ORIGINAL ARTICLE

PREVALENCE OF RENAL ECTOPIA BY DIAGNOSTIC IMAGING

Muhammad Asghar* and Fidaullah Wazir**

Department of *Radiology and **Anatomy, Gomal Medical College, Dera Ismail Khan, Pakistan

ABSTRACT

Background: Renal Ectopia is a congenital anomaly with variable clinical presentation. This study was conducted to know prevalence of renal ectopia in patients with abdominal complaints.

Material & Methods: This cross-sectional study was carried out at Radiology Department, District Head Quarter Teaching Hospital, Dera Ismail Khan, Pakistan, from 1st January 2005 to 31st December 2007. Ultrasonography was performed for all referred patients during 1st January 2005 to 31st December 2007, complaining of abdominal pain, lump in the abdomen, dysurea or haematuria. All patients had plain radiography and ultrasonography. Contrast urography was performed in those patients with obscured /absent or small kidney with poor cortico-medullary differentiation and ectopic or rotated kidneys.

Results: Out of 12,000 patients investigated during the study period, there were 25 (0.2%) cases of renal ectopia. Seven were having right ectopic pelvic, 5 left ectopic pelvic, 5 crossed ectopic fused, 2 crossed ectopic un-fused, 4 horseshoe shaped and 2 bilateral ectopic pelvic kidneys.

Conclusion: Renal ectopia is a rare congenital anomaly, found in 0.2% of patients presenting with abdominal complaints. Ultrasonography is a sensitive investigation for its detection.

Key words: Ectopic kidney, Ultrasonography, Intravenous urography.

INTRODUCTION

Kidneys are normally located in the retroperitoneal position, on either side of vertebral column, against the psoas muscles but when not at such position, it is called renal ectopia or ectopic kidney. Ectopic kidneys are thought to occur in approximately 1 in 1,000 births but only about 1 in 10 of these is ever diagnosed. Some of these are discovered incidentally, when a child or adult is having ultrasonography for a medical condition unrelated to renal ectopia.[1]

Kidneys normally develop in the pelvis and migrate to the upper abdomen. Ascent of kidneys precedes the descent of gonads into the pelvis. A caudal growth in the embryo appears to assist in migration of kidneys out of the pelvis into its eventual retroperitoneal location in the renal fossa. They attain their adult position by the 9th week. Factors, which interfere with development such as teratogens, genetic factors, ureteric bud, when it does not meet with nephrogenic blastema for normal nephrogenisis or metanephric maternal disease, may result in abnormal migration of the kidney resulting in renal ectopia.[1,2] During ascent, each kidney acquires its blood supply from the neighboring vessels, initially from external and internal iliac vessels and at 8th week of development, direct from aorta. Any abnormality in origin of renal arteries may prevent cephalic migration resulting in renal ectopia.[3] Ectopic kidneys may be pelvic, iliac, abdominal, any where along the path of their usual ascend or contralateral referred to as "crossed" with slight predominance on left side and in males.[4]

If the kidney fails to ascend, it remains in the pelvis called ectopic pelvic kidneys, unilateral or bilateral. Bilateral pelvic ectopic kidneys, with or without fusion, are very rare and only few cases are reported in the medical literature.[5] Henot first described fused pelvic kidneys in 1830, while Judd and Harrington made the first radiologic diagnosis of this condition in 1919.[6]

Pelvic Kidneys are usually close together in the pelvis due to the limited amount of space in the pelvic cavity. Due to compression of nephrogenic blastemas of ureteric buds by the umbilical arteries, the entire renal substance is fused into one mass or lump, giving rise to two separate ureters with normal entrance into the urinary bladder or rarely the single ureter, known as cake or pancake kidney.[7] From 20-66% of women with renal ectopia (pelvic Kidney) have abnormalities of either the uterus (unicornuate with or without rudimentary horn, bicornuate, or absent uterus), vagina (atresia of the proximal or distal vagina, vaginal duplication, or absence of vagina) or both.[8]

If the two kidneys fuse at any location along the path of their normal ascent from the pelvis to the mid abdomen, as a result of a teratogenic event involving the abnormal migration of poste-

rior nephrogenic cells, which then coalesce to form the parenchymal bridge, called isthmus at the lower poles of horse shoe kidney. Horse shoe kidney like pelvic kidneys, have multiple renal arteries and veins and are at increased risk for development of hydronephrosis, kidney stones and renal cell carcinoma.[9]

Simple renal ectopia refers to kidney that is located on the proper side but abnormal in position.

