A STUDY OF RENAL ANOMALIES: ABBRENT VESSEL
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HOW TO CITE THIS ARTICLE:
K. Rattaiah, P. Venkateswara Rao. “A Study of Renal Anomalies: Abbrent Vessel”. Journal of Evidence based Medicine and Healthcare; Volume 2, Issue 9, March 02, 2015; Page: 1302-1311.

ABSTRACT: INTRODUCTION: The subject of kidney anomalies including their incidence has created much interest to the scientists in late 1950 and 1960 with the aim of preventing and curing them as much as possible. Knowledge about their incidence particularly helps us to know how frequently they are seen in the population and makes us to search the possible etiological factors for such high occurrence. An attempt has been made to know the various anomalies, detailed dimensions of specimens available from the cadavers. To apply this knowledge to the incoming post graduates in their research works. Renal vascular segmentation was originally recognized by John Hunter in 1794. MATERIALS & METHODS: The parameters like weight, length of the kidney, breadth of the kidney and the breadth at the superior pole, inferior pole and at the hilum are taken with the help of electronic weighing machine, vernier calipers, the scale and thread are used. During the routine dissections the kidneys identified and the photographs are taken in situ wherever necessary. The parameters are taken, anomalies are noted and detailed diagrams are drawn. OBSERVATIONS: In the present study 176 specimens of kidneys were studied out of which 40 were fetal specimens and the rest were adult specimens consisting of both cadaveric and sonograms. The adult specimens from cadavers were 76 and 60 from sonograms. SUMMARY & CONCLUSION: It is stated that anomalies of the urinary tract rank third or fourth in position and they constitute 3 – 4% of total congenital anomalies and seen in 2-3% of population. In the present study, 14 aberrant vessels are observed.

KEYWORDS: Aberrent vessel: birth defects aorto graphy renal parenchyma. Fornix.

INTRODUCTION:
- The subject of kidney anomalies including their incidence has created much interest to the scientists in late 1950 and 1960 with the aim of preventing and curing them as much as possible.
- Knowledge about their incidence particularly helps us to know how frequently they are seen in the population and makes us to search the possible etiological factors for such high occurrence.
- Human kidney serve to filter more than 1700 liters of blood per day into about 1 liter of highly specialized concentrated fluid called urine. In doing so the kidney excrete the waste products of metabolism, precisely regulates the body’s concentration of water and salts, maintains the appropriate acid base balance, and serves as endocrine organ, secreting such hormones as erythropoiten, renin, and prostaglandins. The physiologic mechanism that the kidney has evolved to carrying out these functions requires a high degree of structural complexity.
- Embryology explains the etiological factors of many birth defects including the anomalies of the kidneys and among the explained many are due to various genetic and environmental
factors teratogens such as Physical, Chemical, Nutritional and Biological causing mutations in the genes and affecting the development at various stages of growth it is the intricate action between the differentiation and maturation of the organ systems of the body.

- Kidney is one of the vital organ of the human body, which is affected by many known and unknown teratogens and thus a frequent site of anomalies.
- Now, the modern studies include in addition to the above mentioned, various imaging (radio-diagnosis) procedures such as plain and contrast X-rays, Ultrasound Scanning and MRI etc. It is important to note that the incidence of congenital anomalies vary greatly depending upon the methodology adopted for the study.
- Anomalies of Renal Vasculature.
  a. Aberrant, accessory or multiple vessels.
  b. Renal artery aneurysm.
  c. Renal Arterio Venus fistula
- Aberrant, accessory, or multiple vessels are important to every urologic surgeon, and fortunately this subject lends itself to easy investigation. Anatomists were keenly interested in renal vascular patterns before the turn of the century, but the advent of Aortography in the 1940s and 1950s sphereheaded a systematic clinical approach to this topic. Most of the classic work was performed by investigators in the middle to late 1950s and early 1960s (Graves, 1954, 1956; Anson and Kurth, 1955; Merklin and Michele, 1958; Anson and Dascler, 1961; Coyer and Poutasse, 1962).
- The kidney is divided into various segments, each supplied by a single “end” arterial branch that generally courses from one main renal artery. Multiple renal arteries is the correct term to describe any kidney supplied by more than one vessel. The term anomalous vessels or aberrant vessels should be reserved for arteries that originate from vessels other than the aorta or main renal artery. The term accessory vessel denotes two or more arterial branches supplying the same renal segment.
- Between 71% Merklin and Michele, (1958) and 85% Geyer and Poutasse, (1962) of kidneys have one artery that supplies the entire renal parenchyma. A slightly higher percentage of right-sided kidneys (87%) have a single renal artery compared with left-sided organs Geyer and Poutasse, (1962). This figure does not seem to be influenced significantly by either sex or race. True aberrant vessels are rare except in patients with renal ectopia with or without fusion and in individuals with a horseshoe kidney.

