ORIGINAL ARTICLE

Accessory Renal Arteries in Cadavers and in Computed Tomography Scans – A Comparative Study

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Abstract:

Background and objectives: Renal arteries supply blood to kidneys. Embryonic development of kidneys is a complex phenomenon which is the basis for various anatomical variations found in the humans. Accessory renal artery is a common variation where more than single renal artery is present for one particular kidney. There have been lots of studies carried out to study accessory renal arteries. But those are either cadaveric or radiological studies. Present study was planned to study the comparison of findings in both the studies together with the population having similar geographical region of Indian origin. *Material and Methods:* The study was conducted on 36 formalin fixed cadavers and on 36 computed tomographic scans of renal arteries. In the present study the incidence of accessory renal artery, if any, was recorded on right side and on left side. The data obtained in cadavers was compared with the same obtained in Computed Tomography (CT) scan study. *Results:* The accessory renal artery was found in 12 cadavers and in 3 CT studies unilaterally, while it was present in 4 cadavers and in 2 CT studies bilaterally. *Conclusion:* In current study, the incidence of accessory renal artery was slightly greater in cadavers than in CT scans.

Keywords: Kidney, Accessory renal artery, Computed Tomography Scans, Aorta, Humans, Renal Artery, Incidence, Kidney, Tomography, X-Ray Computed, Cadaver, Embryonic Development, Tomography, Formaldehyde, MeSH

Abbreviations: CT: Computed Tomography; DICOM: Digital Imaging and Communication in Medicine; DVD: Digital Versatile Disc

Introduction:

The primary function of the kidney is removal of metabolic waste from the body. [1] The blood supply of an organ reflects its functional importance. Same is the case with the kidneys and its blood supply too. The right and left kidneys receive their blood supply from the lateral branches of the abdominal aorta, that is from the right and the left renal arteries respectively. Embryonic development of kidneys is a complex phenomenon which is the basis for various anatomical variations found in the humans.[2] These variations are routinely encountered while studying gross human anatomy by dissection of cadavers. The recent advances in radiological techniques allow study of gross human anatomy in living individuals also. Also, since the dawn of laparoscopic nephrectomy as the technique of choice for organ procurement in living kidney donors, CT scan has emerged in a key role. It aids in as a non-invasive preoperative planning method for anatomic evaluation.[3] But unfortunately, there is scarcity of this data in an Indian population. Also, there is dearth of comparative studies done on cadavers and in living. This study was thus planned with an aim to study and compare the morphology of human renal arteries in cadavers and in CT Scans

Material and Methods:

The study was conducted on 36 formalin fixed cadavers and on 36 CT scans of renal arteries. Thus, data of 71 formalin fixed kidneys (36 right and 35 left sides as in one cadaver left kidney were absent) and 72 renal arteries on computed tomographic scans (36 right and 36 left sides) was studied. Cadavers were studied in the Department of Anatomy of a teaching institute and CT scans data were obtained from the Department of Radiology of a tertiary care hospital. The data (reports) of computed tomographic scans were taken retrospectively from the medical records on DVD. The various parameters were measured using digital imaging and communications in medicine (DICOM) viewer software. In cadaveric dissection, presence of accessory renal artery was looked for by gross examination after the dissection. When there was more than one renal artery found, the lower renal artery or the one with lesser diameter was considered to be as an accessory renal artery. Artery coming from main renal artery within 1 cm

of its origin and going to kidney was also considered as accessory renal artery. Similarly, the CT scan images were virtually dissected using Diacom viewer software. Presence of accessory renal artery was looked for with condition same as fixed while doing gross dissection findings, that is when more than one renal artery is present, the lower renal artery or the one with lesser diameter was considered to be an accessory renal artery. Artery coming from main renal artery within 1 cm of its origin and going to kidney was also considered as accessory renal artery.

Results:

The accessory renal artery was found in 12 cadavers and in 3 CT studies unilaterally, while it was present in 4 cadavers and in 2 CT studies bilaterally.

