artery. - PD of Renal Artery. - Renal Pelvis. No. of Kidneys =7/29 (24.1%). Right =4/7, left =3/7.	- AD of Renal Artery. - Renal Vein. - PD of Renal Artery. - Renal Pelvis. No. of Kidneys =4/29 (13.7%). Right =2/4, Left =2/4.	- AD of Renal Artery. - Renal Vein. - Renal Pelvis. - PD of Renal Artery. No. of Kidneys =3/29(10.3%) Right =2/3, Left =1/3.

Table 1: Showing Arrangement of Hilar Structures in Kidneys with Normal Renal Arteries From Anterior to Posterior

Type A	Type B	Type C	Type D
-Renal vein. -Superior accessory renal artery. -Renal artery. -Inferior accessory. Renal artery. -Renal pelvis. No. of kidneys = 5 /13(38.4%). Right =3/5, Left =2/5	-Renal Vein. -Accessory renal artery. -AD of Renal Artery. -PD of Renal Artery. -Renal Pelvis. No. of kidneys = 3/13 (23%) R=2/3 & L= 1/3.	-AD of Renal Artery. -Renal Vein. -Accessory Renal artery. -PD of Renal Artery. -Renal Pelvis. No. of kidneys = 3/13 (23%). R = 1 /3 & L= 2/3.	-Accessory Renal Artery. -AD of Renal Artery. -Renal vein. -PD of Renal artery. -Renal Pelvis. No. of kidneys = 2/13 (15.6%). R = 1/2 & L= 1/2.

Table 2: Showing Arrangement of Hilar Structures in Kidneys with Accessory Renal Arteries from Anterior to Posterior

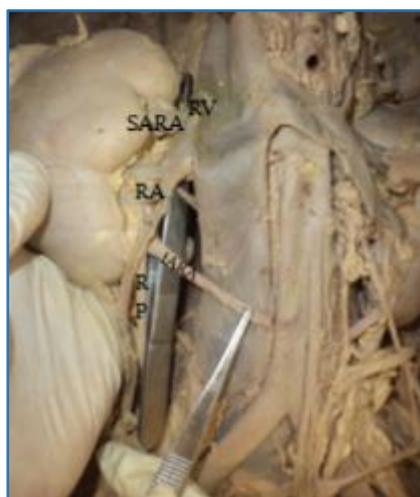


Fig. 1: Showing Type A pattern of Renal Hilar Structures Arrangement

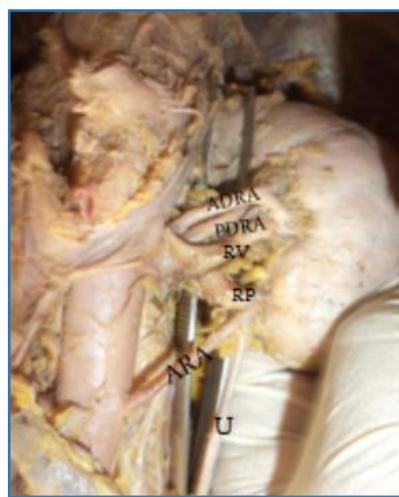


Fig. 2: Showing the Type B pattern of Renal Hilar Structures Arrangement

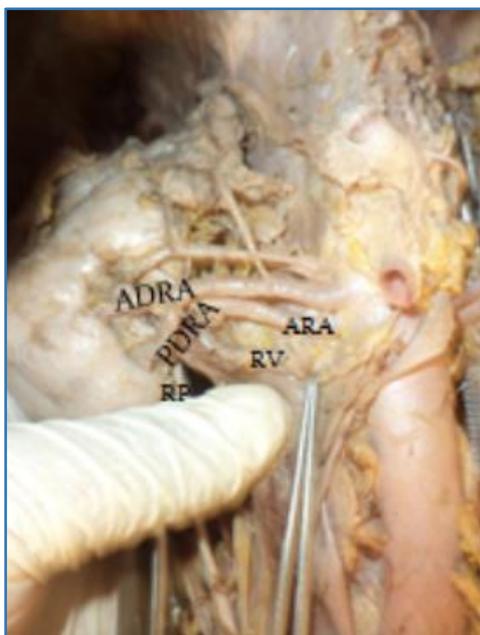


Fig. 3: Showing the Type C pattern of Arrangement of Renal Hilar Structures



Fig. 4: Showing the Type D pattern of Renal Hilar Structures Arrangement

DISCUSSION:

