Original Article

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Accessory Renal Arteries: A Cadaveric Study of 144 Kidneys

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Abstract

Background: Accessory renal arteries are one of the most commonly seen variation of renal arteries. Hilar, upper polar and lower polar are the types of accessory renal arteries seen. *Aim:* To find the incidence of various types of accessory renal arteries in maharashtrian population. *Methods:* 144 kidneys are studied for variations in renal arteries like source of origin and number. *Results:* 17 kidneys (11.8%) show presence of accessory renal arteries. Maximum 10 (6.94%) kidneys show lower polar accessory renl arteries. 100% aortic origin for renal arteries is noted. *Conclusion:* Knowledge of variations like accessory renal arteries are very important for surgeons and radiologists during radiological examination before ureteropelvic procedures and renal transplants.

Keywords: Accessory Renal Artery; Renal Transplant; Hilar Renal Artery; Lower Polar Renal Artery; Upper Polar Renal Artery and Supernumerary Renal Artery.

Background

Renal arteries take origin from abdominal aorta bilaterally. Variations in renal vasculature are well documented in literature. Terms like accessory, supernumerary and abberent arteries are used for additional renal arteries. Accessory renal artery can take origin from abdominal aorta and from main renal artery. Various types of accessory renal artery are hilar, upper polar and lower polar [1]. With increase in number of renal transplant surgeries and other urological procedures, the knowledge of variations in renal arteries is very important.

Methods

This study was carried out in department of Anatomy of Dr. D.Y. Patil Medical college, Pimpri, Pune 144 kidneys are observed for variations in renal arteries 72 formalin embalmed cadavers used for routine 1st M.B.B.S. dissection over period of three years [2015 -2017]. Variations in number and source of origin of renal artery are noted.

Results

Accessory renal arteries are noted in 17 kidneys (11.80 %). 3 Hilar accessory renal artery (Fig. 1) are seen in 3 kidneys (2.08%). 10 lower polar accessory renal arteries as seen figure 2 (6.94%) and 4 upper polar accessory renal arteries (2.77%) as seen in figure 3 are observed.

Fig. 1: Hilar accessory renal artery

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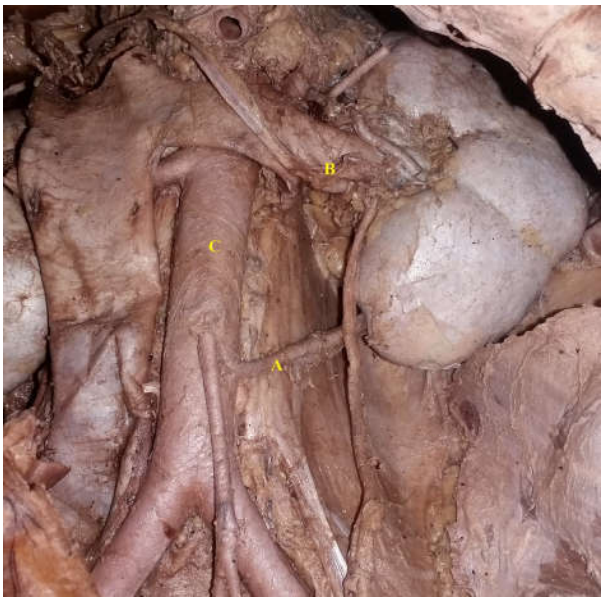

Fig. 2: Lower polar accessory renal artery

Fig. 3: Upper polar accessory renal artery
A – Accessory renal artery
B – Main renal artery
C – Abdominal aorta

Table 1: Comparison of various studies on Accessory renal arteries [numbers show percentage]

	Mutyalapati and Lokadolalu	R. Chitra	Budhiraja et al	Present study
Accessory renal artery	24	24	59.5	11.80
Hilar accessory renal artery	14	8	29.7	2.08
Upper polar accessory renal artery	2	4	16.2	2.77
Lower polar accessory renal artery	12	12	12.2	6.94

Aortic origin and unilateral variation is seen in all the accessory renal arteries. 15 male (10.41 %) with 3 hilar, 8 inferior polar and 4 upper polar accessory renal arteries and two female (1.39 %) cadavers with lower polar accessory renal artery are seen.