Table 1: Incidence of accessory renal artery as per laterality

Type of study	Unilateral (Fig. 1, 2)	Bilateral (Fig. 3, 4)
Cadaveric	12 (34.2%)	04 (11.1%)
CT Angiogram	03 (8.3%)	02 (5.7%)

Fig. 1: Illustration showing accessory renal artery on right side arising from abdominal aorta in cadaver

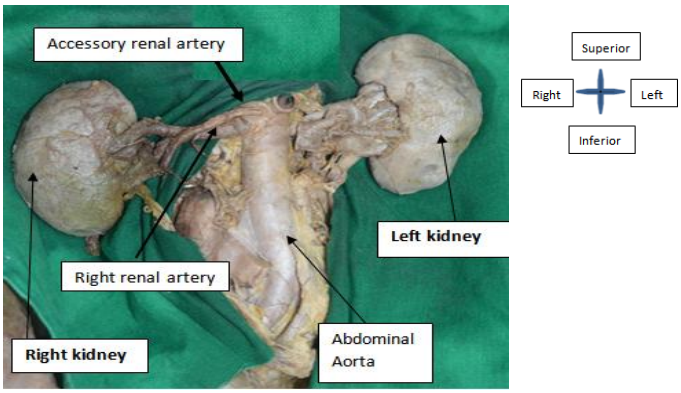


Fig. 2: Illustration showing accessory renal on right side arising from abdominal aorta study

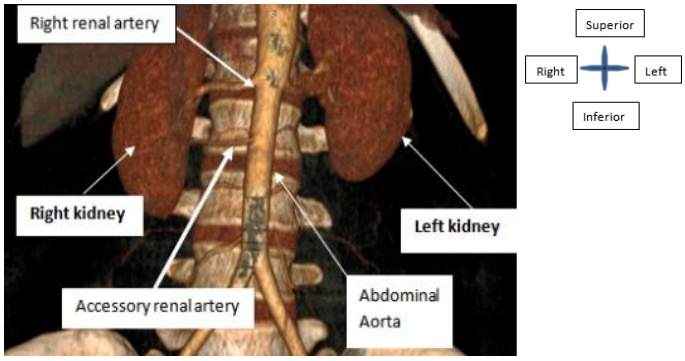


Fig. 3: Illustration showing bilateral presence of accessory renal artery in cadaver

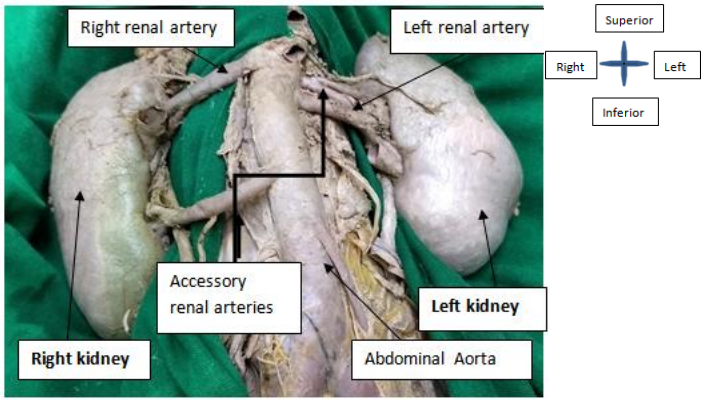
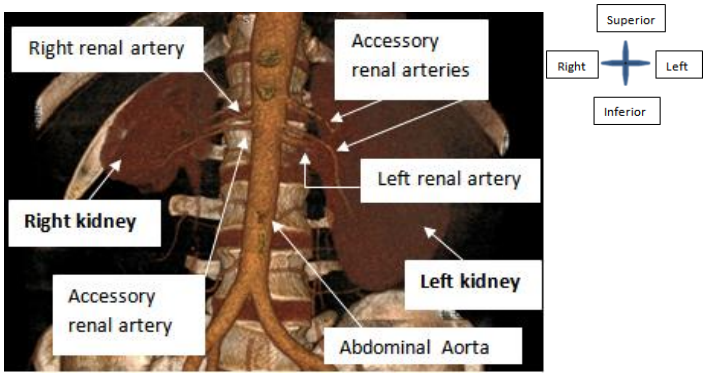