- In our study, totally 42 kidneys were observed for arrangement of Hilar structures. In these 42 kidneys, 29 kidneys (69%) were having normal renal arteries, whereas 13 kidneys (31%) showed accessory renal arteries. In 29 kidneys, 51.7% (15 in no.) of kidneys show normal arrangement of Hilar structures. 24.1% of kidneys (7 in no.) show two divisions of renal arteries were present in between renal vein & renal pelvis. In 13.7% of kidneys (4 in no.), renal vein was present in between the 2 divisions of renal artery and renal pelvis was present behind the posterior division of renal artery. In 10.3% of kidneys (3 in no.), renal vein & renal pelvis were present in between 2 divisions of renal artery.
- According to Sanjay Kumar Sinha et al,⁽⁸⁾ in 20% of specimens, 2 divisions of renal artery were present in between RV & RP, but in this study, 24.1% of

specimens show 2 divisions of RA were present in between RV & RP; in 12.5% of specimens, RV was present in between AD, PD of RA; but in present study, in 13.7% cases RV was present in between AD, PD of RA; in 7.5% specimens, PD of RA was present posterior to the RP; but in this study, 10.3% specimens show PD of RA is present behind the RP.

- In total 42 kidneys, 13 kidneys (31%) show accessory renal arteries. In 38.4% of kidneys (5 in no.), in between the renal vein & renal pelvis; superior & inferior accessory renal arteries & main renal artery were present in order. In 23% of kidneys (3 in no.), in between the renal vein & renal artery; accessory renal artery, anterior & posterior divisions of renal artery were present in order. In 23% of kidneys (3 in no.), in between the anterior division of renal artery and renal pelvis; renal vein, accessory renal artery, posterior division of renal artery were present in order. In 15.6% of kidneys (2 in no.), in between the accessory renal artery & renal pelvis; anterior division of renal artery, renal vein, posterior division of renal artery were present in order.
- These variations of renal hilar structures were not mentioned in any standard textbooks of Anatomy, but these variations were encountered during routine cadaveric dissections. Usually, right renal vein develops from a single anastomotic venous channel but the left renal vein develops from multiple anastomotic venous channels. So these renal hilar structure variations are more common on left side. Knowledge of anatomy about renal pelvis & ureteropelvic junction is very important because the obstruction of this region is very common. This obstruction is due to compression by renal vessels^(9,10,12) as well as defects in rotation of kidney during development is also one of the common reason for abnormalities in arrangement of renal hilar structures. Incomplete rotation of kidney also results in obstruction of renal pelvis/pelviureteric junction by renal vessels.⁽¹¹⁾
- During nephrectomy/partial nephrectomy procedures, clamping of renal vessels & renal pelvis is performed individually because AV fistula develops as a late complication in postoperative period. Especially during interpretation of renal angiograms, any variations of renal hilar structures make reporting difficult, and it is a very difficult task for the radiologists.^(12,14)
- Variations of renal hilar structures are very important to the urologists, because during surgery it results in various intraoperative & postoperative complications. In recent days, renal transplantation procedures are performed very commonly. In this setting, knowledge of renal hilar structures variations are very important.⁽¹⁵⁾ A variation in the pattern of renal hilar structures leads to overcrowding of structures at renal hilum.^(16,17) and this pattern confuses the surgeon and it is very challenging surgically to dissect

at hilar region as it may cause surgical trauma to these structures and lead to surgical emergency especially during laparoscopic partial nephrectomy, partial nephrectomy, radical nephrectomy procedures.^(18,19,20)

CONCLUSION: Anatomical knowledge of renal hilar structures arrangement is very important because in recent days several surgeries like partial nephrectomy, laparoscopic partial nephrectomy, nephrolithotomy, endopyelotomy, etc. are performed very commonly due to several reasons by the general surgeons, urologists, renal transplant surgeons. Prior to surgery, knowing of pattern of renal artery divisions, arrangement of renal hilar structures minimises the development of various intraoperative & postoperative complications.

