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Congenital Renal Anomalies - A Dissection Observational Study

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ABSTRACT

Aim: To know the percentages of incidences of various types of congenital anomalies of the renal system that was observed and studied in the three different countries namely Republic of India, Nepal and Republic of China

Places of Study: This study was done in six institutions in three different countries, namely-Republic of India, Republic of China, and Nepal in the respective Department of Anatomy.

Observations: A study was done by in the Departments of Anatomy in the above said colleges by dissection method and observation was made on dissected specimens for the presence of morphological anomalies in kidneys and the anatomical locations of kidneys and ureters. This study was done on the agenesis of kidney, nodular kidney and constricted (small) kidney location, ectopic kidneys bilateral polycystic kidneys. In the donated body the kidney was horse shoe shaped, small, multiple cysts kidneys with double ureters on the right side.

Concluson: This study contributes towards the knowledge of anomalies of kidneys not only to anatomists but to all clinicians especially to urologists and nephrologists. Hence the present study and the reports are significant

Key words: Birth defects, Ectopic positions, Agenesis of kidneys, Polycystic kidneys, Fusion of lower poles

INTRODUCTION

Anomaly is a congenital disorder. It is a medical condition that is present since birth. But the word congenital neither applies nor excludes genetic disorder. Congenital anomalies due to environmental factors are called as Teratogens. Infections, deficiency in the diet and toxins are environmental causes. Maternal folic acid deficiency may cause spina bifida. Intake of alcohol, and certain prescribed drugs like phenytoin may cause congenital anomalies or defects. Apart from physical anomalies, other types of congenital disorders are inborn errors of metabolism (Kumar, Abbas and Fausto, 2005). About 15% to 25% of anomalies are due to chromosomal factors or single gene factors, 8% to 12% anomalies are said to be due to environmental factors, 25% are said to be due to multifactorial inheritance 40% to 60% of anomalies are of unknown origin (Stevenson, 1993 ; Nelson and Holmes, 1984). Congenital anomalies are present since birth with structural deformity found immediately after birth or their presence may be detected by signs and symptoms later on (Holland and Brew, 1991). Congenital Anomalies are seen in 2% of population as major abnormality. There are two types of abnormalities, namely malformations where growth disturbances occur during embryogenesis and the other is deformation. It is late change that appears in a structure which was normal earlier (Roizen and Patterson, 2003).

MATERIALS AND METHODS

This study was done on cadavers in Departments of Anatomy of:

i. Sree Dev Raj Urs Medical College Tamaka, Kolar Karnataka, India in the year1996

ii. Nepalgunj Medical College, Chisapani, Nepal, 2000

iii. Xing xiang Medical College Xing xiang, Henan Province, Republic of China in the year 2004

iv. Narayana Medical College, Nellore, Andhra Pradesh, India

v. Hassan Institute of Medical Sciences [HIMS], Hassan Karnataka, India

vi. Mahatma Gandhi Medical College, Pilliyarkupam, Pondicherry, India

vii. Velammal Medical College Anupannadi, Madurai Tamil Nadu, India

viii. Sree Mookambika Institute of Medical Sciences, Kulasekaram, Kanyakumari District,Tamil Nadu, India

The congenital renal anomalies were studied by the dissection methods. These were incidental findings during routine dissection of cadavers by the students as well as faculties in the above colleges. Observation was made on dissected specimens for the presence of any variations in the morphology of kidneys and ureters. All the unwanted fasciae and fat were removed and the specimens were cleaned to note the anomalies. There were other voluntarily donated bodies who are said to have died of renal problems were also dissected. They showed anomalies not only of renal but also associated ureters and limbs.

Following variations were studied

a) Morphological variations like agenesis of kidney, nodular kidney, constricted (small) kidneys and bilateral polycystic kidneys

b) Variations in locations like ectopic kidneys and

c) Variations in morphology of ureters like presence of double ureters on the right side were noted.

d) All the above anomalies were said to present since birth. A thorough check up was done for the presence of any other associated anomalies.