Crossed renal ectopia was first described by Pannorlus in 1964[10] and refer to kidney that has crossed from left to right or vice-versa, with moving of one kidney to the opposite side following ascent of the other kidney, so that both kidneys are located on the same side of the body, mostly fused called crossed fused ectopia.

The fusion of the two kidneys is believed to result from (1) failure of the primitive nephrogenic cell masses to separate or (2) fusion of the two blastemas during their abdominal ascent.[11]

An abnormally high ascent of the metanephros will generate a diaphragmatic defect and subsequently an ectopic kidney in the thorax. Intrathoracic ectopic kidney may be congenital or acquired This condition is rarely bilateral and occurs mostly on the left with preponderance in the males.[12,13] True intra-thoracic ectopic kidney presents during fetal life and has four characteristics (i) rotation anomaly (ii) long ureter (iii) anomalous high derivation of the renal vessels from the thoracic aorta and (iv) medial deviation of the lower pole of the kidney. The etiology of true ectopic kidney is not well known. Acquired intra thoracic ectopic kidney occurs due to a diaphragmatic hernia that may be caused by a congenital defect in the diaphragm, in which case the vascular pedicle has a normal morphology. It can also be caused by trauma. In most cases, it is a symptomatic. The diagnosis of intra thoracic kidney is one of the unusual causes of mediastinal mass on chest radiograph and is confirmed by intra venous urography or computer tomography.[14,15]

Incidence of intra thoracic ectopic kidney is very low, 1:1300. Apart from its rare complications such as respiratory distress in newborn babies, this anomaly does not require any specific treatment.[16] Thoracic kidney, is very rare, 1 in 20,000 patients, may present as a thoracic mass on routine chest x-ray film, with a common differential diagnosis of pulmonary and chest wall neoplasm, any mediastinal, sub-diaphragmatic and retroperitoneal tumor, diaphragmatic hernias and eventration of diaphragm. In routine, at the end of 2nd gestational month, the diaphragmatic leaflets are formed as a pleuro-peritoneal membrane that separates pleural cavity from the peritoneal cavity with closure of leaflets, so either due to delayed closure of the diaphragm or accelerated ascent of kidneys before normal diaphragm leaflets closure, the kidney usually lies in the postero-lateral aspect of the diaphragm in the foramen of Bochdalek from where renal vasculature /ureter exit. The ureter is elongated and not ectopic.[17]

MATERIAL AND METHODS

This cross-sectional study was carried out at Radiology Department, District Head Quarter Teaching Hospital, Dera Ismail Khan, Pakistan, from 1st January 2005 to 31st December 2007. Ultrasonography and plain radiography was performed for all referred patients, complaining of abdominal pain, lump in the abdomen, dysurea or haematuria. Contrast urography was performed in those patients with obscured /absent kidney or small kidneys with poor cortico-medullary differentiation, ectopic or rotated kidneys.

RESULTS

During the study period, 12,000 patients were referred to the Radiology Department for USG of abdomen and pelvis. Renal ectopia was observed in 25 (0.2%) patients. Out of patients with renal ectopia, 7 (28%) were with right ectopic pelvic kidneys, 5 (20%) with left ectopic pelvic kidneys, 2 (8%) with crossed ectopic un-fused kidneys, 5 (20%) with crossed ectopic fused kidneys, 4 (16%) with horseshoe shaped kidneys and 2 (8%) with bilateral ectopic pelvic kidneys. Table-1 shows characteristics of patients with renal ectopia.

Table-1: Characteristics of patients with renal ectopia.

Anomaly	Incidence	Percentage	Male/ Female	Normal functioning	Hypo functioning	Non functioning
Right ectopic kidney	7	28 %	5/2	6	1	—
Left ectopic Kidney	5	20 %	4/1	2	2	1
Crossed ectopic un-fused Kidneys	2	8 %	1/1	1	1	—
Crossed ectopic fussed Kidneys	5	20 %	4/1	5	—	—
Horseshoe-shaped kidneys	4	16 %	2/2	4	—	—
Bilateral ectopic pelvic kidneys	2	8 %	1/1	2	—	—

Figures 1-11 show some of the typical USG and IVU pictures of our patients with renal ectopia.

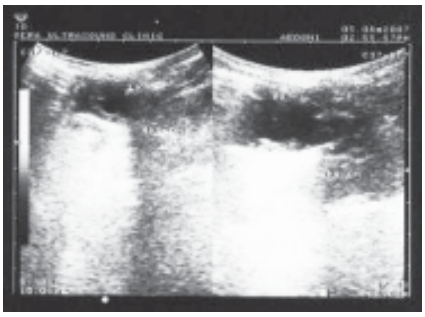

Fig. 1: Bilateral ectopic pelvic kidney.

