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Case report

Trilobar pelvic kidney with renal vascular variations in a fetus

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ABSTRACT

An ectopic kidney is one that is located outside the renal fossa. It results from failure in upward migration of ureteric bud and metanephric blastema from pelvis to the lumbar region. Failure in the ascent can result in vascular variations and positional variations. Left sided renal ectopia with associated genital anomaly was observed during dissection of a 29 weeks female fetus. The left kidney was tri-lobular and presented positional and vascular variations. Vascular variations on left side include two renal arteries and two renal veins with variation in their origin, course, length and branching pattern. Right kidney though normal in location and vascularization presented hydro ureter. The genital anomaly in the form of unicornuate uterus was present. Positional variation on left side indicates developmental arrest in the ascent of kidney at pelvic brim in front of termination of aorta with hilum facing anterior due to failure of rotation. The positional and vascular variations of kidney are important not only for anatomists but also for surgeons.

1. Introduction

Congenital anomalies of the kidney and urinary tract constitute approximately 20 to 30 percent of all anomalies identified in the prenatal period. [1] Ectopic variations account for 40% of urinary system pathology and these include variations in number, position, size, shape, rotation and vascular pattern in the kidney. Associated anomalies of other systems like vertebral column, genital tract, nervous system etc were also reported in the literature. [2] An ectopic kidney is a birth defect in which a kidney is located in an abnormal position. Ectopic kidney is noticed only after death either at autopsy or during dissection with an incidence of 1 in 900 with equal incidence in both sexes and 10% incidence of bilateral ectopic [3]. Pelvic kidney is most common example of renal ectopia with an incidence of 1 in 2200 and 1 in 3000 for one normal and one pelvic kidney [4]. Other sites of ectopic kidneys include the iliac region, the abdomen, the chest, and, in some cases contra lateral referred to as "crossed renal ectopia".

Kidney develops between 4th to 12th weeks of intrauterine life. During 4th week of pregnancy, ureteric bud separates from Wolffian duct and ascends towards the urogenital ridge. In the 5th – 6th week, the metanephric blastema appears above the migrating bud. During its ascent kidney passes through a 90` rotation from a horizontal to a vertical position. This rotation results in ultimate direction of renal hilum medially. By 7th week the hilum points medially and kidneys are located in the abdomen. Migration and rotation appears to be completed by 8th week. As the embryo continues to grow in a caudal direction, the kidneys are left behind and eventually come to lie in a retroperitoneal position at the level of L1 by 9th week of intrauterine life and starts functioning from 12th week [5].

Origin of renal arteries from different sources and their frequent variations can be explained by the development of 20-30 segmental mesonephric arteries in the fetal life. These arteries form a vascular net feeding the kidneys, suprarenal glands, gonads on both sides of the aorta between 6th cervical and 3rd lumbar vertebrae, a region known as RETE ARTERIOSUM UROGENITALE. During the process of ascent from the pelvis, the kidneys derive their blood supply sequentially from vessels that are closest to them - initially median sacral, then common iliac and inferior mesenteric, and finally aorta with degeneration of primitive lower vessels. Failure of degeneration of these primitive lower vessels in ectopic caudal kidney results in origin of more than one accessory and polar renal artery [5]. Teratogens, genetic factors, ureteric bud or metanephric defects and maternal diseases that may interfere with the development of kidney may result in abnormal migration

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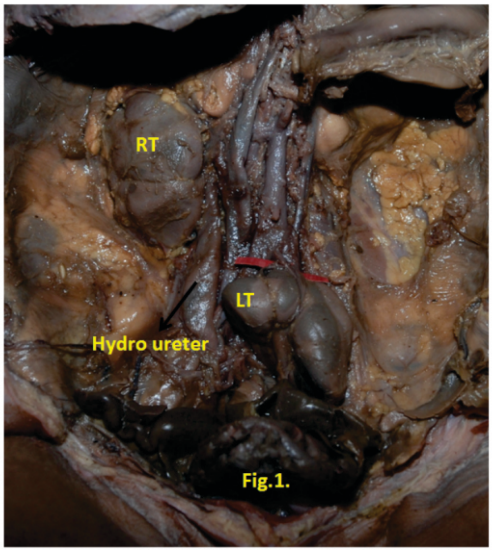
of the kidney and renal ectopia. The renal vascular pattern remains frozen at whatever development stage the ascent of kidney ceases [6].