Fig. 4: Illustration showing presence of two renal arteries on right side and three renal arteries on left side in CT study



Discussion:

Developmentally, kidneys develop in the pelvic region. During its ascension, each kidney is vascularized by the major blood vessel in its vicinity. Initially, its neighboring arterial branching originates from external and internal iliac arteries and finally by aorta at its final position. Normally, the caudal primordial branches undergo involution and disappear. Approximately 25% of adult kidneys have two to four renal arteries.[4] Variations of renal arteries have been reported by anatomists since 1552. . The advent of computed tomographic angiography made the both the radiologists and anatomists to study the most important organ – Kidneys and its vasculature. These studies tremendously helped the clinicians and surgeons in understanding the renal vasculature in depth. This was a boon for most of the renally depilated patients as was seen with the success rates of renal transplantation. Also, the mortality and morbidity rates of the patients suffering from renal disorders were decreased. Unfortunately, it was seen that most of the studies focused on the number of renal arteries and branching pattern of renal arteries either in cadavers alone or in patients alone. Because of the

discrepancies in the measuring tool and non-uniformity of the data, we could not apply it completely to our population. Hence, this current study was planned where; we have tried to compare our findings with findings of various authors and tabulated the same.

Table 2: Comparison of incidence renal arteries as per laterality

Study	Number of cases studied (N)	Single renal artery	Unilateral accessory	Bilateral accessory
Rubin et al[5]	24	71%	29%	0%
Dachman et al[6]	36	76%	20%	4%
Platt et al[7]	307	68.4%	27.6%	0%
Geyer et al[8]	400	75.1%	17.2%	4.3%
Urban et al[9]	-	60%	30%	10%
Kapoor et al[10]	118	73.3%	26.7%	-
Uday et al[11]	102	74.4%	24.5%	-
Satyapal et al[12]	236	72.3%	27.7%	-
Shokeir et al[13]	500	72%	25%	3%
Nosratina et al[14]	516	68.6%	31.4%	4.3%
Hemmanth Kommuru et al[15]	184	71%	3.2%	10.8%
Present study	71Cadaveric	54.7%	34.2%	11.1%
	72 CT Angiogram	86%	8.3%	5.7%

In current study, accessory renal artery is bilaterally present in 11.1 % of cadavers which is slightly greater than previous study done by Hemmanth Kommuru et al[15] and Urban et al.[9] While accessory renal artery is unilaterally present in 34.2% of slightly greater than previous study done by Nosratina et al.[14]

Conclusions:

Accessory renal artery was unilaterally present in 12 cadavers (34.2%) and in 03 CT studies (8.3%) while it was present bilaterally in 04 cadavers (11.1%) (08 kidneys), and in 02 CT studies (5.7%) (4 kidneys). This comparative data will be helpful for anatomists for further research and also for clinicians and surgeons for kidney related treatment planning. Also, since the dawn of laparoscopic nephrectomy as the technique of choice for organ procurement in living kidney donors, CT scan has emerged in a key role. Thus, this study adds on the existing data and is more helpful for the Indian population cases.

Sources of supports: Nil

Conflicts of Interest: Nil

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How to cite this article:
Parvez A. Chowki, Rashmi A. Patil and Sana P. Chowki. Accessory Renal Arteries in Cadavers and in Computed Tomography Scans – A Comparative Study. Walawalkar International Medical Journal 2023;10(2):13-16.
http://www.wimjournal.com.

Received date:25/11/2023 Revised date:08/01/2024 Accepted date: 09/01/2024