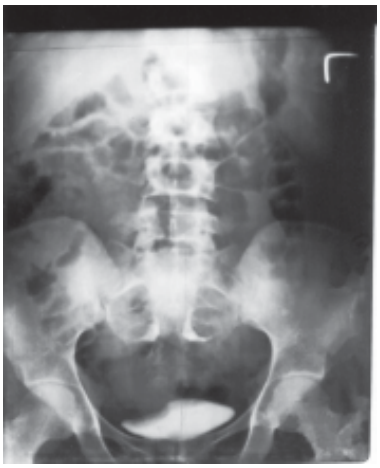

Fig. 2: Normal functioning bilateral ectopic pelvic kidney.

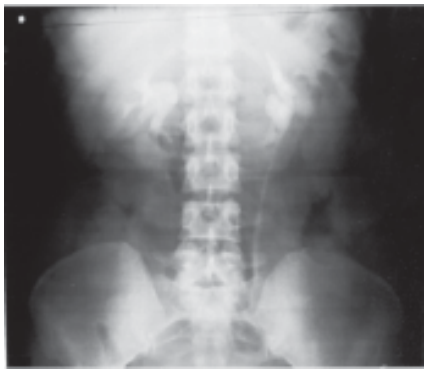

Fig. 3: Normal functioning horse shoe shaped kidney.

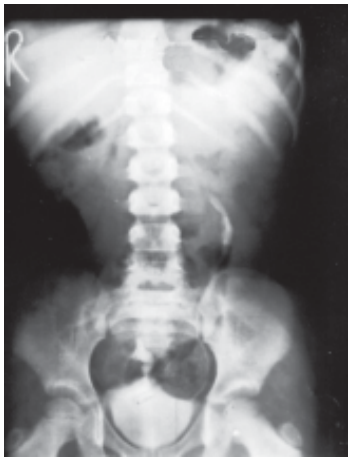

Fig. 4: Normal functioning right ectopic pelvic kidney

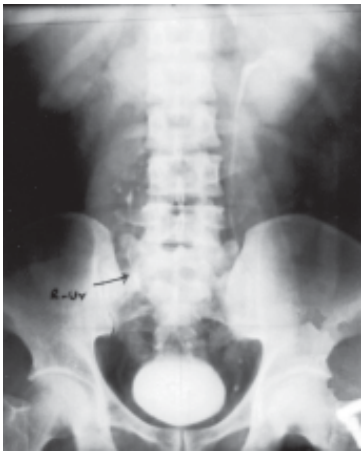

Fig. 5: Normal functioning right ectopic low lying kidney

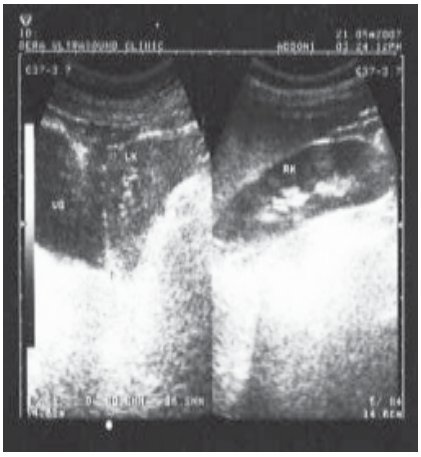

Fig. 6: Left ectopic pelvic kidney

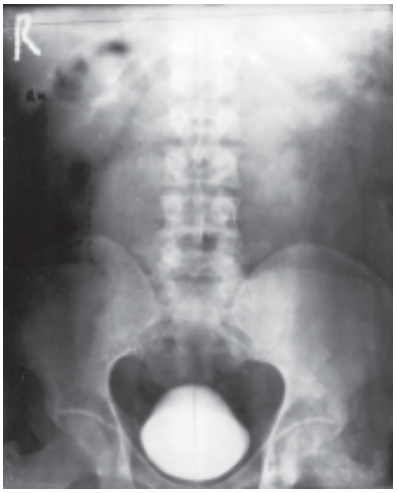

Fig. 7: Markedly hypo-functioning left crossed ectopic un-fused kidney.

