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RESEARCH ARTICLE

RENAL CASTING OF A DUPLEX COLLECTING SYSTEM.

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Abstract

Presence of two pelvicalyceal systems with single or double ureter within the same kidney is referred to as a duplex collecting system. Casting of 50 kidneys were done during which one kidney showed a duplex collecting system. The embryological basis and clinical significance is discussed here.

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Introduction:-

Ureter is a long tubular structure extending from renal pelvis to urinary bladder, measuring 25-30 cm in length and 3-4mm in diameter. It has a thick muscular wall and a narrow lumen. Superiorly it is continuous with a funnel shaped structure called renal pelvis through which it communicates with the secreting part of the kidney. Inferiorly it opens into the lateral angle of the base of the urinary bladder.¹

Duplications of the abdominal part of the ureter and the renal pelvis are common. These anomalies result from the division of the metanephric diverticulum. The extent of the duplication depends on how complete the division of the diverticulum was. Incomplete division of the metanephric diverticulum results in a divided kidney with a bifid ureter. Complete division results in a double kidney with a bifid ureter or separate ureters²

Materials and methods:-

The kidneys were dissected out as described in Cunningham's manual of Dissection, Vol.3. The shape, position of the hilum and surface lobulations of the kidneys were examined. The renal vessels and loose areolar tissues from both surfaces of the pelvis were removed and cleaned. The pelvis was further traced to reach the major and minor calyces. The branching pattern of the major and minor calyces and their corresponding cap of cortical tissues were delineated.

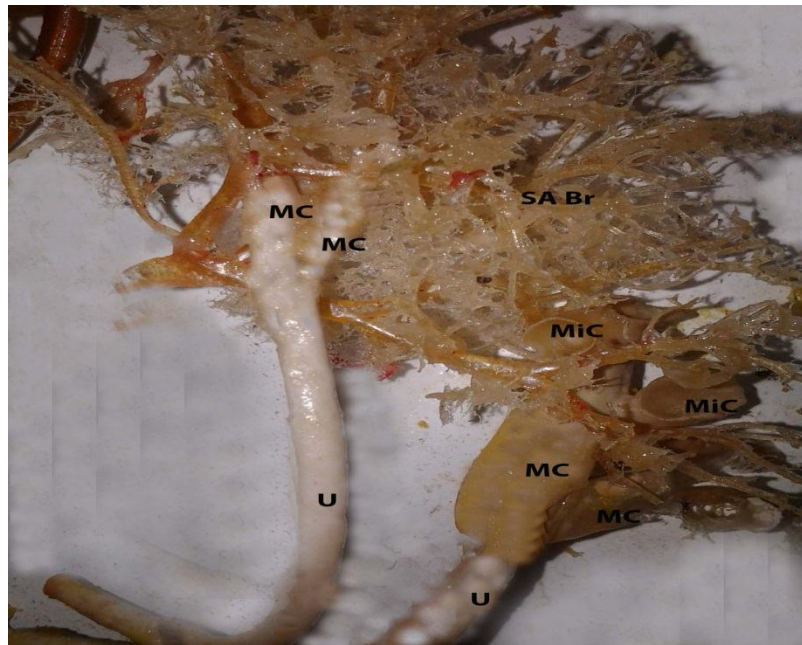
50 fresh specimens were used for preparation of renal arterial and pelvicalyceal casts. The cast material consisted of Acrylic repair material (denture base polymer resin powder) used in dentistry, ⁸ available in two colors, pink and clear. Pink was used for the arteries and the clear for the pelvicalyceal system. This powder was mixed with the cold cure liquid, Acrylin R in a ratio of 1:2; (one part powder and two parts liquid). The prepared resin was immediately injected, since it begins to set in less than a minute or so.

The kidneys, along with a segment of aorta and the ureter, were removed and then washed with tap water thoroughly. The renal arteries were canulated through the aorta using an infant feeding tube. The blood from the kidneys were washed away by injecting tap water through the infant feeding tube, the washed out blood exiting via the renal vein. Once the arterial system was completely washed out and the kidneys turned pale, the cast material was prepared and then immediately injected into the canulated renal arteries, the end point being when the cast

material exited via the renal vein. The renal arteries were ligated and kept aside for the material to set, approximately one hour. Following this the ureters were cannulated, again with an infant feeding tube. The cast material was again freshly prepared and injected immediately. For the ureters, an amount of 6ml of the cast material was used, for fear of rupturing the pelvicalyceal system. After injection the ureters were also ligated and the kidneys were placed in formalin for 24 hours for the cast to set. The next day the kidneys were placed in glass jars containing concentrated sulphuric or hydrochloric acid. After a period of 24-48 hours the kidneys were removed from the acid, washed under running tap water to remove acid and any tissue debris attaching itself to the cast. Once clean, the casts were air dried and the minute branches were trimmed to observe the patterns better.

Case report:

Of the 50 casts prepared, one kidney showed a duplex collecting system. This kidney had two ureters which were separately draining two independent pelvicalyceal system (fig 1). The upper ureter drains the upper pole while the lower ureter drains the lower pole of the kidney.



Cast showing duplex collecting system:

MC: major calyx

MiC: minor calyx

U: ureter

SABr: segmental artery branches

Discussion:-

The duplex collecting system is one of the most common among congenital renal anomalies with the majority of cases being unilateral. It has an incidence of 0.8%. Females are shown to have a higher incidence as compared to males³. The ureteric bud arises from the mesonephric duct during the 4th week of intra embryonic life. If two buds arise double ureters are formed with the lower ureter and upper ureters draining the lower and upper poles of the kidney respectively⁴. Usually this condition is asymptomatic with the discovery being an incidental finding. Complete duplication may be associated with vesicoureteric reflux, ectopic ureterocoele and ectopic ureteric insertion. Because of poor function and anatomic variations these anomalies are difficult to detect on excretory urography, sonography and voiding cystourethrography⁵. Ureteropelvic obstruction is more common when a duplex kidney exists. This condition shows an autosomal dominant inheritance⁶.

The Committee on Terminology, Nomenclature, and Classification of the Section on Urology of the American Academy of Pediatrics suggests the use of the following terms in reference to duplex collecting systems⁷:

Duplex kidney–

The duplex kidney has a single renal parenchyma that is drained by 2 pyelocaliceal systems.

1. Upper or lower pole - The poles represent one component of a duplex kidney.
2. Duplex system - The kidney has 2 pyelocaliceal systems and is associated with a single ureter or with a bifid ureter (a partial duplication) or, in the case of a complete duplication, with 2 ureters (double ureters) that drain separately into the urinary bladder.
3. Bifid system - Two pyelocaliceal systems join at the ureteropelvic junction (bifid pelvis), or 2 ureters join before draining into the urinary bladder (bifid ureters).
4. Double ureters - Two ureters open separately into the renal pelvis superiorly and drain separately into the bladder or genital tract.
5. Upper and lower pole ureters - Upper and lower pole ureters drain a duplex kidney's upper and lower poles, respectively.
6. The most common complication of a duplicated collecting system is reflux. The exact nature depends on the type of system involved as for example reflux associated with partially duplicated systems is ureteroureteric reflux and complete duplicated systems is usually associated with vesicoureteric reflux⁸.

Conclusion:-

Duplex collecting system is one the more common congenital renal anomalies. But they are usually asymptomatic with most of the cases seen or reported being incidental findings. Despite this being the case surgeons, urologist and gynaecologists must always keep this condition in mind prior to surgery especially in children presenting with ureteroceles or recurrent urinary tract infection. Since symptomatic cases are usually associated with bilateral duplex systems, it is important to assess both the kidneys.

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