OBSERVATION

A nodular kidney (Fig.1) on the right side was detected in cadaver in the Department of Anatomy Xing xiang Medical College Xing Xiang, Henan Province, Republic of China -2005. The other left kidney was ectopic in the pelvis.The anterior surface of Nodulated kidney was uneven and found to be enlarged (Table 1.). While left kidney was smaller and normal in the position.

Fig 1: Photographs showing nodular kidney having uneven surface on the anterior surface

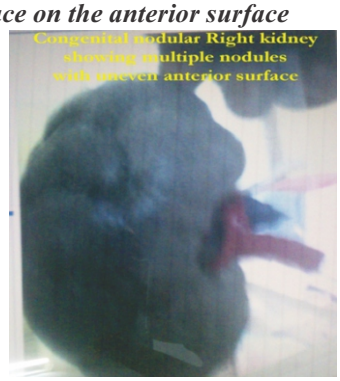

Table-1: Showing various types of Anomalies of Kidneys sides, and their percentages of incidences

Sl. No	Name of the College	Anomaly of the kidneys	Number	side	Percentage
1	Xing Xiang Medical College Xing Xiang, Henan Province Republic of China - 2005	• A nodular Kidney on the right side was detected in cadaver • Left kidney was ectopic in the pelvis. • Nodulated kidney was uneven and found to be enlarged • Left kidney was smaller and normal in the position.	One	on the right side	12.5%
2.	Nepalgunj Medical College, Chisapani Nepal—2000.	• A nodular Kidney was also seen in dissected cadaver\ • Right kidney was normal in morphology and in location. • Another cadaver showing absence of kidney on the right side while left side kidney and ureter were intact.	Two	on the left side	25%
3	Hassan Institute of Medical Sciences [HIMS], Hassan Karnataka	• Polycystic Kidneys in both kidneys were detected in cadaver	One	Both sides	12.5%
4	Sree Devraj Urs Medical college,Tamaka Kolar Karnataka	Bilateral, smaller than normal size kidneys	Two	Bilateral	25%
5	Mahatma Gandhi Medical College, Pilliyarkupam, Pondicherry Sree Moookambika Institute of Medical Sciences, Kulasrkaram of Kanyakumari district Tamil Nadu	Horse shoe Shaped Kidneys –Fusion of lower poles of kidneys	Two	Bilateral	25%
6	Velammal Medical college Anupannadi, Madurai	• Unusual double ureters present on the right side. Both kidneys were normal • Ureter with kidney on the left side were normal	One	One – right side only	12.5%

There was another cadaver showing absence of kidney on the right side while left side kidney and ureter were intact. Empty Renal Fossa was observed in both cadavers no other anomalies were observed.

Polycystic Kidneys: A polycystic kidneys were seen in a 51 year's old donated male body in the Department

of Anatomy at Hassan Institute of Medical Sciences [HIMS], Hassan Karnataka (Table 1). When he was living, he was said to be suffering from pain between ribs and back, recurring urinary tract infection with Hematuria. But no renal stone, high blood pressure was detected. He was said to have associated multiple pancreatic cysts also.

Small kidneys: On performing dissection in elderly female cadaver aged around 70-75 years were observed with bilateral, smaller than normal size kidneys (Table 1) at Sree Devraj Urs Medical College, Tamaka Kolar Karnataka. But ureters and bladder were normal. Right kidney measured 7.1cm and left kidney measured 6.2cm. Parenchymal thickness of right kidney was 0.8 cm, and that of left kidney was 0.8cm.

Horse shoe shaped kidneys was found in male unknown cadaver

A] In Department of Anatomy of Mahatma Gandhi Medical College, Pilliyarkupam, Pondicherry. Both kidneys were fused in the lower pole in horse shoe shaped manner (Table 1). Ureters were normal.