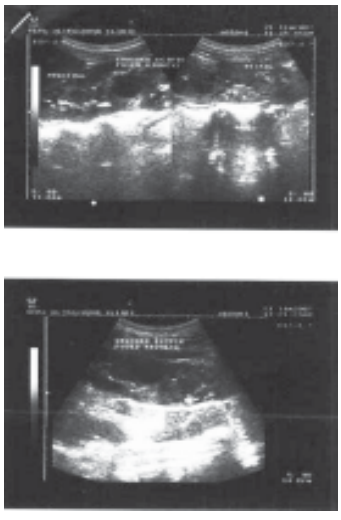

Fig. 8: Crossed ectopic right kidney.

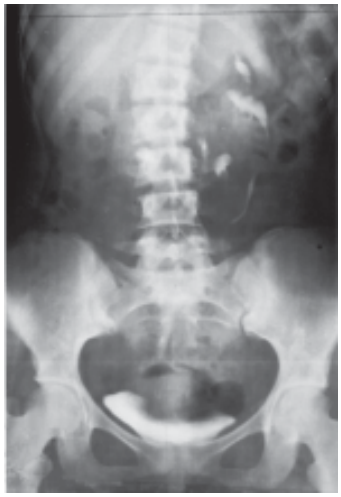

Fig. 9: Normal functioning crossed ectopic unfused right kidney.

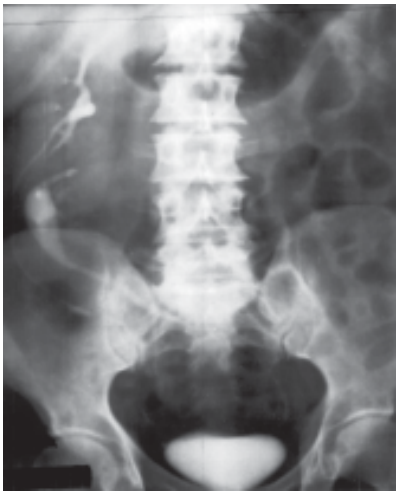

Fig. 10: Normal functioning left crossed ectopic fused kidney.

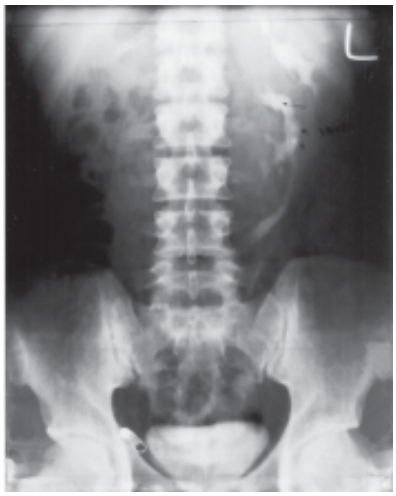

Fig. 11: Normal functioning left crossed right ectopic fused kidney with multiple small stones in the calyces.

In patients of right ectopic pelvic kidneys, USG outlined their abnormal location and Intravenous Urography (IVU) confirmed normal excretory function in six cases including one showing slightly dilated pelvi-calyceal system due to rotated renal position, while in seventh patient, kidney was marked hypo functioning with persistent faint nephrogram up to delayed films.

In patients of left ectopic pelvic kidneys, two were of small size and other of normal size. USG outlined normal cortico-medullary ratio and parenchymal texture in two, while poor cortico-medullary differentiation in rest of the three. IVU declared two patients with normal functioning kidneys, two with poor functioning up to faint nephrogram persistent in delayed films, while one as non-excretory up to 12 hours delayed films.

In patients with crossed ectopic non-fused kidneys, IVU outlined a normal functioning crossed ectopic kidney in 1 patient, while poorly functioning up to nephrogram level in delayed film in the other, however normally located kidneys were normal functioning in both.

In crossed ectopic fused kidneys, USG was inconclusive about renal fusion in one patient while it was obvious in the four. IVU outlined normal excretory function in all with confirmation of renal parenchymal fusion. Stones were also visualized in one patient.

In horseshoe shaped kidneys, USG was inconclusive in one patient about isthmus due to gut gases on the anterior side & lumbar vertebrae from the posterior side however plain and contrast radiography outlined the isthmus and normal excretory function in all the patients with no hydronephrosis. In bilateral ectopic pelvic kidneys, contrast radiography outlined normal excretory function.

DISCUSSION

In our study ectopic pelvic kidneys were diagnosed by USG and confirmed by urography, the same is reported by other researchers.[18] Some patients having pelvic kidneys present as pelvic mass and may also result in obstetric complication, in our study no patient presenting with pelvic kidney resulted in obstetric complications.[19,20]

Patient may have hematuria with pain,[21] we have also received patients with same complaints due to ectopic kidneys.