AIM OF THE STUDY:
- An attempt has been made to know the various anomalies, detailed dimensions of specimens available from the cadavers.
- The study has been taken up with the fond hope of helping the clinician, sonologist, and surgeons during their routine work.
- As the genetic study is enormously increasing, as some of the genetically originated diseases like autosomal recessive and autosomal dominant polycystic kidney diseases may be arrested in future through gene therapy.
- To apply this knowledge to the incoming post graduates in their research works.
HISTORICAL ASPECT:
- Renal vascular segmentation was originally recognized by John Hunter in 1794.
- Kaspor Friedrich discovered mesonephric duct (1773 – 1794).
- In 1820 – Morgagni described first diseased horseshoe kidney.

EMBRIOLOGICAL BASIS OF KIDNEY:
- The renal arterial tree is derived from three groups of primitive vascular channels that coalesce to form the mature vascular pattern for all retroperitoneal structures. The cranial group consists of two pairs of arteries dorsal to the suprarenal gland that shift dorsally to form the phrenic artery. The middle group is made up of three pairs of vessels that pass through the suprarenal area. They retain the same lateral position and become the adrenal artery. Finally, the caudal group has four pairs of arteries that cross ventral to the suprarenal area and become the main renal artery. Sometimes these are joined by the most inferior pair from the middle group Guggemos, (1962). It is believed that during renal migration this network of vessels selectively degenerates, and the remaining adjacent arteries assume a progressively more important function. By a process of elimination, one primitive renal arterial pair eventually becomes the dominant vessel, the completed process being dependent on the final position of the kidney (Graves, 1956). Polar arteries or multiple renal arteries to the normally positioned kidney represent a failure of complete degeneration of all primitive vascular channels. The multiple vessel pattern that has been described for renal ectopia should be considered an arrested embryonic state for that particular renal position (Gray and Skandalakis, 1972).
- On the basis of vascular supply, the renal parenchyma is divided into five segments-apical, upper, middle, lower, and posterior. The main renal artery divides initially into anterior and posterior branches. The anterior branch almost always supplies the upper, middle, and lower segments of the kidney. The posterior branch invariably nourishes the posterior and lower segments Sampaio and Aragao, (1990). The vessel to the apical segment has the greatest variation in origin; it arises from\(^{(1)}\) the anterior division (43%);\(^{(2)}\) the junction of the anterior and posterior divisions (23%);\(^{(3)}\) the main stem renal artery or aorta (23%); or\(^{(4)}\) the posterior division of the main renal artery (10%) Graves, (1954). Rarely, the upper segment is supplied from a branch that is totally separate from the main renal artery Merkl in and Michele, (1958). The arterial and venous tree of the kidney and its relationship to the collecting system were beautifully depicted in endo casts by Sampaio and Aragao (1990, 1990a). These investigations showed that the least likely areas in which to encounter vessels when entering the collecting system either embryologically or with open surgery is directly end on through a fornix or inferiorly on the posterior aspect of the pelvis.
- The lower renal segment however is often fed by an accessory vessel. This vessel is usually the most proximal branch when it arises from the main renal artery or its anterior division (Graves, 1954). However, it may originate directly from the aorta near the main renal artery, or it may be aberrant, arising from the gonadal vessel. A summary of findings from Gray and Skandalakis (1972), who analyzed reports from almost 11,000 kidneys. The relationship of the main renal artery and its proximal branches to the renal vein is seen. The
venous drainage of the kidney has been carefully restudied by Sampaio and Aragao (1990a), who noted a close association between the inferior branch to the main renal vein and the anterior inferior aspect of the renal pelvis in 40% of kidneys. They cautioned that an endourologic incision of an obstructed ureteropelvic junction should be done laterally and posteriorly instead of anteriorly to avoid injury to this vessel.

REVIEW & LITERATURE:

- Garcia Bud and his co-workers (1949) observed 8 cases of horse-shoe kidney in their routine urographic studies.
- Bergman in 1950 stated that abnormal blood vessels were responsible for genesis of hydronephrosis of kidney. In total 10 cases, 2 patients had abnormal arteries, 4 had abnormal veins and remaining 4 cases had both abnormality in veins and arteries.
- In late 1950 and early 1960, Graves 1954 and 1956, Anson and Kurth 1955, Merklin and Michel 1958, Anson and Daseler 1961, Geyer and Poutassi 1962 Anatomist are keenly interested in vascular pattern. Multiple renal artery is the correct term to describe any kidney supplied by more than one vessel. The term anomalous or aberrant vessels should be reserved for arteries that originate from vessels other than aorta or main renal artery.