B] Similar anomaly was seen in Department of Anatomy of Sree Moookambika Institute of Medical Sciences, Kulasrkaram of Kanyakumari district Tamil Nadu. Both the kidneys were fused in the lower pole. Fusion of both kidneys in lower pole in the midline anterior to abdominal aorta was seen in a cadaver (Table 1).

In the department of Anatomy at Velammal Medical College, Madurai, TN Institute it was observed that ureters were unequal in length with left ureter was longer than right ureters along with distortion of renal parenchyma. Major and minor calyces were not differentiated.

Double ureters were seen in an unknown cadaver on the right side (Table 1). Both the kidneys were present. This was seen in a cadaver in Department of Anatomy at Velammal Medical College Anupannadi, Madurai Tamil Nadu. There were associated anomalies like polydactyly in left hand comparatively kidneys were smaller in size.

DISCUSSION

1] Absence of Right Kidney: A female age 48 years came to Out Patient Department (OPD) of Surgeryal teaching Hospital of Nepalgunj Medical College, at Kohalpur, Nepal. The patient came with history of pain in the abdomen for month. Her ultra sound report showed Empty Renal Fossa on the Right Side. Impression-Agenesis of Right Kidney (Bilodi and Gangadhar, 2012).

2] Small kidneys: An elderly female age seventy six years came to surgical OPD St John's Medical College Hospital with history of pain in both loins since 2 weeks. Ultra sound was done and he was diagnosed to have small kidneys on both sides. She belonged to family having multiple renal anomalies (Bilodi *et al*., 2013)

Double ureters are of paramount importance for surgeons who performs hemicolectomy and also for the urologists. The presence of double ureters may cause repeated infections, caliculi formations and hydronephrosis. Whereas presence of multiple renal arteries is of paramount importance to surgeons who perform kidney transplantations because renal arteries are end arteries. Anastomosis must be made to all arteries of donor kidney (Mugunathan *et al*., 2008).

3] Hohenfellner *et al*., (1992) suggested that during development of kidney teratogenic factors are wholly responsible for nephrogenic cells to migrate abnormally to form the isthmus of horse shoe shaped kidney and also suggested that it has got the tendency to form the Wilm's tumor.

4] Another study reported a rare case of rudimentary ectopic right kidney fused to lower pole of left kidney with multiple aberrant renal vessels during routine dissection of the abdomen in 63 years old male cadaver in the department of Anatomy in one of the Medical College of (I.P.G.M.E. & R.) in Kolkata. An empty right renal fossa on the right side was observed with anomalous in the right and left veins. The ureters were normal. The left ureter had normal pelvis while right had extra renal pelvis. The ureter entered bladder normally, with the right ureter passing midline. Hence anatomical knowledge can minimize complications of the patient both preoperatively and post operatively (Palit, Datta and Tapadar, 2008).

DEVELOPMENT OF KIDNEY

Kidneys at Birth: Kidneys have uneven surfaces – it shows lobulations indicating the division of foetal kidney in to lobes. But this disappears at the end of foetal period (Garg, 2012).

Kidneys During Infancy: As kidneys enlarge in size, there is disappearance of lobulation. This is due to increase in size of both interstitial tissue and increase in size of nephrons. It is said nephrons do not increase in number after birth (Garg, 2012).

Molecular Development: Transcription factor [WT1] produced by the mesenchyme of the metanephric blastema helps in the epithelisation ureteric bud. Production of Glial Derived Neurotrophic factor [GDNF] and Hepatocyte growth factor [HCF] are regulated by WT1. Ureteric bud produces PAX2 and WNT4 that helps in epithelisation of mesenchyme to form and differentiate into excretory tubules. The growth factor known as FGF2 and BMP7, stimulates the proliferation of mesenchyme and WT1 expression (Garg, 2012).