It may be difficult to visualize the isthmus of Horse-shoe kidney on USG due to bowel gases anterior to it.[22] We observed the same problem and found that USG was inconclusive in one patient. It was confirmed by contrast radiography.

The prevalence of ectopic kidneys in our study was 0.2%, which coincides with the international data.[1]

CONCLUSION

Renal ectopia is a rare congenital anomaly, found in 0.2% of patients with abdominal complaints in our set up. Ultrasonography is a sensitive investigation for its detection.

Patients with suspicion of such anomaly should have ultrasonography for the early diagnosis and prevention of complications.

REFERENCES

1. Moore KL and Persaud TVN. Urogenital system. In: The developing human. Clinically oriented embryology (8th ed). Philadelphia: WB Saunders, 2008; pp: 244-56.
2. Walsh P, Gittes R, Perimutter A. Cambell's Urology, Philadelphia: WB Saunders, 1986; 2: 1 674-75.
3. Renal ectopia. Available online at www.medcyclopaedia .com/library/topics/volume_vii/e/ectopia_renal.aspx?s=Renal+ectopia&mode=1&syn=&scope=v.
4. Bauer SB. Anomalies of the kidney and ureteropelvic junction. In: Walsh PC, Retik AB, Vaughan ED, Jr, (eds). Campbell's urology, 7th ed. Philadelphia: WB Saunders, 1998; 1709-1755.
5. Arch E. Bilateral pelvic kidney. J Urol 1966; 49: 977-78.
6. Judd ES, Harrington SW. Ectopic pelvic kidney Surg. Gynecol. Obstetric 1919. 28: 446-451.
7. Calado AA, Macedo A, Srougi M. Cake kidney drained by single ureter. Int Braz J Urol 2004; 30: 321-22.
8. Bauer SB. Anomalies of the kidney and ureteropelvic junction; in Walsh PC, Retik AB, Vaughan ED Jr, Wein AJ (eds): Campbell's urology. Philadelphia, Saunders, 1998, pp 1708-55.
9. David H. Abnormal kidney development. Available online at www.meddean.Lic.edu/Lumen/mdE.d/urology /abnrendv.htm
10. Birmole BY, Brorwankar SS, Vaidya AS, Kulkarni BK. Crossed renal ectopia. J Postgrad Med 1993; 39: 149-51.
11. George Gross. Chief of Pediatric Radiology, University of Maryland Medical Center, Professor, Department of Diagnostic Radiology, university of Maryland, School of Medicine, Last Updated: June 10, 2005 available at F:\eMedicine - Crossed Fused Renal Ectopia Article by George Gross, MD. htm
12. Lozano R, Rodriquez C. Intra thoracic ectopic kidney: Report of a case. J Urol 1975; 114: 601-2.
13. Sfaxi M, Miladi M, Loussaief H, Munif A, Chebil M, Ayed M. Thoracic ectopic kidney by diaphragmatic herniation. Progres en Urologie 2002; 12: 447-78.
14. William RR, Jeans WD. Thoracic ectopic kidney in an adult. Scan. J Urol. Nephrol, 1996; 30: 133-34.
15. Nagashima Y, Okabe T, Mineo H, Sugimura H. A case of thoracic kidney. Nihon Kyobu Shikkan Gakkai Zasshi 1989; 27: 1562-67.
16. Ogunbiyi OA. Ectopic thoracic kidney. Afr J Med. Sci 1986; 15: 99-101.
17. N'Guessan G, Stephens FD, Congenital superior ectopic (thoracic) kidney. Urology 1984; 24: 219-21.
18. Belsare SM, Chimmalgi M, Vaidya SA, Sant SM. Ectopic kidney and associated anomalies: A case report. 2002; 51: 2002-12.
19. Wilczak M, Sajdak S, Spaczynski M, Pisarski T. Ectopic kidney in the small pelvis. Waid lek 1994; 47: 77-9.
20. Banner EA. The ectopic kidney in obstetric gynecology and surgery. Gynaecology and Obstetric 1965; 121: 32-6.
21. Howard LT, Ectopic (Pelvic) kidney. Annals of Surgery 1931; 93: 880-5.
22. Renal variant diagnostic radiology - health information encyclopedia, draligus available at file:///H:/3445-renal-variants-diagnostic-radiology.html

Address for Correspondence:

Dr. Muhammad Asghar
Dera X-Ray /Ultrasound Clinic
Faqirni Gait, South Circular Road
Dera Ismail Khan, NWFP
Pakistan