Knowledge of renal positional and vascular variations is important for urologists, radiologists and surgeons in general. This report may also be useful to clinicians for invasive technique and for vascular surgeons.

2.Case report

During fetal autopsy of an apparently normal female fetus of 29 weeks gestational age normal right kidney with hydroureter and three lobed left kidney lying at pelvic brim in front of termination of aorta with hilum facing anterior was observed (Fig.1). The ureter is most anterior to the vessels and was seen running downwards and finally entered the urinary bladder.

Fig.1 .Right kidney with hydronephrosis. Pelvic position of Left kidney.



The renal vascular pattern was normal on right side where as on left two renal arteries and two renal veins with variation in their origin, course and branching pattern (Fig.2-4) were observed.

The first renal artery (RA 1) originating from bifurcation of aorta (Fig.2) descended 0.5 cm towards left kidney and bifurcated into an anterior (AD) and posterior branch (PD). Anterior branch of 1.3 cm in length passed towards upper pole where it further divided into a polar branch (PB) of 0.4 cm length entering the upper pole and a hilar branch (H1) of 1.3 cm length travelling towards the anterior aspect of hilum where it entered the substance of kidney. Posterior branch continued as a hilar branch (H2) of 1.6 cm was seen running lateral to the hilar branch of anterior and entered the hilum on its anterior aspect. In the present case two hilar branches were given by renal artery (Fig, 4). Second renal artery of 2.1 cm length was originating from median sacral artery (MSA) and entered the hilum on its antero-medial surface and found twisted with the vein. A total of 3 hilar branches were observed in the present case.

First renal vein (RV) started from hilum (Fig.2), posterior to the ureter and accompanied hilar branch of first renal artery and travelled in between the anterior two lobes of kidney winding around its antero-lateral surface and passed behind the left common iliac artery receiving a communication from the suprarenal and gonadal veins and ran horizontally behind the termination of aorta and drained into inferior venacava. Second renal vein (ARV) starting from hilum ran along the anteromedial surface and the vessels are twisted on posterior surface of kidney and drained into right common iliac vein and did not receive any tributaries.

Fig.2 renal artery (RA) arising from abdominal aorta and accessory renal artery from median sacral artery (MSA).Division of RA in to anterior (AD)and posterior(PD) branches and their distribution