Present study has shown 6 types of congenital anomaly seen in dissected cadavers in department of Anatomy in various medical colleges in three different countries, namely –Republic of China --Republic of India and Nepal. Consequently three groups of anomalies were studied.

I] Morphological variations like agenesis of Kidney, nodular kidney, constricted (small) kidneys, bilateral Polycystic kidneys were also noted. It is genetic disorder characterized by numerous cysts in parenchyma It is most common Autosomal dominant but rarely autosomal recessive Autosomal dominant is diagnosed by imaging studies CT, MRI.PKD whether autosomal dominant or recessive has no cure.

II] Variations in locations like Ectopic kidneys was also detected

III] Variations in morphology of ureters like presence of double ureters on the right side were noted.

Agenesis of kidneys is failure of interaction occurs between metanephric mesoderm and ureteric bud ,Then there occurs Renal Agenesis Renal Agenesis also occurs when there is mutation of genes That regulates the expression of signaling of GDNF1.

There three cases of nodular kidneys-[Uneven outer surfaces]. Regarding repeated infections, calculus formations and hydronephrosis, and presence of multiple renal arteries were not known. But in donated bodies, there was history of repeated urinary tract infections; back pain was present as told by the relatives.

In case of the rest of the unknown bodies, history was not known.

CONCLUSION

These anomalies of renal system have profound embryological importance. It gives lot of information regarding variations in the development of kidneys to the Anatomist and to the clinicians. This study gives knowledge of variations in the development of kidneys and ureters. These anomalies can be detected through ultrasound and other latest investigating tools. When one diagnosis has been established, then proper advice can be given to the patients to be careful and to prevent further complications.

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REFERENCES

Bilodi, A. S. K. & Gangadhar, M. R. (2012). A case of unilateral Agenesis of kidney in a female, International Journal of Anatomical Sciences. 3(1), pp.4-7.

Bilodi, A. S. K., Kadam, J. D., Bahaddur, A. & Gangadhar, M. R. (2013). A Rare Case of Bilateral Small Kidneys in an Elderly Female – A Case Report, International Journal of Anatomical Sciences. 4(2), pp 26-29.

Garg, K. (2012). Khurana Arushi Khurana Indu: Human Embryology, 2nd edition-reprint, CBS Publications and Distributors PVT LTD.

Hohenfellner. M., Schutlz Lampel, D., Lampel, A., Steinbach F., Cramer B. M. & Thüroff J. W., (1992). Tumor in the Horse shoe shaped Kidney: clinical implications and review of embryogenesis. The Journal of Urology. 147(4), pp 1098-102.

Holland, E., Brews, A., Daftary, S. N. & Chakravarti, S. (1991). Holland and Brews: Manual of Obstetrics, 5th edition B. I. Churchill Livingstone.

Kumar, V., Abbas, A. K. & Fausto, N. (2005). Pathologic Basis of Disease, (eds.). Robbins and Cotran, 7th edition.

Elsevier Inc., Philadelphia.

Mugunathan, N., Felicia, C. & Thenmozh, (2008). Double utters and multiple renal arteries. Souvenir of 31st Annual conference of Association of Anatomists of Tamil Nadu.

Nelson. K & Holmes, L. B. (1984). Malformations due to presumed spontaneous mutations in new born infants. New England Journal of Medicine. 320(1), pp 19-23.

Palit, S., Datta, A. K. & Tapadar, A. (2008). A rare presentation of rudimentary ectopic right kidney fused to lower pole of left with multiple aberrant renal vessels: A case Report. Journal of Anatomical Society of India. 57(2), pp148-150.

Roizen, N. J. & Patterson, D. (2003). Down's syndrome. Lancet. 361(9365), pp 1261-1289.

Stevenson, R. E. (1993). The Genetic Basis of Human Anomalies. In Stevenson. R. E: Hall. J.G, and Goodman, R. M. (Eds), Human Malformation and Related Anomalies. Vol.1, Oxford University Press, New York.