REFERENCES

1. Snell RS. Clinical anatomy by regions. Philadelphia, PA: Walters Kluwer-Lippincott Williams and Wilkins. 8th edn. 2008:260-264.
2. Jacob S. Atlas of human anatomy. 1st edn. UK: Churchill Livingstone 2002:124-25.
3. Datta AK. Essentials of human anatomy (part-1). 8th edn. Calcutta: Current Books International 2008:294-296.
4. Standring S. Kidney and ureter. Chapter 74. In: Gray's anatomy. The anatomical basis of clinical practice. 40th edn. London: Churchill Livingstone Elsevier 2008:1225,1230.
5. Huang WC, Levey AS, Serio AM, et al. Chronic kidney disease after nephrectomy in patients with renal cortical tumours: a retrospective cohort study. *Lancet Oncol* 2006;7(9):735-740.
6. Desai MM, Gill IS. Laparoscopic partial nephrectomy for tumour: current status at the Cleveland clinic. *BJU Int* 2005;95(2):41-45.
7. Rapp DE, Orvieto MA, Gerber GS, et al. En bloc stapling of renal hilum during laparoscopic nephrectomy and nephroureterectomy. *Urology* 2004;64(4):655-659.
8. Sinha SK, Fatima N, Perween G, et al. Observation on arrangement of hilar structures in cadaveric kidneys and their clinical significance. *Journal of Evidence based Medicine and Healthcare* 2014;1(17):2153-2155.
9. Trivedi S, Athavale S, Kotgiriwar S. Normal and variant anatomy of renal hilar structures and its clinical significance. *International Journal of Morphology* 2011;29(4):1379-1383.
10. Snyder HM, Lebowitz RL, Colodny AH, et al. Ureteropelvic junction obstruction in children. *Urol Clin North Am* 1980;7:273-290.
11. Das S, Paul S. Variation of renal hilar structures: a cadaveric case. *European Journal of Anatomy* 2006;10(1):41-44.
12. Sampaio FJ, Favorito LA. Ureteropelvic junction stenosis: vascular anatomical background for endopyelotomy. *J Urol* 1993;150(6):1787-1791.
13. Barnett JS, Stephens FD. The role of the lower segmental vessel in the aetiology of hydronephrosis. *Aus NZ J Surg* 1962;31(3):201-213.
14. Loh HK, Gupta V, Arora J, et al. Atypical twin renal arteries with altered hilar anatomy. *International Journal of Anatomical Variations* 2009;2:124-126.
15. Kommuru H, Lekha SD, Jothi SS, et al. Presence of renal artery variations and its surgical correlation. *International Journal of Medical and Clinical Research* 2012;3:176-179.
16. Sinnatamby CS. Abdomen. Chapter 5. Last's anatomy regional and applied. 12th edn. China: Churchill Livingstone Elsevier 2011:p. 283,286.
17. Standring S. Gray's Anatomy, The Anatomical Basis of Clinical Practice. 40th Ed. London: Churchill Livingstone Elsevier; 2008. Chapter 74, Kidney and Ureter; p1230.
18. Gill IS, Colombo JR, Frank I, et al. Laparoscopic partial nephrectomy for hilar tumours. *J Urol* 2005;174(3):850-854.
19. Lattouf JB, Beri A, D'Ambrosio OF, et al. Laparoscopic partial nephrectomy for hilar tumours: technique and results. *Eur Urol* 2008;54(2):409-416.
20. Rogers CG, Metwalli A, Blatt AM, et al. Robotic partial nephrectomy for renal hilar tumours: a multi-institutional analysis. *J Urol* 2008;180(6):2353-2356.