CASE REPORT

SUPERIOR AND INFERIOR POLAR ARTERIES TO LEFT KIDNEY

N. Shakuntala Rao¹, K. Manivannan², Gangadhara³, H. R Krishna Rao⁴

HOW TO CITE THIS ARTICLE:

N. Shakuntala Rao, K. Manivannan, Gangadhara, H. R Krishna Rao. "Superior and Inferior Polar Arteries to Left Kidney". Journal of Evolution of Medical and Dental Sciences 2014; Vol. 3, Issue 09, March 3; Page: 2148-2152, DOI: 10.14260/jemds/2014/2118

ABSTRACT: Normally the kidneys are supplied by renal arteries from the aorta. A pair of renal arteries arises from the lateral side of aorta. They run at right angles to aorta. In 70% of individuals a single artery supplies the kidney on each side. Near the renal hilum these arteries divide into an anterior and posterior division. They divide further into segmental arteries to supply renal vascular segments. In 30% of individuals accessory renal arteries have been reported. They are regarded as persistent embryonic lateral splanchnic arteries. The accessory vessels to inferior pole cross anterior to the ureter. In such a position the ureter may be obstructed causing hydronephrosis. During routine dissection of cadavers for teaching purpose in the department of Anatomy it was observed that one of the cadavers, a female, showed variations in the renal arteries on both sides and in the left renal vein. There were two renal arteries on the left side from the aorta. They divided outside the hilum. The upper artery gave a branch to the upper pole which entered the kidney behind the supra renal gland. The lower artery went to the lower pole behind the pelvis of ureter. The renal vein on the left side was seen to be draining into the inferior vena cava behind the aorta-retro-aortic vein. An attempt has been made to describe the variation for the purpose of documentation which is very important for future references. The knowledge of variability in pattern of arteries is essential in surgical interventions like transplantations.

KEYWORDS: Retro-aortic vein, Renal artery, Polar artery.

INTRODUCTION: The development of renal vascular supply has been detailed in standard textbooks. The kidney develops from the metanephros in the pelvis at the caudal end of intermediate mesoderm. It ascends to the posterior wall of abdomen and as it ascends, blood vessels connect to it from the aorta and inferior vena cava at varying levels. As it ascends the lower vessels disappear. The arteries that arise from the aorta close to superior mesenteric arteries remain to supply the kidney on either side.

According to standard textbook description accessory renal arteries which arise from the aorta above or below the main renal artery and go to the hilum are regarded as persistent embryonic lateral splanchnic arteries.¹

Regarding renal veins, the development of left vein is more complex than the right vein. It develops from three sources. a) the mesonephric vein draining into the left subcardinal vein, b) part of the left subcardinal vein c) communicating channels between the subcardinal veins. This channel lies in front of the aorta hence the left renal vein lies in front of the aorta.²

In this case the presence of superior and inferior polar arteries to the left kidney, with the superior polar artery entering the kidney below the supra renal gland (fig-1) and the presence of retro-aortic vein (fig-2) has been described.

CASE REPORT

CASE REPORT: During routine dissection of a female cadaver, it was observed that the left kidney had two renal arteries arising at two different levels from the aorta. One was at the level of superior mesenteric artery. The other took origin from the aorta between the inferior mesenteric and the bifurcation of aorta. Both arteries were of equal caliber. The superior artery gave a separate branch to the upper pole which entered the kidney at its uppermost tip below the supra renal gland (Fig-1). The artery entered the hilum after dividing into segmental branches. The lower artery after arising from the aorta went towards the lower pole of kidney (fig-1). At its origin it gave a slender branch which entered the hilum of kidney. The lower artery at the lower pole was closely related to the ureter as it passed downwards from the pelvis. On the left side the renal vein passed behind the aorta to drain in the inferior vena cava (Retro-aortic vein-fig:2) On the right side the renal artery divided before entering the hilum and the renal vein was normal in its course.