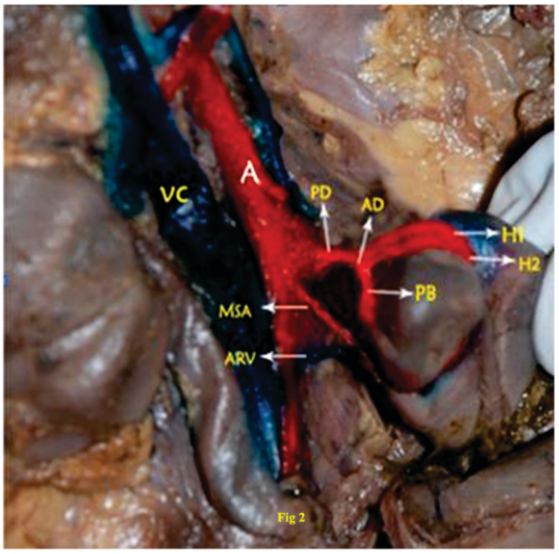


Fig.3 Renal artery branches and renal (RV) and accessory renal (ARV) veins

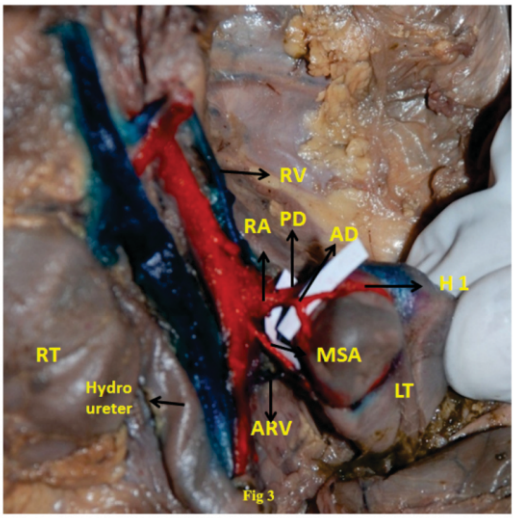
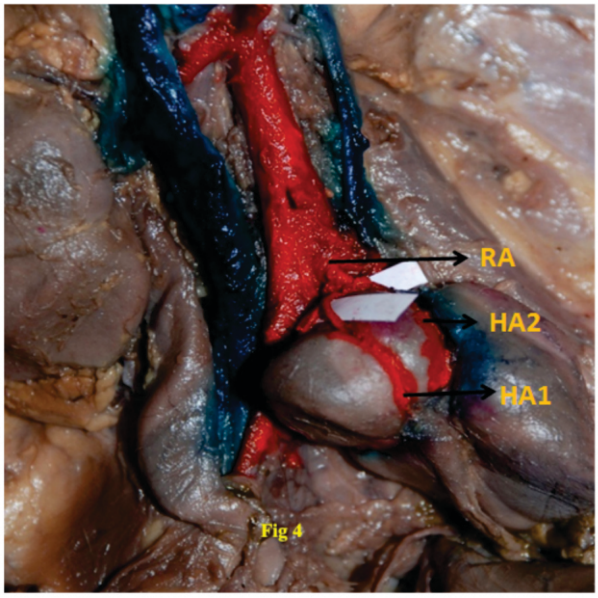


Fig.4. Hilar branches of renal artery



3. Discussion

Cases of ectopic kidney, unilateral or bilateral have been reported regularly in the literature. Unilateral ectopic kidney is commoner than bilateral. It is also found that congenital pelvic kidney is commoner on left side than on the right and in males than in females. In this case the ectopia was unilateral and on the left side in accordance with the findings of others. The frequency was higher in males than females [7, 8], but it was found in a female fetus.

The kidney that fails to ascend may remain close to common iliac artery receiving blood supply from the primitive vessels. Review of literature suggests middle sacral artery providing a renal artery in cases of pelvic kidney [9]. In the present case the middle sacral artery originating at the bifurcation of aorta was supplying the Pelvic kidney. Bergman et.al. reported 22% incidence of origin of middle sacral artery at the point of bifurcation of aorta. In the present case the left kidney was arrested at pelvic brim in front of termination of aorta and received blood supply from a renal artery originating at bifurcation of aorta and from the primitive renal artery originating from median sacral artery

Insufficient degeneration of mesonephric arteries, leads to presence of more than one renal artery. Renal artery variations are categorized in to two types: "early branching" and "extra renal arteries". In early branching main renal artery is more proximal to hilum. Extra renal arteries are grouped in to hilar (accessory) and polar (aberrant) arteries. Hilar arteries enter kidney through hilum with main renal artery, polar arteries penetrate kidney directly through the capsule from outside of the hilum [10, 11]. In the present case the pelvic kidney had a renal artery and an additional or accessory artery. The renal artery originating at the level of bifurcation of aorta, presented early branching into hilar and polar arteries. Additional extra renal hilar (accessory) artery originated from the median sacral artery. A mean prevalence of 28% was reported in the literature for extra renal artery [7, 8].

4.Conclusion

Documentation of fetal ectopic kidney is important because it signals the need to search for associated anomalies which involves genitourinary, cardiac, and skeletal system. Cases like ectopic kidney have a good prognosis if detected antenatal.

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