Discussion

During development the primitive dorsal aorta gives rise to ventral and lateral splanchnic arteries, somatic arteries and continue caudally. The lateral splanchnic arteries supply the developing mesonephros,metanephros , supra renal gland and testis or ovary. Three suprarenal branches and one gonadal artery remain. The most cranial suprarenal artery forms the phrenic artery while the most caudal one forms the renal artery. Accessory renal arteries are formed by the persistent lateral splanchnic arteries [2].

Sonic hedgehog factor secreted by notochord induces formation of angioblasts which are precursors of blood vessels and then induces the mesenchyme to express vascular endothelial growth factor. This factor induces the Notch pathway which specifies arterial development by expression of ephrin B2 . Abberent arterial development is seen on misexpression of any of these transcription factors [3].

Mutyalapati and Lokadolalu [4] report 24% incidence of accessory renal arteries. Hilar accessory renal arteries were seen in maximum (14%) kidneys. These findings contraindicate our findings of minimum incidence of hilar (2.08%) variety and total incidence of 11.8%. The researchers mention lower polar variety to be seen in 12% which is more than our finding (6.94%) . Upper polar variety is seen in 2% kidneys which coincides with our study (2.08%).

Budhiraja et al. [1] give a higher incidence (59.5%) of accessory renal arteries . The authors opine that accessory arteries of renal artery origin which supplies the poles are more common causes of polar infarcts. Ureteropelvic junction obstruction is common in kidneys with inferior polar accessory renal arteries.

Kem et al. [5] state that stenosing lesions are seen more frequently in patients with accessory renal arteries. Smaller caliber and more length of these

accessory arteries cause more resistance and predispose underperfusion. These patients had more incidence of undergoing angiography [Kem et al].

In a review of MR angiography data Gupta and Tello [6] studied hypertensive patients to check if hypertension is more prevalent in persons with accessory renal arteries. They reported that 24% patients with hypertension had an accessory renal artery. 20% patients with hypertension and accessory artery showed renal artery stenosis while 30% patients with hypertension and a single renal artery showed stenosis of renal artery. So they conclude that accessory renal arteries should be considered as a vascular anomaly and a direct cause for hypertension.

Thangaraj et al. [7] describe a case report where the testicular artery is found arising from the accessory renal artery. Polycystic kidney was also noted in this case. Renal and testicular artery variations are seen due to anomalous embryological origin of the lateral splanchnic artery from the aorta. Knowledge of the variant origin of renal and gonadal arteries will be of use while performing laproscopic surgeries and transplant operations.

Chitra [8] gives a 24 % incidence of accessory renal arteries in a cadaveric study in Andhra Pradesh. Accessory renal arteries is one of the causes for hydronephrosis. She is of the opinion that endovascular procedures like theurapeutic embolisation and angioplasties should be carried out only after prior radiological examination.

Rainier et al. [9] are of the view to preserve accessory renal arteries during abdominal aorta aneurysm repair surgeries. During abdominal aorta aneurysm surgeries many times the accessory renal arteries are sacrificed, leading to complications. They mention that diameter of the accessory renal artery is exceeding main renal artery and presence of renal disease are the contraindications of exclusion of accessory renal arteries during endovascular repair procedures.

Karmacharya J[10] contradict Rainier et al. [9] in saying that occlusion of accessory renal arteries during endovascular procedures. Even in patients with moderate renal insufficiency. Patients with removal of accessory renal artery during abdominal aorta aneurysm repair did not show renal infarction. So accessory renal arteries don't contribute to endoleaks and can be safely sacrificed.

In a Doppler based study of renal areties in live donor renal allo-transplantation procedures Harraz et al. [11] note Impaired perfusion (IP) in the graft areas supplied by the accessory renal arteries. Comparatively high level of impaired perfusion was seen in grafts with upper polar accessory renal arteries. So to avoid delayed graft function in transplants with upper polar accessory renal arteries, more attention and consideration should be exerted by the surgeon.

Conclusion

We report 11.80% incidence of accessory renal arteries with a higher incidence of lower polar accessory renal arteries (6.94%). With increase in incidence of planned renal transplant surgeries, knowledge about variations in renal vasculature becomes imminent. Keeping in mind these variations, CT and arteriography are indicated before urological procedures, renal transplant and abdominal aorta aneurysm repair. Presence of accessory renal artery is not a contraindication for renal transplant, but prior knowledge of this variation can increase the incidence of positive outcome post surgery. Knowledge of these variations of renal vasculature will be beneficial for the radiologist and surgeon.

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