DISCUSSION: Renal artery variations are divided into two groups: early division and ERA (extra renal arteries). ERA is divided into two groups: Hilar (accessory) and polar (aberrant) arteries. Ozkan U et al³ have done angiographic evaluation of renal arteries in 855 consecutive patients. They have reported multiple arteries in 24%, bilateral multiple arteries in 5%, and early division in 8% of the cases. In 16% they have reported additional renal arteries. The percentage of accessory and aberrant renal arteries were 49% and 51% respectively. Bordei et al⁴ has described 54 cases of double renal arteries supplying one kidney originating from aorta in his study. Bordei and Antohe⁵ have also reported triple renal arteries in their eight year study of renal blood supply. In the present study there were two renal arteries on the left side and one on the right side. On both sides the arteries divided outside the hilum.

Budhiraja V et al's⁶ study on 84 formalin fixed cadavers (73 male and 11 female, 168 kidneys in total) found the superior polar renal artery in 22.6% cases. Different sources of the polar arteries were described in the study. The polar artery arose from the abdominal aorta as an accessory renal artery in 10.7%, and in 5.4% of cases the main renal artery gave a direct branch to the superior pole. In 3.0% of cases a segmental branch of the renal artery was the source and the superior hilar renal artery in 3.6% of cases. The hilar branching patterns of renal arteries were also described in the study. A fork pattern in 11.3% of cases, ladder pattern, net pattern & triplicate. In the present case the hilar branching pattern was the fork pattern, and the superior polar artery was from the superior renal artery which is accessory.³

Rao Metal⁷ have reported pre-hilar multiple branching with a superior polar artery on both sides passing supero-laterally to the upper pole of kidney. Bakheit MA, Motabagani MA⁸ have reported that accessory renal and pre-hilar branching resembled polar arteries. In the present study the lower accessory renal artery which arose from the aorta entered the lower pole of kidney close to the ureter (Fig-1). It can be classified as both accessory and aberrant. V. Bhudiraja et al⁹ has referred to Keibel F Mall in his article on renal artery variations that persistence of middle group of lateral mesonephric arteries results in multiple renal arteries. Therefore duplication is due to persistence of two lateral mesonephric arteries of the middle group.

Kyung DS et al¹⁰ observed double retro-aortic renal veins that coursed behind the aorta to drain into the inferior vena cava. The superior retro-aortic renal vein drained into the inferior vena cava at the lower border of the L2 vertebra, and the inferior retro-aortic renal vein drained into the inferior vena cava at the upper border of the L4 vertebra. In the discussion the authors have referred to the classification of left retro-aortic vein by Hoeltl et al as types-I and II.

CASE REPORT

Satyapal KS et al ¹¹ observed in his study in a sample size of 1008 kidneys and reported an incidence of 0.8-7.1% retro-aortic vein, In aortic aneurysm repair, retro-aortic vein is important in repair of aortic aneurysm. During retroperitoneal surgery, the surgeon must be aware of the additional retro-aortic component or a posterior primary tributary lest he may avulse it while mobilizing the kidney or clamping the aorta.

The same author in another study¹² with a sample size of 1008 has described left renal vein variations and has reported the retro-aortic vein in 0.5% of his sample.

Left renal vein hypertension (LRVH) syndrome –‘Nut cracker syndrome’ was described by Deschepper¹³ in 1972. Posterior nut cracker syndrome is caused by compression of the left renal vein between the lumbar spine and the aorta which results in left renal venous hypertension. It is manifested by left flank and abdominal pain with or without unilateral hematuria. Due to the compression “Pelvic congestion syndrome” in females has been reported. Lower limb varices and varicoceles in males have been reported in males due to compression of LRV which causes left renal to gonadal vein reflex.

Poynter also noted the wide discrepancy in textbooks as to the frequency of multiple renal arteries and noted that 1883 specimens yielded 456 cases of multiple renal arteries and that individual investigators (Poynter cited 10 individuals) reported frequencies of 14 to 59% in the 465 of cases studied.

CONCLUSION: The pattern of renal arterial branching in this case can be considered not only aberrant but also additional as the polar arteries each arose independently from the renal arteries from the aorta. The main artery to the kidney divided before entering the hilum thus making the polar artery an entirely different entity entering the pole.

The more that variations are observed the more is the need to document for future perusal by surgeons and clinicians concerned. The observation of a single variation can warrant a change in the number of incidences already recorded. Surgery on voluntary donors or emergency conditions of organ transplant requires adequate knowledge of variations. So it becomes the responsibility of anatomical dissectors to record the variations and report.