The term accessory vessels denote two or more arterial branches supplying the same renal segment. As each segment is supplied by a single end artery:

- Evans et al in 1951 and Tuli in 1968 noted multiple congenital anomalies affecting nervous system, urogenital system and cardiovascular system resulting from acute folic acid deficiency during gestation in pregnant rates.
- Glenn in 1959 described in 30% of cases the blood supply from one renal artery to each kidney. Boatman et al 1971, Colin et al 1972 the blood supply may be internal iliac artery or external iliac artery or sacral arteries.
- Malformation of renal and testicular veins - a case report from the journal of the anatomical society of India volume 54, No.2 (2005, 2006) authors Varma R., Kalaras and Rana K.

MATERIALS & METHODS:

- The present study has been undertaken on 76 kidneys from cadavers and 60 from sonograms and 40 from fetal kidneys. The study was started and finished in a period of 2 years. The specimens from cadavers were obtained from siddartha medical college, vijayawada and kakatiya medical college, warangal. The sonograms are obtained from GGH, vijayawada from the in and out patients attending to the radiology department.
- The parameters like weight, length of the kidney, breadth of the kidney and the breadth at the superior pole, inferior pole and at the hilum are taken with the help of electronic weighing machine, vernier calipers, the scale and thread are used. During the routine dissections the kidneys identified and the photographs are taken in situ wherever necessary. The parameters are taken, anomalies are noted and detailed diagrams are drawn.
**ORIGINAL ARTICLE**

- Screening of general population by non-invasive imaging procedures like plain X-ray of kidney, ureter and bladder (KUB), ultra sound of the abdomen, etc.
- Screening of patients attending to various outpatient (op) departments of the hospitals.
- Looking for any renal anomalies during various genitourinary abdominal operative procedures and nothing down the incidence
- Cadaveric studies including fetal dissections, fetuses are obtained from G.G.H, vijayawada.
- It should be emphasized once again that the incidence of congenital anomalies varies greatly depending upon the methodology adopted for the study. For example hollinshed (1956) and K. mortn (1958) observed renal anomalies in 2-3% of all operations and 0.5 to 1% in all autopsies.
- The present study was conducted on:
  - 76 adult cadavers.
  - 20 still born fetuses of kidney specimens of 40.
  - 60 kidneys from patients attending general outpatient department of radiology, GGH, and vijayawada.

**Screening of patients for any renal anomalies, who-where attending to the urological outpatients departments:**

**1. Anomalies:**

- **Cadavers of anatomy dissection hall and autopsy:** 76 specimens were studied and the study of upper urinary tract was undertaken in detail, after noting the Sl. No, Sex, parameters. Anomalies were studied and photographs were taken:
  - **Unclaimed still born fetus:** 40 specimens were studied after noting the following particulars.
    - Sl. No:
    - Approx. age of fetus.
    - Sex of fetus
    - Parameters:
    - Anomalies

**PROCEDURE:** the abdomen was opened by right para median incisions and two parallel transverse incisions, which were taken at the end of the right para median incision. The superficial viscera were studied in detail and noted the anomalies if any present. Next the coils of small intestines were removed from abdominal cavity to get a clear view of the posterior abdominal organs.

  The size, shape and position of the kidney were recorded. The hilum of the kidneys and the structures in relation to it were noted down. Next the pelvic viscera, diaphragm, great vessels were examined for any anomalies.

**OBSERVATIONS:** In the present study 176 specimens of kidneys were studied out of which 40 were fetal specimens and the rest were adult specimens consisting of both cadaveric and sonograms. The adult specimens from cadavers were 76 and 60 from sonograms.
The following observations were made:

Out of 40 fetal specimens 2 anomalies were observed.
1. Aberrant renal artery.
2. Aberrant renal vein.
3. Agenesis of Left Kidney.

Out of 76 cadaveric specimens the following anomalies were observed.
1. Aberrant renal arteries - 10
2. Double ureter - 1
3. Lobulated adults kidneys - 5
4. Hypoplastic kidneys - 10
5. Testicular veins - testicular vein draining into renal vein.

Out of 60 sonograms of kidney,
1. Polycystic kidneys - 2
2. Hydro nephrosis - 10
3. Renal Calculi - 4

ACKNOWLEDGEMENTS: The authors would like to thank the colligues- K. V. Pavanakumari, D. Ranzeetha, K.V.S. Priya, for their co-operation in this study

DISCUSSION:
- The medial testicular vein on right side was bifurcating into two divisions, the lateral one was connected with the lower renal vein where-as medial one was draining directly into the inferior vena cava.
- In normal case, there is one renal vein and one testicular vein on each side. On right side both renal and testicular vein open directly into the IVC. The right renal vein is a mesonephric vein that originally drains into that portion of right sub cardinal veins which form part of IVC. The testicular veins are remnant of that part of sub cardinal vein which lie below inter sub-cardinal anastomosis.
- The reason for this observation could be attributed to early stages of development.
- Regarding anomalies of renal vasculature the observations in the study were 14 aberrant vessels (10 in 76 cadaveric specimens and in 40 fetal specimens). According to Merklin and Michele, (1958) 71% and according to Geyer and Poutasse, (1962) 85% of kidneys have one artery that supplies the entire renal parenchyma.
- A slightly higher percentage i.e. 87% of right sided kidneys have a single renal vessel was observed by Geyer and Poutasse (1962). In this present study it was observed that 12:168 (i.e. 7.14%) of which right-sided are 7 and left are 5. So as per the study single artery kidneys are 93%.
SUMMARY AND CONCLUSION:

- It is of interest to note that congenital anomalies were noted from as early as 460-377 B.C. It is stated that anomalies of the urinary tract rank third or fourth in position and they constitute 3 – 4% of total congenital anomalies and seen in 2-3% of population.
- The present study is confined mainly to study various anomalies of kidney. The study was undertaken in 176 specimens, which includes cadavers (including fetuses) and sonograms.
- The results of the present study have been discussed in detail and comparative study has been made with the available data.
- In the present study, a rare anomaly of right testicular vein joining the right renal vein is observed.
- In the present study, two adult polycystic kidney anomalies are observed.
  - In the present study, 14 aberrant vessels are observed.
  - In the present study 10 hypoplastic kidneys are observed.
  - In the present study 10 specimens of hydronephrosis are observed.
  - In the present study 5 specimens of fetal specimen lobulations are observed.

Further in the present study, a fetal kidney showed unilateral agenesis.
- To conclude the findings of the present study may be useful to clinicians and urologists at large.

| Sl. No | Length in Cm | Breadth in Cm | Sup. Pole length in Cm. | Inferior Pole length in Cm | Weight in Grams | Right or Left | Variations |
|--------|---------------|---------------|-------------------------|---------------------------|-----------------|---------------|------------|
| 1      | 5.60          | 5.06          | 4.04                    | 4.74                      | 126             | Right – F    | Inferior Pole, Aberrant artery. Length is short |
| 2      | 8.63          | 5.73          | 5.41                    | 5.18                      | 115             | Left – F     | Left superior pole, aberrant artery            |
| 3      | 9.53          | 5.82          | 4.51                    | 4.15                      | 145             | Left – M     | Left superior pole, aberrant artery            |
| 4      | 8.48          | 4.88          | 4.11                    | 4.15                      | 145             | Left – M     | Left Superior Pole, aberrant artery.           |
| 5      | 10.0          | 4.56          | 5.29                    | 4.52                      | 157             | Left – F     | Aberrant artery, superior pole.               |
|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 6 | 10.6 | 3.23 | 5.64 | 3.77 | 126 | Right -F | Inferior pole, Aberrant artery. |
| 7 | 9.19 | 4.36 | 5.64 | 4.09 | 106 | Left -M | Aberrant artery at Superior Pole |
| 8 | 9.80 | 5.40 | 4.50 | 3.60 | 145 | Left-M | Aberrant artery Superior Pole |

**APENDIX**

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 9  | 10.6 | 4.5 | 3.3 | 3.40 | 110 |   | Aberrant renal artery |
| 10 | 11  | 4.00 | 2.50 | 3.25 | 105 |   | Aberrant renal ven |
| 11 | 13  | 8.2  | 4.50 | 5.50 | 208 | Right | Aberrant renal ven from Superior Pole. |
| 12 | 3.07 | 1.75 | 1.10 | 4.42 | 9.2 | Left -F | Lobulated with aberrant vein at right superior pole. Weight 1.6k.g |
| 13 | 4.22 | 2.32 | 2.32 | 2.18 | 10.58 | Left -F | CRL: 35cm, weight: 2.78 Aberrant arteries to left. Superior pole |

**WET SPECIMENS (ADULT CADAVERS)**

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Date of Submission: 02/02/2015.
Date of Peer Review: 03/02/2015.
Date of Acceptance: 07/02/2015.
Date of Publishing: 26/02/2015.