REFERENCES:

1. Susan Standring. Gray’s Anatomy- the Anatomical Basis of Clinical Practice, 40thed Elsevier Churchill Livingstone, Urogenital system 2008: 1231-33.
2. DK Kadasne. Kadasne’s Textbook of Embryology, first ed Jaypee publishers, cardiovascular system. 2011: 248.
3. Ozkan U, Oğuzkurt L, Tercan F, Kizilkiliç O, Koç Z, Koca N. Renal artery origins and variations: angiographic evaluation of 855 consecutive patients. *Diagn Interv Radiol*.2006.12:183-86.
4. Bordei P, Sapte E, Iliescu D. Double renal arteries originating from the aorta, *Surg Radiol Anat*, 2004, 26(6): 474-479.
5. Bordei P, Antohe D S. Anatomical study of triple renal arteries. *Morphologie*.2002;86:37-41.
6. Budhiraja V, Rastogi R, Asthana A K. Variant origin of superior polar artery and unusual hilar branching pattern of renal artery with clinical correlation. *Folia Morphol (Warsz)* 2011 Feb; 70 (1): 24-8.

CASE REPORT

7. Rao M, Bhat S M, Venkataramana V, Deepthinath R, Bolla S R. Bilateral prehilar multiple branching of renal arteries: a case report and literature review. Kathmandu Univ Med J (KUMJ). 2006 Jul-Sep; 4(3):345-8.
8. Bakheit M A, Motabagani M A. Anomalies of the renal, phrenic, suprarenal arteries. Saudi Med J. 2004 Mar; 25(3):376-8.
9. V. Bhudiraja, R. Rastogi, A. K. Asthana. Renal artery variations: embryological basis and surgical correlation. Romanian Journal of Morphology and Embryology 2010, 51(3):533-536.
10. Kyung DS, Lee JH, Shin DY, Kim DK, Choi IJ. The double retro-aortic left renal vein. Anat Cell Biol. 2012 Dec; 45(4): 282-4.
11. Satyapal K S, Kalideen J M, Haffeejee A A, Singh B, Robbs J V & Kalideen J. M. Additional renal arteries: incidence and morphometry. Surg. Radiol. Anat. 2001 23:33-8.
12. Satyapal K S, Kalideen J M, Haffeejee A A, Singh B, Robbs J V. Left renal variation. Surg Radiol Anat. 1999; 21: 77-81.
13. Deschepper A, Belge J "Nut cracker" phenomenon of the renal vein and venous pathology of the left kidney (in Dutch). Radiol. 1972; 55:507-11.

Figure 1

LK – Left kidney, SPA - Superior polar artery, RA - Renal artery, AA - Abdominal aorta, IPA - Inferior polar artery, U- ureter

Figure 2

IVC – Inferior vena cava, AA – abdominal aorta, RAV – retro-aortic vein

CASE REPORT

AUTHORS:

1. N. Shakuntala Rao
2. K. Manivannan
3. Gangadhara
4. H. R. Krishna Rao

PARTICULARS OF CONTRIBUTORS:

1. Professor, Department of Anatomy, P.E.S Institute of Medical Sciences & Research, Kuppam, Chittoor District, Andhra Pradesh.
2. Assistant Professor, Department of Anatomy, P.E.S Institute of Medical Sciences & Research, Kuppam, Chittoor District, Andhra Pradesh.
3. Assistant Professor, Department of Anatomy, P.E.S Institute of Medical Sciences & Research, Kuppam, Chittoor District, Andhra Pradesh.

4. Professor and HOD, Department of Anatomy, P.E.S Institute of Medical Sciences & Research, Kuppam, Chittoor District, Andhra Pradesh.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. N. Shakuntala Rao,
Professor of Anatomy,
Department of Anatomy,
P.E.S Institute of Medical Sciences & Research,
Kuppam – 517425,
Chittoor Dist., Andhra Pradesh.
E-mail: drshakuntala@gmail.com

Date of Submission: 23/01/2014.
Date of Peer Review: 24/01/2014.
Date of Acceptance: 12/02/2014.
Date of Publishing: 25/02/2014.